TRANSACTIONS AND PROCEEDINGS

OF THE

BOTANICAL SOCIETY OF EDINBURGH.

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VOLUME XXIII.

INCLUDING SESSIONS LXIX.–LXXII.
(1905–1908).

WITH NUMEROUS ILLUSTRATIONS.

EDINBURGH:

PRINTED FOR THE BOTANICAL SOCIETY.

1908.

CONTENTS OF VOL. XXIII.

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PART I.

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NEILL & CO., LIMITED.

1905.

CONTENTS.

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BOTANICAL SOCIETY OF EDINBURGH.

SESSION LXIX.

MEETING OF THE SOCIETY,

Thursday, November 10, 1904.

Symington Grieve, Esq., Vice-President, in the Chair.

The following Office-Bearers were appointed for Session 1904–5:—

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VICE-PRESIDENTS.

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Symington Grieve, Esq.
Robert Lindsay, Esq.
Robert A. Robertson, M.A., B.Sc., F.R.S.E.

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Perth—Sir Robert Pullar. F.R.S.E.
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„ J. H. Wilson, D.Sc.
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„ Professor Ramsey Wright, M.A., B.Sc.
Wellington, New Zealand—Sir James Hector, M.D., K.C.M.G., F.R.SS. L. & E.
Wolverhampton—John Fraser, M.A., M.D.

The Honorary Assistant-Secretary read the communication of Mr. W. West, F.L.S., and Professor G. S. West, M.A., F.L.S., on "The Freshwater Algæ of the Orkneys and Shetlands." The paper was communicated by Professor I. Bayley Balfour.

Freshwater Algæ from the Orkneys and Shetlands.

By W. West, F.L.S., and Professor G. S. West, M.A., F.L.S.

I.—Introduction.

With the assistance of a grant from the Royal Society, a visit was made during August 1903 to the Orkney and Shetland Islands for the purpose of extending our knowledge of the distribution of British freshwater algæ.

The Orkneys were visited first, the only islands investigated being the southern part of Pomona and the northern part of Hoy. On Pomona, collections were made from the neighbourhood of Kirkwall, Stromness, Finstown, and Loch Kirbister, but as the geological formation is mostly Old Red Sandstone, these localities are not so good as one would otherwise expect. The collections from Hoy were somewhat richer, perhaps owing to the fact that some of them were made at a greater altitude, but there were few suitable places for the occurrence of these plants.

The only two islands of the Shetland group which could be visited were Bressay and the Mainland. The principal area examined on Bressay was in the northern part, in the immediate vicinity of a group of small lakes known as the Beosetter Lochs. The districts investigated on the Mainland were to the south and west of Lerwick and to the north and east of Scalloway.

Cultivation of the land is relatively much more extensive in both the Orkneys and the Shetlands than in many parts of Scotland, and the low-lying districts which were probably at one time extensive bogs, are now drained, and algæ are consequently scarce in such localities. Sleeping accommodation away from the fishing towns is practically non-existent, and in very wet seasons this fact seriously interferes with the investigation of many of the more promising districts. Another factor which has caused this contribution to be less representative than it might have been was the difficulty of obtaining a passage from one island to another.

Since the recent investigations of freshwater algæ from Iceland and the Faeröe Islands by Börgesen, the present contribution is of special interest.

Börgesen[1] records 321 species of freshwater algæ from the Faeröes, exclusive of Diatoms. Of these, 174 are Desmids, 118 of which are now known to occur from the Orkneys and Shetlands. Certain species recorded from the Faeröes are conspicuous by their absence from our own collections. Such are *Euastrum crassum* (Bréb.), Kütz; *E. insigne*, Hass; *Xanthidium armatum* (Bréb.), Rabenh.; and *Micrasterias oscitans*, Ralfs, var. *mucronata* (Dixon), Wille, although it is most probable that all these occur in the Shetlands, if not in the Orkneys also.

From Iceland, Börgesen[2] records 58 Desmids, 50 of which occur in the Orkneys and Shetlands. One of the most notable of these is *Cosmarium Cucumis*, Corda, var. *magnum*, Racib.

The previous records of freshwater algæ from the two groups of the Orkneys and Shetlands are very scanty.

In West's "Notes on Scotch Freshwater Algæ" ("Journ. Bot.," April 1893) there are the following records from the Orkneys:—*Œdogonium Itzigsohnii*, De Bary, var. *minor*, West; *Microspora pachyderma* (Wille), Lagerh. ["*Conferva pachyderma*, Wille"]; *M. floccosa* (Vauch.), Thur. ["*Conferva floccosa*, Ag."]; *Tribonema bombycinum* (Ag.), Derb. and Sol. ["*Conferva bombycina*, Ag."]; *Oocystis apiculata*, West; *Trochiscia insignis* (Reinsch). Hansg., f. *minor*, West: *Glœocystis gigas* (L.), Lagerh. ["*Gl. ampla* (Kütz), Rabenh."]; *Gl. rupestris* (Lyngb.), Rabenh.; *Urococcus insignis*, Kütz; *Glœotrichia Pisum* (Ag.), Thur.; *Stigonema turfaceum* (Eng. Bot.), Cooke: *Cyclotella operculata*, Kütz; *Navicula cryptocephala*, Kütz; *N. dicephala*, Ehrenb.: *N. radiosa*, Kütz; *N. Brébissonii*, Kütz.

In W. and G. S. West's "New British Freshwater Algæ" ("Journ. Roy. Micr. Soc.," 1894) two species are mentioned from the Orkneys: *Xanthidium Robinsonianum*, Arch., and *Cosmarium furcatospermum*, W. and G. S. West.

[1] F. Börgesen, "Freshwater Algæ of Faeröes," "Bot. of Faeröes," Part I., Copenhagen, 1901.

[2] F. Börgesen, "Nogle Ferskvandsalger fra Island," "Botanisk Tidsskrift," Bd. 22, 1898.

In Roy and Bissett's "Scottish Desmidieæ" ("Ann. Scott. Nat. Hist.," 1893–94), the following Desmids are mentioned from the Orkneys:—*Staurastrum muricatum*, Bréb.; *Arthrodesmus octocornis*, Ehrenb., *β major*, Ralfs; *Cosmarium bioculatum*, Bréb.; *C. pseudonitidulum*, Nordst; *Closterium attenuatum*, Ehrenb.; *Cl. Cynthia*, De Not; *Cl. intermedium*, Ralfs; *Cl. Leibleinii*, Kütz; *Cylindrocystis diplospora*, Lund; and *Cosmarium amœnum*, Bréb.; *Closterium attenuatum*, Ehrenb.; and *Penium polymorphum*, Perty, from Unst, Shetlands.

II.—Phytoplankton from the Orkneys and Shetlands.

Plankton material was obtained from only one freshwater loch in Pomona, Orkneys. This was Loch Kirbister, about six miles south-east of Kirkwall, and 49 feet above the sea-level. The material was collected on a stormy day, and has proved somewhat poor. One of the chief features was the presence of numerous specimens of *Amphora ovalis*, Kütz, of large size. Three typical plankton-species of the genus *Staurastrum* were present, and there were numerous Rhizopods and Peridinieæ.

On the Mainland of the Shetlands plankton-material was collected from Loch Asta (altit. about 26 ft.), Neugles Water (altit. 222 ft.), Loch Sandy (altit. about 240 ft.), Loch Trebister (altit. 243 ft.), and Loch Brindister (altit. 217 ft.) On Bressay material was obtained from several of the Lochs Beosetter (altit. about 50 ft.).

The plankton was not very rich, and this can doubtless be partly attributed to the wetness of the season, the lochs being very full. Another determining factor of the relative richness of the plankton of these lochs was the shallowness of the water. They were all small, shallow lochs, and the plankton of such bodies of water differs very considerably from that of larger rocky lakes, containing fewer species of the Desmidiaceæ. *Asterionella formosa*, Hass, was abundant, but no specimens of *A. gracillima*, Heib., were observed, a species which is abundant in the plankton of Sutherland, Ross, and the Outer Hebrides.

The most interesting species noticed in the collections were, *Genicularia Spirotænia*, De Bary, from Loch Beosetter, Bressay *Closteriopsis longissima*, Lemm., var. *tropicum*, from Loch Asta;

and *Crucigenia irregularis*, Wille, from several lochs in the Shetlands. The latter is of special interest, as it occurs in the Norwegian plankton. Very large forms of *Amphipleura pellucida*, Kütz, were observed in some of the collections, individuals attaining two or three times the usual size of this Diatom. Two undescribed species of *Staurastrum* occurred in quantity: a very prettily marked species—*St. boreale*, sp. n.—from Loch Asta, and *St. affine*, sp. n., from Loch Brindister and Neugles Water. *St. Manfeldtii*, Delp., was not uncommon, and in Loch Sandy it was in enormous abundance.

One form of *Xanthidium antilopæum* (Bréb.), Kütz, which appears to be a feature of the plankton of the English Lake District, of Scotland, and the Outer Hebrides, and which occurred in quantity from the Shetlands, we have named *X. antilopæum*, var. *depauperatum*.

Quite recently Börgesen and Ostenfeld [1] have reported on some plankton from the Faeröes, and of the 52 species of algæ they record, 28 occur in the plankton of the Shetlands.

A number of the Peridinieæ were abundant, and some long-spined forms of *Ceratium hirundinella* were observed. Rhizopods were by no means uncommon, and the Rotifers *Anuræa cochlearis*, *A. aculeata*, and *Notholca longispina*, were abundant. *Mallomonas acaroides* occurred in immense quantity in Loch Sandy, and large numbers of *Daphnia* were in the plankton of Loch Trebister.

The description of these plankton-collections is tabulated, the last column being reserved for Börgesen and Ostenfeld's records from the Faeröes. This is inserted for direct comparison.

[1] F. Börgesen and C. H. Ostenfeld, "Phytoplankton of Lakes in the Faeröes," "Bot. of Faeröes," Copenhagen, 1902.

Species.	Orkneys. Loch Kirbister.	Shetlands. Loch Asta.	Loch Brindister.	Loch Clickhimin.	Neugles Water.	Loch Sandy.	Loch Trebister.	Loch Beosetter, Bressay.	Faeröes (Börgesen).
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.
CHLOROPHYCEÆ.									
Œdogonium, spp. (sterile)		×			×	×	×	×	
Ulothrix subtilis, Kütz, var. *variabilis* (Kütz), Kirchn.			×		×	×	×	×	
,, *moniliformis*, Kütz.		×							
Mougeotia, spp. (sterile)			×			×	×	×	
Debarya glyptosperma (De Bary), Wittr.								×	
Zygnema stellinum, Vauch., var. *cylindrospermum*, var. n.		×							
Spirogyra, spp. (sterile)			×	×					
Genicularia Spirotænia, De Bary								×	
Gonatozygon monotænium, De Bary		×						×	
,, *Kinahani* (Arch.), Rabenh.			×		×			×	
Netrium Digitus (Ehrenb.), Itzigsh. and Rothe								×	
Penium margaritaceum (Ehrenb.), Bréb., var. *irregularius*, var. n.		×							
P. minutum (Ralfs), Cleve								×	
Closterium Cynthia, De Not							×		
,, *parvulum*, Näg	×						×	×	
,, *Venus*, Kütz		×							
,, *incurvum*, Bréb.		×						×	
,, *Leibleinii*, Kütz		×		×					
,, *moniliferum* (Bory), Ehrenb.		×		×				×	
,, *Ehrenbergii*, Menegh.			×		×				
,, *Lunula* (Müll.), Nitzsch.	×								
,, *acerosum* (Schrank), Ehrenb.		×							
,, *macilentum*, Bréb.								×	
,, *abruptum*, West								×	
,, *Cornu*, Ehrenb.								×	
,, *aciculare*, T. West, var. *subpronum*, W. and G. S. West		×							×
Tetmemorus granulatus (Bréb.), Ralfs								×	
,, *lævis* (Kütz), Ralfs								×	
Euastrum oblongum (Grev.), Ralfs								×	×
,, *sinuosum*, Lenorm.								×	
,, *ansatum*, Ralfs				×			×		
,, *bidentatum*, Näg							×	×	
,, *elegans* (Bréb.), Kutz								×	×
,, *denticulatum* (Kirchn.), Gay								×	
,, *gemmatum* (Bréb.), Ralfs								×	
,, *pectinatum*, Bréb., var. *inevolutum*, var. n.								×	
,, *verrucosum*, Ehrenb., var. *reductum*, Nordst.					×				×
Micrasterias denticulata, Bréb.								×	
,, *Sol*, Ehrenb.								×	
,, *papillifera*, Bréb.								×	
Cosmarium subcrenatum, Hantzsch		×							
,, *Phaseolus*, Bréb.								×	×
,, *reniforme* (Ralfs), Arch.		×						×	
,, *margaritiferum* (Turp.), Menegh.		×						×	×
,, *depressum* (Näg.), Lund.		×						×	
,, *bioculatum*, Bréb.		×						×	
,, *contractum*, Kirchn., var. *ellipsoideum* (Elfv.), W. and G. S. West								×	
,, *subtumidum*, Nordst., var. *Klebsii* (Gutw.) nob.		×							
,, *Turpinii*, Bréb.		×							
,, *subpunctulatum*, Nordst		×							
,, *punctulatum*, Bréb.								×	
,, *humile*, Gay	×	×						×	
,, *Bœckii*, Wille		×						×	

Species.	Loch Kirbister, Orkneys.	Shetlands.							Faeroes (Börgesen).
		Loch Asta.	Loch Brindister.	Loch Clickhimin.	Neugles Water.	Loch Sandy.	Loch Trebister.	Loch Beosetter, Bressay.	
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.
CHLOROPHYCEÆ—*continued.*									
Cosmarium subprotumidum, Nordst			×						
,, *subcostatum*, Nordst	×			×					
,, *formosulum*, Hoff.		×		×	×				
,, *pyramidatum*, Bréb.								×	
,, *granatum*, Bréb., var. *subgranatum*. Nordst	×	×							×
,, *tetraophthalmum*, Bréb.		×						×	
,, *Botrytis* (Bory), Menegh.	×	×	×	×				×	×
,, *speciosum*, Lund.	×								
,, *subspeciosum*, Nordst								×	
,, *subarctoüm* (Lagerh.), Racib.. forma *punctata*								×	
,, *abbreviatum*, Racib.		×						×	
,, *Meneghinii*, Bréb.	×								
,, ,, forma *octangularis*, Wille		×				×			×
,, *angulosum*, Bréb., var. *concinnum* (Rabenh.), W. and G. S. West		×							
,, *difficile*, Lütkem, var. *sublæve*, Lütkem								×	
Xanthidium antilopæum (Bréb.). Kütz, var *depauperatum*, var. n.			×		×			×	×
Arthrodesmus triangularis, Lagerh.								×	
,, ,, var. *hebridarum*, W. and G. S. West								×	
Staurastrum dejectum, Bréb.		×	×		×				×
,, ,, var. *inflatum*, West		×	×		×			×	
,, *curvatum*, West		×							
,, *jaculiferum*, West	×				×		×		×
cuspidatum, Bréb., var. *maximum*, West		×	×		×	×		×	
,, *teliferum*, Ralfs	×							×	
,, *pilosum*, Näg							×		
,, *Saxonicum*, Buln.							×		
,, *erasum*, Bréb.			×					×	
,, *brevispinum*, Bréb.		×		×				×	
,, *lunatum*, Ralfs, var. *planctonicum*, W. and G. S. West			×					×	×
,, *granulosum* (Ehrenb.), Ralfs		×							
,, *punctulatum*, Bréb.							×		
,, *alternans*, Bréb.		×							
,, *dilatatum*, Ehrenb., var. *obtusilobum*, De Not								×	
,, *orbiculare*, Ralfs, var. *depressum*, Roy and Biss.		×							
,, *brachiatum*, Ralfs								×	
,, *hexacerum* (Ehrenb.), Wittr.		×		×				×	×
,, *cyrtocerum*, Bréb., var *compactum*, var. n.							×		
,, *affine*, sp. n.			×		×				
,, *pelagicum*, W. and G. S. West		×						×	
,, *pseudopelagicum*, W. and G. S. West	×								
,, *paradoxum*, Meyen.			×		×	×	×	×	
,, ,, var. *longipes*, Nordst	×		×			×			
,, ,, var. *cingulum*, W. and G. S. West						×	×		
,, *gracile*, Ralfs	×			×	×			×	
,, *boreale*, sp. n.		×							
,, *Manfeldtii*, Delp.						×	×	×	
,, *anatinum*, Cooke and Wills			×		×				
,, *tetracerum*, Ralfs		×							
,, ,, var. *evolutum*, var. n.			×		×			×	
Sphærozosma granulatum, Roy and Biss.		×						×	

Species.	Loch Kirbister, Orkneys. I.	Shetlands. Loch Asta. II.	Shetlands. Loch Brindister. III.	Shetlands. Loch Clickhimin. IV.	Shetlands. Neugles Water. V.	Shetlands. Loch Sanday. VI.	Shetlands. Loch Trebister. VIII.	Shetlands. Loch Beosetter, Bressay. VII.	Faeröes (Börgesen). IX.
CHLOROPHYCEÆ—*continued.*									
Hyalotheca mucosa (Dillw.), Ehrenb.								×	
Pandorina morum (Müll.), Bory		×							
Eudorina elegans, Ehrenb.	×	×							
Urococcus insignis, Kütz								×	
Pediastrum Boryanum (Turp.), Menegh.	×	×	×	×	×			×	×
,, ,, var. *granulatum*, Ralfs	×	×		×					
,, *glanduliferum*, Benn.								×	
,, *duplex*, Meyen.	×	×	×	×				×	×
,, *integrum*, Näg								×	
Cœlastrum sphæricum, Näg		×						×	×
Crucigenia irregularis, Wille		×	×					×	
Scenedesmus bijugatus (Turp.), Kütz		×							×
,, *quadricauda* (Turp.), Bréb.	×	×		×	×			×	×
,, ,, var. *abundans*, Kirchn.		×							
,, *denticulatus*, Lagerh.		×							
,, *acutiformis*, Schröder, var. *brasiliensis* (Bohlin), nob.		×							
Ankistrodesmus falcatus (Corda), Ralfs		×						×	
,, ,, var. *acicularis* (A. Br.), G. S. West	×			×					
,, ,, var. *spiralis* (Turn.), G. S. West		×							
,, ,, var. *mirabilis*, G. S. West						×	×	×	
,, *Pfitzeri* (Schröder), G. S. West		×						×	
Closteriopsis longissima, Lemm., var. *tropicum*, W. and G. S. West		×							
Kirchneriella obesa (West), Schmidle					×				
Oocystis crassa, Wittr.		×							
,, *apiculata*, West		×							
,, *parva*, W. and G. S. West		×							
Nephrocytium Agardhianum, Näg								×	
Tetraëdron minimum (A. Br.), Hansg.		×							
Dictyosphærium Ehrenbergianum, Näg		×							
Ineffigiata neglecta, W. and G. S. West		×		×	×			×	
Sphærocystis Schroeteri, Chodat		×	×		×			×	×
Glœocystis gigas (Kütz). Lagerh.	×	×		×				×	
PHÆOPHYCEÆ.									
Dinobryon cylindricum, Imhof, var. *divergens* (Imhof), Lemm.								×	
,, *elongatum*, Imhof, var. *undulatum*, Lemm.								×	
BACILLARIEÆ.									
Melosira granulata (Ehrenb.), Ralfs			×	×	×	×		×	
Cyclotella comta (Ehrenb.), Kütz		×							
Tabellaria flocculosa (Roth), Kütz	×		×		×		×	×	×
,, *fenestrata* (Lyngb.), Kütz	×		×					×	×
,, ,, var. *asterionelloides*, Grun.	×		×					×	
Diatoma elongatum, Ag.	×								
Fragilaria mutabilis (W. Sm.), Grun.							×		
,, *Crotonensis* (A. M. Edw.), Kitton	×	×							×
Synedra pulchella, Kütz	×					×			
,, *Acus* (Kütz), Grun.	×							×	
Asterionella formosa, Hass		×	×		×	×	×	×	×
Achnanthes coarctata. Bréb.	×								
Cocconeis Placentula, Ehrenb.		×							
Navicula major, Kütz		×						×	
,, *viridis*, Kütz	×			×				×	

Species.	Loch Kirbister, Orkneys.	Shetlands.							Faeröes (Börgesen).
		Loch Asta.	Loch Brindister.	Loch Clickhimin.	Neugles Water.	Loch Sandy.	Loch Trebister.	Loch Beosetter, Bressay.	
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.
BACILLARIEÆ—*continued.*									
Navicula alpina (W. Sm.), Ralfs								×	
,, *Brébissonii*, Kütz	×								
,, *radiosa*, Kütz	×								
,, *elliptica*, Kütz	×	×							
,, *Iridis*, Ehrenb., var. *affinis* (Ehrenb.), Van Heurck	×								
,, *pusilla*, W. Sm.								×	
Stauroneis Phœnicenteron, Ehrenb.		×							
Vanheurckia rhomboides (Ehrenb.), Bréb., var. *Saxonica* (Rabenh.), G. S. West				×			×		
Amphipleura pellucida, Kütz							×		
Gyrosigma attenuatum (Kütz), Rabenh.		×							
Gomphonema intricatum, Kütz, var. *Vibrio* (Ehrenb.), Van Heurck	×								
,, *olivaceum* (Lyngb.), Kütz	×								
Cocconema lanceolatum, Ehrenb.	×								
,, *cymbiforme*, Ehrenb.	×								
Amphora ovalis, Kütz	×	×		×					
Epithemia turgida (Ehrenb.), Kütz		×							
,, *gibba*, Kütz		×						×	
Nitzschia Palea (Kütz), W. Sm.	×	×					×		
,, *linearis* (Ag.), W. Sm.			×						
Cymatopleura elliptica (Bréb.), W. Sm.	×	×							
Surirella robusta, Ehrenb.				×					
,, ,, var. *splendida* (Ehrenb.), V. Heurck		×	×		×			×	
,, *linearis*, W. Sm.	×							×	
Campylodiscus Hibernicus, Ehrenb.		×							
MYXOPHYCEÆ.									
Anabæna circinalis, Rabenh.		×	×	×	×		×		
Oscillatoria tenuis, Ag.		×				×		×	×
Merismopedia glauca (Ehrenb.), Näg								×	
,, *æruginea*, Bréb.		×	×	×			×		
,, *elegans*, A. Br.			×					×	
Cœlosphærium Kutzingianum, Näg		×	×		×				
,, *Nägelianum*, Unger			×						×
Microcystis Flos-aquæ (Wittr.), Kirchn.			×	×					
,, *prasina* (Wittr.), Lemm.					×			×	
,, *elabens* (Bréb.), Kütz								×	
,, *stagnalis*, Lemm.		×			×				
Aphanocapsa pulchra (Kütz), Rabenh.								×	
Chroococcus turgidus (Kütz), Näg		×	×						
,, *cohærens* (Bréb.), Näg								×	
,, *pallidus*, Näg								×	
,, *limneticus*, Lemm.					×				×
,, *minor* (Kütz), Näg						×			

III.—General Systematic Account of the Collections.

In this part of the present paper is embodied a detailed account of all the freshwater algæ collected in the Orkneys and Shetlands in 1903. Certain species and varieties are here described for the first time, and critical notes are appended to other interesting species. The contractions "*O.*" and "*S.*" are used respectively for Orkneys and Shetlands.

Class RHODOPHYCEÆ.

Order NEMALIONACEÆ.

Family HELMINTHOCLADIEÆ.

Genus BATRACHOSPERMUM, Roth.

1. *B. moniliforme*, Roth. *O.*—Near Stromness.

Class PHÆOPHYCEÆ.

Order SYNGENETICÆ.

Family DINOBRYACEÆ.

Genus DINOBRYON, Ehrenb.

2. *D. Sertularia*, Ehrenb. *O.*—Near Kirkwall.
3. *D. cylindricum*, Imhof. *O.*—W. of Kirkwall.
   Var. *divergens*, Lemm. *O.*—Hoy; Finstown. *S.*—Scalloway; Lerwick; Plankton of Loch Beosetter, Bressay.
4. *D. protuberans*, Lemm. *O.*—Near Kirkwall. *S.*—Lerwick.
5. *D. elongatum*, Imhof, var. *undulatum*, Lemm. *S.*—Near the outlet of Loch Beosetter, Bressay.

Class CHLOROPHYCEÆ.

Order ŒDOGONIALES.

Family ŒDOGONIACEÆ.

Genus ŒDOGONIUM, Link.

6. *Œ. punctato-striatum*, De Bary. *S.*—Lerwick; Bressay.
7. *Œ. platygynum*, Wittr. *O.*—W. of Kirkwall.
   Numerous sterile species of this genus were observed from both the Orkneys and Shetlands.

Genus BULBOCHÆTE, Ag.

8. *B. varians*, Wittr. *S.*—Loch Beosetter, Bressay.

Order CHÆTOPHORALES

Family COLEOCHÆTACEÆ.

Genus COLEOCHÆTE, Bréb.

9. *C. scutata*, Bréb. *O.*—Near Kirkwall. *S.*—Bressay.
10. *C. irregularis*, Pringsh. *O.*—Near Kirkwall.

Family ULOTRICHACEÆ.

Genus ULOTHRIX, Kütz.

11. *U. zonata* (Web. and Mohr), Kütz. *O.*—Near Kirkwall; Hoy.
12. *U. moniliformis*, Kütz. *S.*—Plankton of Loch Asta.

13. *U. subtilis*, Kütz. *O.*—Near Kirkwall. *S.*—Bressay.
Var. *variabilis* (Kütz), Kirchn. *O.*—Near Stromness. *S.*—Plankton of Lochs Brindister, Sandy, and Trebister; also of Neugles Water, and of Loch Beosetter, Bressay.

Genus HORMOSPORA, Bréb.

14. *H. mutabilis*, Bréb. *O.*—W. of Kirkwall.

Genus URONEMA, Lagerh.

15. *U. conferricolum*, Lagerh. Long. fil. tot. 55–450μ; crass. fil. 3·5–5μ; *O.*—Near Kirkwall, very abundant and epiphytic on *Tribonema bombycinum* (Ag.), Derb. and Sol. *S.*—Lerwick.

Genus BINUCLEARIA, Wittr.

16. *B. tatrana*, Wittr. *O.*—Hoy. *S.*—Lerwick; Bressay.

Family CHÆTOPHORACEÆ.

Genus CHÆTOPHORA, Schrank.

17. *Ch. pisiformis* (Roth), Ag. *S.*—Near Lerwick.

Genus MYXONEMA, Fries.

18. *M. tenue* (Ag.), Rabenh. (*Stigeoclonium tenue*, Ag.). *S.*—Near Lerwick.

Genus DRAPARNALDIA, Bory.

19. *D. glomerata* (Vauch.), Ag. *O.*—Finstown. *S.*—Lerwick.

Family MICROTHAMNIACEÆ.

Genus MICROTHAMNION, Näg.

20. *M. strictissimum*, Rabenh. *S.*—Near Lerwick.

Family TRENTEPOHLIACEÆ.

Genus TRENTEPOHLIA, Mart.

21. *T. aurea*, Mart. *O.*—Near Stromness; near Finstown. *S.*—Near Scalloway.

Order SCHIZOGONIALES.

Family PRASIOLACEÆ.

Genus PRASIOLA, Ag.

22. *P. crispa* (Lightf.), Menegh. *O.* and *S.*—Not uncommon.

Order MICROSPORALES.

Family MICROSPORACEÆ.

Genus MICROSPORA, Thur.; em. Lagerh.

23. M. *amœna* (Kütz), Lagerh. *O.*—Hoy; W. of Kirkwall. *S.*—Near Lerwick.
Some forms of this species were observed in which the cell-walls had become greatly thickened, the filaments presenting an irregular external surface.
24. *M. pachyderma* (Wille), Lagerh. *O.*—Hoy; W. of Kirkwall.

Order CLADOPHORALES.

Family Cladophoraceæ.

Genus rhizoclonium, Kütz.

25. *R. hieroglyphicum*, Kütz ; em. Stockm. *O.*—Near Kirkwall. *S.*—Near Loch Clickhimin.

Genus cladophora, Kütz.

26. *Cl. glomerata* (L.), Kütz. *S.*—Near Scalloway.
27. *Cl. crispata* (Roth), Kütz. *O.*—Hoy ; Kirkwall ; Stromness.
28. *Cl. flavescens*, Ag. *O.*—Near Kirkwall.

Order CONJUGATÆ.

Family Zygnemaceæ.

Genus mougeotia, Ag.

29. *M. elegantula*, Wittr. *O.*—Hoy.
Many sterile species of this genus were obtained from bog-pools and ditches, and also from the plankton.
One species from near Scalloway, Shetlands, possessed a purple cell-sap, and short lateral branches were developed at irregular intervals along the filaments. Crass. fil. 11–12μ.

Genus debarya, Wittr.

30. *D. glyptosperma* (De Bary), Wittr. Crass. cell. veget. 11·5–13μ ; Long. spor. 53–62μ ; lat. spor. 42–48μ. *S.*—Plankton of Loch Beosetter, Bressay.

Genus zygnema, Ag.

31. *Z. ericetorum* (Kütz), Hansg. *S.*—Near Lerwick ; near Scalloway.
32. *Z. insigne* (Hass.), Kütz. Cells $1\frac{1}{4}$—twice longer than their diameter ; zygospores subglobose or ellipsoid-globose ; crass cell. veget. 27–30μ ; long. zygosp. 32–33μ ; lat. zygosp. 29–30μ. *S.*—Near Scalloway.
33. *Z. Vaucherii*, Ag., var. *subtile*, Rabenh. Cells $2\frac{1}{2}$–3 times longer than their diameter ; zygospores ellipsoidal ; crass. cell. veget. 17–18μ ; long. zygosp. 32–35μ ; lat. zygosp. 18–20μ. *S.*—Near Scalloway.
34. *Z. stellinum* (Vauch.), Kütz. ; var. *cylindrospermum*, var. n. (figs. 2–5).
Var. cellulis $2\frac{1}{2}$–$3\frac{1}{2}$-plo longioribus ; zygosporis oblongis vel. oblongo-cylindricis, polis late rotundatis ; membrana mediana zygosporæ dense et minute scrobiculata.
Crass. cell. veget. 15–16μ ; long. zygosp. 23–44μ ; lat. zygosp. 15–17·5μ.
S.—Plankton of Loch Asta.
This variety is at once distinguished by the cylindrical form of the zygospores.

Genus spirogyra, Link.

35. *Sp. jugalis* (Dillw.), Kütz. Cells $1\frac{1}{2}$–3 times longer than their diameter ; spiral chloroplasts 3 in number, with serrated edges and with large pyrenoids. Crass. fil. 90–97μ. The specimens were conjugating, but the zygospores were unripe ; dimensions of unripe spore, 135 x 90μ. *S.*—Bressay, in a ditch.

Many species of both *Zygnema* and *Spirogyra* were observed in the sterile condition or in such a condition as precluded their accurate identification. Representatives of both genera occurred in quantity in the plankton.

Family Desmidiaceæ.

Genus gonatozygon, De Bary.

36. *G. monotænium*, De Bary. (*G. Ralfsii*, De Bary). *O.*—Pond near Kirkwall. *S.*—Bressay, in a ditch; plankton of Loch Asta and of Loch Beosetter, Bressay.
37. *G. Brebissonii*, De Bary. *O.*—Finstown. *S.*—Bressay.
    Var. *læve* (Hilse), W. and G. S. West. *O.*—Hoy.
38. *G. Kinahani* (Arch.), Rabenh. *S.*—In ditches, and in plankton of Loch Beosetter, Bressay; plankton of Loch Asta and Neugles Water.

Genus genicularia, De Bary.

39. *G. Spirotænia*, De Bary. Diam. cell. 20–22μ; long. cell. 250–307μ (fig. 17). *S.*—Plankton of Loch Beosetter, Bressay.
    The specimens of this rare Desmid were quite typical, and cells possessed either two or three spiral, parietal chloroplasts.

Genus mesotænium, Näg.

40. *M. De Greyi*, Turn., forma *major*, W. and G. S. West. Long. 100μ; lat 26μ. *O.*—W. of Kirkwall.
41. *M. chlamydosporum*, De Bary. *O.*—Ward Hill, Hoy. *S.*—Bressay: near Lerwick.
42. *M. Endlicherianum*, Näg. *O.*—W. of Kirkwall.
    Var. *grande*, Nordst. *O.*—W. of Kirkwall. *S.*—Scalloway.

Genus cylindrocystis, Menegh.

43. *C. Brebissonii*, Menegh. *O.*—Kirkwall; Hoy. *S.*—Lerwick; Bressay.
44. *C. crassa*, De Bary. *O.*—Finstown: Kirkwall: Stromness: Hoy. *S.*—Lerwick; Neugles Water.
45. *C. diplospora*, Lund. *O.*—Hoy.

Genus netrium (Näg), W. and G. S. West.

46. *N. Digitus* (Ehrenb.), Itzigsh. and Rothe. *O.*—Kirkwall; Hoy. *S.*—Scalloway; Lerwick; Neugles Water; plankton of Loch Beosetter, Bressay.
47. *N. interruptum* (Bréb.), Lütkem. *S.*—Neugles Water.
48. *N. oblongum* (De Bary), Lütkem. *O.*—Kirkwall.
    Var. *cylindricum*, W. and G. S. West. *O.*—W. of Kirkwall.

Genus penium, Bréb.

49. *P. Navicula*, Bréb. *S.*—Lerwick; Neugles Water.
50. *P. Mooreanum*, Arch. *S.*—Scalloway.
51. *P. minutissimum*, Nordst. *O.*—W. of Kirkwall; Hoy. *S.*—Bressay.
52. *P margaritaceum* (Ehrenb.), Bréb. *S.*—Bressay.
    Var. *irregularius*, var. n. (fig. 23).
    Var. major, granulis majoribus et irregulariter dispositis. Long. 254μ; lat. max. 29μ; lat. apic. 20μ.

S.—Plankton of Loch Asta.

This variety differs principally in the scattered disposition of the granules, which in typical *P. margaritaceum* are arranged in longitudinal series.

53. *P. Cylindrus* (Ehrenb.), Bréb. *S.*—Lerwick.
54. *P. exiguum*, West. *O.*—Hoy.
55. *P. spirostriolatum*, Barker. *O.*—Hoy.
56. *P. polymorphum*, Perty. *O.*—W. of Kirkwall. *S.*—Scalloway; Lerwick.
57. *P. cucurbitinum*, Biss. *O.*—Kirkwall; Hoy. *S.*—Scalloway; Lerwick.

 Forma *minor*, W. and G. S. West. *S.*—Lerwick.

 Var. *subpolymorphum*, Nordst. *S.*—Lerwick.

58. *P. curtum*, Bréb. *O.*– W. of Kirkwall. *S.*—Scalloway, Lerwick.
59. *P. minutum* (Ralfs), Cleve. *S.*—Plankton of Loch Beosetter, Bressay.

Genus CLOSTERIUM, Nitzsch.

60. *Cl. Cynthia*, De Not. *S.*—Plankton of Loch Trebister.
61. *Cl. costatum*, Corda. *O.*—Kirkwall. *S.*—Scalloway; Lerwick.
62. *Cl. striolatum*, Ehrenb. *O.*—Hoy. *S.*—Bressay; Scalloway.
63. *Cl. intermedium*, Ralfs. *O.*—Kirkwall; Hoy.
64. *Cl. juncidum*, Ralfs. *S.*—Lerwick.
65. *Cl. macilentum*, Bréb. *S.*—Plankton of Loch Beosetter, Bressay.
66. *Cl. Dianæ*, Ehrenb. *O.*—Kirkwall; Hoy. *S.*—Near Scalloway; Bressay.
67. *Cl. parvulum*, Näg. *O.*—Hoy; plankton of Loch Kirbister. *S.*—Lerwick; Scalloway; plankton of Loch Beosetter, Bressay, and of Loch Trebister; pools in Bressay.
68. *Cl. Jenneri*, Ralfs. *S.*—Neugles Water; Bressay.
69. *Cl. incurvum*, Bréb. *O.*—Hoy. *S.*—Plankton of Loch Beosetter, Bressay, and of Loch Asta; pools in Bressay.
70. *Cl. Venus*, Kütz. *O.*—Hoy; Kirkwall; Finstown. *S.*—Lerwick; plankton of Loch Asta.
71. *Cl. calosporum*, Wittr. *O.*—Hoy; Kirkwall. *S.*—Scalloway.
72. *Cl. exile*, sp. n. (fig. 10).

 Cl. minutum, cellulis diametro circiter 8-plo longioribus, modice curvatum, margine externo gradus arci 80–85 metiens, margine interno in parte mediana leviter inflato, apices obtusos versus sensim et æqualiter attenuatum; pyrenoidibus 2 in chromatophora unaquaque; membrana glabra et achroa.

 Long. 66-70μ; lat. 8·2–8·4μ; lat. apic. circ. 1·8μ. *S.*—In pools, Bressay.

 This species differs from *Cl. Cornu*, Ehrenb., in its smaller size, its greater curvature, its tumid inner margin, and in its narrower apices. From *Cl. tumidum*, Johns, it is distinguished by its smaller size, its greater curvature, and by its much narrower, obtuse apices.

73. *Cl. Leibleinii*, Kütz. *O.*—Hoy; Finstown; pond near Kirkwall. *S.*—Lerwick; plankton of Loch Asta, Loch Clickhimin, and Neugles Water; Bressay.
74. *Cl. moniliferum* (Bory), Ehrenb. *S.*—Lerwick; Bressay; plankton of Lochs Asta and Clickhimin, and of Loch Beosetter, Bressay.

 Forma cellulis curvatioribus, apicibus crassioribus. Lat. 61μ; lat. apic. circ. 10·5μ; apic. inter se distantibus 275μ.

 O.—Loch Kirbister.

 This form occurred in some quantity, and differs from typical

Cl. moniliferum in its greater curvature and thicker apices. The outer margin occupied 140° of arc, the curvature thus being nearer that of *Cl. Leibleinii*. The ventral (or inner) margin was less tumid than usual.

75. *Cl. Ehrenbergii*, Menegh. *O.*—W. of Kirkwall. *S.*—Lerwick; Bressay. Plankton of Loch Beosetter, Bressay, and of Neugles Water.
76. *Cl. acerosum* (Schrank), Ehrenb. *O.*—Hoy; pond near Kirkwall. *S.*—Near Lerwick; plankton of Loch Asta.
77. *Cl. lanceolatum*, Kütz. *O.*—Kirkwall. *S.*—Lerwick.
78. *Cl. Lunula* (Müll.), Nitzsch. *O.*—Finstown; Kirkwall; plankton of Loch Kirbister. *S.*—Near Lerwick, very abundant.
79. *Cl. Cornu*, Ehrenb. *S.*—Scalloway; plankton of Loch Beosetter, Bressay.
80. *Cl. abruptum*, West. *O.*—Hoy; Kirkwall. *S.*—Plankton of Loch Beosetter, Bressay.
81. *Cl. gracile*, Bréb. *O.*—Kirkwall. *S.*—Bressay.
    Var. *tenue* (Lemm.), W. and G. S. West. *O.*—W. of Kirkwall. *S.*—Scalloway.
82. *Cl. Pritchardianum*, Arch. *O.*—Hoy.
83. *Cl. pronum*, Bréb. *O.*—Pond near Kirkwall. Long. 400μ; lat. 6·7μ.
84. *Cl. aciculare*, Tuffen West. *O.*—Kirkwall.
    Var. *subpronum*, W. and G. S. West. *S.*—Plankton of Loch Asta.
85. *Cl. acutum*, Bréb. *S.*—Lerwick.
86. *Cl. rostratum*, Ehrenb. *O.*—Kirkwall; Finstown. *S.*—Scalloway.
87. *Cl. setaceum*, Ehrenb. *O.*—Kirkwall. *S.*—Bressay.

Genus PLEUROTÆNIUM, Näg.

88. *Pl. coronatum* (Bréb.), Rabenh., var. *nodulosum* (Bréb.), West. *O.*—Kirkwall. *S.*—Near Scalloway.
89. *Pl. truncatum* (Bréb.), Näg. Long. 340–412μ; lat. 50–71μ. *O.*—Kirkwall. *S.*—Bressay.
90. *Pl. Ehrenbergii* (Bréb.), De Bary. *O.*—Kirkwall; Hoy. *S.* Scalloway; Bressay.
91. *Pl. Trabecula* (Ehrenb.), Näg. *O.*—Kirkwall; Finstown; Hoy.

Genus TETMEMORUS, Ralfs.

92. *T. Brébissonii* (Menegh.), Ralfs. *O.*—Kirkwall; Hoy.
    Var. *minor*, De Bary. *O.*—Hoy.
93. *T. granulatus* (Bréb.), Ralfs. *O.*—Kirkwall; Hoy. *S.*—Lerwick; Scalloway; Loch Brindister; Neugles Water; Bressay, in pools and in the plankton of Loch Beosetter.

    Zygospores of this species were noticed from near Kirkwall. A curious monstrous form was observed in which only a partial fusion of the cell-contents had taken place, although the whole was invested with a thick, brown cell-wall (fig. 37).

    Var. *attenuatus*, West. *O.*—Kirkwall; Hoy. *S.*—Scalloway; Lerwick.
94. *T. lævis* (Kütz), Ralfs. *O.*—Kirkwall. *S.*—Scalloway; Lerwick; Bressay, in pools and in the plankton of Loch Beosetter.

Genus EUASTRUM, Ehrenb.

95. *E. oblongum* (Grev.), Ralfs. *O.*—Kirkwall. *S.*—Lerwick; Scalloway; plankton of Loch Beosetter, Bressay.

96. *E. Didelta* (Turp.), Ralfs. *O.*—Hoy.
97. *E. ampullaceum*, Ralfs. *O.*—Kirkwall ; Hoy.
98. *E. sinuosum*, Lenorm. *S.*—Plankton of Loch Beosetter, Bressay.
99. *E. ansatum*, Ralfs. *O.*—Kirkwall ; Hoy. *S.*—Scalloway ; Lerwick ; Neugles Water ; Bressay ; plankton of Lochs Clickhimin and Trebister.
100. *E. bidentatum*, Näg. *O.*—Kirkwall ; Finstown ; Stromness. *S.*—Scalloway ; Lerwick ; Neugles Water ; Bressay. Plankton of Loch Trebister, and of Loch Beosetter, Bressay.
101. *E. dubium*, Näg. (*E. lobulatum*, Bréb.) *O.*—Kirkwall ; Finstown ; Hoy. *S.*—Lerwick.
102. *E. elegans* (Bréb.), Kütz. *O.*—Kirkwall ; Hoy. *S.*—Bressay, in pools, and also in plankton of Loch Beosetter.
103. *E. binale* (Turp.), Ehrenb. *O.*—Kirkwall ; Hoy. *S.*—Lerwick ; Scalloway.

Forma *Gutwinskii*, Schmidle. *O.*—Near Kirkwall ; Hoy.

104. *E. denticulatum* (Kirchn.), Gay. *O.*—Hoy. *S.*—Neugles Water ; Bressay, in pools and in the plankton of Loch Beosetter.
105. *E. montanum*, sp. n. (figs. 11 and 12).

[*Cosmarium Meneghinii*, Bréb., forma Boldt, in "Bihang till K. Sv. Vet.-Akad. Handl.," xiii., No. 5, 1888, p. 13, t. 1, f. 15. *C. Meneghinii*, forma *Boldtii*, West. in "Journ. Roy. Micr. Soc.," 1892, p. 726. *C. Subreinschii*, Schmidle, var. *Boldtiana*, Schmidle, in "Flora," 1894, p. 90, t. 6, f. 8 ; West and G. S. West, "Alga-fl. Yorks.," 1900, p. 80.]

E. minutum, circiter $1\frac{1}{2}$-plo longius quam latum, profunde constrictum, sinu angusto-lineari extremo subampliato ; semicellulæ transverse oblongo-rectangulares, marginibus lateralibus convexis et biundulatis, undulatione majori supra undulationem minorem ; apicibus subprotractis, truncatis et in medio emarginatis, angulis apicalibus rectangularibus ; a latere visæ ovatæ, cum tumore rotundato prope basin utrobique ; a vertice visæ ellipticæ, cum tumore rotundato in medio utrobique. Membrana glabra.

Long. 20·4–27μ ; lat. 15·6–20μ ; lat. apic. 10·8–14·3μ ; lat. isthm. 3·5–4·8μ ; crass. 11·5–14·5μ.

O.—W. of Kirkwall.

This small Desmid is widely distributed in the upland districts of the British Islands. It has been known for the last ten years under the name of "*Cosmarium Subreinschii*, var. *Boldtiana*, Schmidle," but it is easily distinguished from *Cosmarium Subreinschii* by its larger and broader central protuberances, by its relatively wider and more angular apices, and by the apical notch. After carefully considering these differences along with its wide distribution and constant characters, we think there is good reason for its specific separation, especially as typical *C. Subreinschii* is not known to occur in the British Islands. And not merely do we think this Desmid better regarded as a separate species, but the distinct apical emargination of the semi-cells, accompanied by a large central protuberance, are features which at once place it in the genus *Euastrum*.

The specific name "*Boldtii*" could not be adopted, as it has already been utilised by Schmidle for another species of *Euastrum*.

106. *E. pectinatum*, Bréb. *O.*—Kirkwall ; Hoy. *S.*—Scalloway.

Var. *inevolutum*, var. n. (figs. 13 and 14).

Var. cellulis paullo minoribus quam in forma typica, lobis lateralibus fere quadratioribus, marginibus exterioribus levissime retusis; collo lobi polaris latiori et breviori; apice lobi polaris convexiori et retusiori in medio, angulis apicalibus rotundioribus; tumoribus partis inferioris semicellulæ et lobi polaris multe reductis (ut in vertice visis).

Long. 51-63μ; lat. 36–42μ; lat. lobi polar. 24–28μ; lat. isthm. 10–11·5μ; crass. 21–26μ.

S.—Scalloway; Neugles Water. Plankton of Loch Beosetter, Bressay.

This variety is widely distributed all over the British Islands, and is more commonly met with than the type. It stands near to *E. pectinatum*, forma *intermedia*, Boldt (in "Bih. till K. Sv. Vet.-Akad. Handl.," xiii., No. 5, 1888, p. 6, t. 1, f. 3), but in the latter the polar lobe is very small, and its lateral margins almost vertical. Boldt does not state whether the protuberances are reduced in his form or not, whereas this is one of the principal features of var. *inevolutum*.

In the vertical view the angles of the polar lobe and the lateral lobules of var. *inevolutum* are broadly truncate or truncate-emarginate, scarcely bilobulate as in the type.

107. *E. gemmatum*, Bréb. *S.*—Bressay, in pools, and also in the plankton of Loch Beosetter.

108. *E. verrucosum*, Ehrenb. *S.*—Bressay.

Var. *reductum*, Nordst. *S.*—Plankton of Neugles Water and of Loch Beosetter, Bressay.

Genus MICRASTERIAS, Ag.

109. *M. truncata* (Corda), Bréb. *O.*—Hoy. *S.*—Near Lerwick.

110. *M. papillifera*, Bréb. *O.*—Kirkwall; Hoy. *S.*—Plankton of Loch Beosetter, Bressay.

111. *M. sol.*, Ehrenb. (*M. radiosa*, Ralfs.) *S.*—Plankton of Loch Beosetter, Bressay.

112. *M. rotata* (Grev.), Ralfs. *S.*—Near Lerwick.

113. *M. denticulata*, Bréb. *S.*—Near Scalloway. Plankton of Loch Beosetter, Bressay.

Genus COSMARIUM, Corda.

114. *C. Ralfsii*, Bréb. *O.*—Hoy.

115. *C. Cucumis*, Corda. *O.*—Kirkwall; Hoy. *S.*—Scalloway; Lerwick; Bressay.

Var. *magnum*, Racib. [*C. Cucumis* 5, *magna* Racib., in "Pamiętnik Wydz. matem.-przy. Akad. Umiej. Krakow.," x., 1885, p. 70; *C. Cucumis*, "forma major non tam profunde constricta quam anglica, membrana crassa," Nordst, in "Öfvers. af K. Vet.-Akad. Förh.," 1875, No. 6, p. 29, t. 8, f. 28.]

Long. 98μ; lat. 53μ; lat. isthm. 33μ; crass. 38·5μ.

O.—W. of Kirkwall.

116. *C. subtumidum*, Nordst. *O.*—Stromness; Hoy.

117. *C. Subcucumis*, Schmidle. *O.*—Hoy.

118. *C. cœlatum*, Ralfs. *S.*—Lerwick.

119. *C. subcrenatum*, Hantzsch. *O.*—Hoy. *S.*—Plankton of Loch Asta.

120. *C. Phaseolus*, Bréb. *O.*—Finstown. *S.*—Plankton of Loch Beosetter, Bressay.

121 *C. reniforme* (Ralfs), Arch. *O.*—Finstown; Hoy. *S.*—Scalloway;

Lerwick; Neugles Water. Plankton of Loch Asta and of Loch Beosetter, Bressay.

122. *C. margaritiferum* (Turp.), Menegh. "Synops. Desm. in Linnæa," 1840, p. 219; Ralfs, in "Ann. Nat. Hist.," 1844, xiv., p. 393, t. 11, f. 4.

[*C. margaritiferum*, Ralfs, "Brit. Desm.," p. 100, t. 16, f. 2 *b* and *d*; *C. Malinvernianum* (Racib.), Schmidle, var. *Badense*, Schmidle in "Flora," 1894, t. 7, f. 21.]

O.—Kirkwall; Hoy. *S.*—Scalloway; Bressay.

No species of this genus has given rise to greater confusion than *C. margaritiferum*. Ralfs included three species in his figures of it, and the typical form has since received at least one new name. The zygospore of true *C. margaritiferum*, which was well described by both Ralfs and Archer, is globose, and its walls are furnished with numerous thickenings which have been likened to "bull's-eyes." As the species was understood by the earlier observers it was undoubtedly common, and it possessed this remarkable zygospore.

Ralfs' figures of this plant are not good. He did not sufficiently indicate the flattened apices of the semi-cells, nor did he figure the minute scrobiculations at the centre and between the granules. His figures *2b*, *2c*, and *2d* (on t. xvi.) are the only ones which represent the species.

In 1894 Schmidle described under the name of "*C. Malinvernianum*, var. *Badense*," a *Cosmarium* which is very abundant in the British Islands and in other parts of Europe. It occurs principally in bogs, and does not disagree with the published but incomplete descriptions of *C. margaritiferum*. Moreover, it is of the same size, and its zygospore, which we have found repeatedly, agrees exactly with that described and figured for *C. margaritiferum*. It is inconceivable that the older investigators could have missed such a striking and common Desmid, seeing that they repeatedly found most of its associates, and, moreover, amongst these associates they invariably recorded "*C. margaritiferum*."

Hence, as we constantly find in bogs a *Cosmarium* as common as *C. margaritiferum* was reported to be, of the same size, and not differing materially from the published descriptions of that species; and as this *Cosmarium* occurs with the same associates with which *C. margaritiferum* was generally said to be found, and as it has exactly the same zygospore, we are forced to the conclusion that *it is C. margaritiferum.*

At the same time the species is unquestionably identical with the "*C. Malinvernianum*, var. *Badense*," described by Schmidle, and therefore Schmidle's name must become a synonym of *C. margaritiferum*. Schmidle was the first to point out the constantly flattened apex of the semi-cells and the presence of the minute scrobiculations between the depressed central granules.

We have previously given a figure of the zygospore of this species under the erroneous name of "*C. confusum*, var. *regularius*" (*vide* West and G. S. West, in "Journ. Roy. Micr. Soc.," 1896, p. 156, t. 4, f. 41).

123. *C. Brébissonii*, Menegh. *S.*—Scalloway.

124. *C. trachypleurum*, Lund. *O.*—W. of Kirkwall. *S.*—Bressay.

125. *C. isthmochondrum*, Nordst.

Var. *pergranulatum*, var. n. (fig. 20).

Var. granulis ad margines laterales semicellularum minus distinctis, scrobiculis centralibus nullis, granulis intra margines numerosioribus.

Long. 37·5μ ; lat. 31·5μ ; lat. isthm. 7·5μ ; crass. 20μ.

O.—Pond near Kirkwall.

126. *C. sphalerostichum*, Nordst. *S.*—Lerwick ; Scalloway.

127. *C. depressum* (Näg.), Lund. (*C. Scenedesmus*, Delp.) *O.*—Hoy. *S.*—Bressay, in pools, and also in plankton of Loch Beosetter; Neugles Water. Plankton of Loch Asta.

128. *C. bioculatum*, Bréb. *S.*—Neugles Water ; Lerwick. Plankton of Loch Asta and of Loch Beosetter, Bressay.

129. *C. tinctum*, Ralfs. *O.*—Kirkwall ; Hoy. *S.*—Lerwick ; Scalloway ; Bressay.

130. *C. contractum*, Kirchn., var. *ellipsoideum* (Elfv.), W. and G. S. West. *S.*—Plankton of Loch Beosetter, Bressay.

131. *C. subcontractum*, sp. n. (fig. 21).

C. parvum, paullo longius quam latum, profundissime constrictum, sinu angusto prope apicem, sed late aperto extrorsum ; semicellulæ obverse semicirculares, apicibus latissimis et subrectis, angulis superioribus rotundatis ; a latere visæ subglobosæ ; a vertice visæ subanguste ellipticæ ; membrana punctata ; pyrenoidibus singulis.

Long. 33μ ; lat. 30–31μ ; lat. isthm. 6·5μ ; crass. 16μ.

S.—Bressay, in pools, not uncommon.

In outline this species much resembles *C. staurastroides*, Eichler and Gutw. (in "Rospraw. Wydz. matem.-przyr. Akad. Umiej. Krakow," xxviii., 1894, p. 171, t. 5, f. 30), but is distinguished by its much larger size, its narrower isthmus, and the narrowly elliptical vertical view. Moreover, the apices of the semi-cells are never retuse, and the cell-wall is distinctly punctate.

It should also be compared with *C. aversum*, W. and G. S. West.

132. *C. Hammeri*, Reinsch [inclus. *C. homalodermum*, Nordst]. *O.*—Hoy. S.—Near Scalloway.

133. *C. galeritum*, Nordst. *S.*—Lerwick.

134. *C. præmorsum*, Bréb. *O.*—Hoy. *S.*—Near Scalloway ; Loch Brindister ; Bressay.

135. *C. Corbula*, Bréb. *O.*—Kirkwall.

136. *C. Turpinii*, Bréb. *S.*—Plankton of Loch Asta.

137. *C. subpunctulatum*, Nordst. *O.*—Kirkwall ; Stromness. *S.*—Neugles Water. Plankton of Loch Asta.

138. *C. punctulatum*, Bréb. *O.*—Kirkwall ; Stromness ; Hoy. *S.*—Bressay, in pools, and also in the plankton of Loch Beosetter.

139. *C. humile* (Gay), Nordst. *O.*—Pond near Kirkwall. Plankton of Loch Kirbister. *S.*—Plankton of Loch Asta, and of Loch Beosetter, Bressay.

Var. *substriatum* (Nordst.), Schmidle. *O.*—Stromness ; Finstown ; Hoy. *S.*—Lerwick ; Neugles Water ; Loch Brindister ; Bressay.

140. *C. Blyttii*, Wille. *O.*—Kirkwall.

141. *C. Boeckii*, Wille. *O.*—Kirkwall ; Finstown. *S.* — Lerwick ; Neugles Water. Plankton of Loch Asta, and of Loch Beosetter, Bressay.

142. *C. subprotumidum*, Nordst. *S.*—Lerwick. Plankton of Loch Brindister.

143. *C. calcareum*, Wittr. Long. 28–30μ ; lat. 25·5–27·5μ ; lat. isthm. 7–7·2μ ; crass. 15·5–16μ. *S.*—Lerwick.

This Desmid occurred abundantly in a small pond.

The specimens were not exactly like the figure given by Wittrock (in "Bihang till K. Vet.-Akad. Handl.," Bd. 1, No. 1, 1872, t. 4, f. 13), the central protuberance being somewhat larger and more granulated.

144. *C. subcostatum*, Nordst. *O.*—Plankton of Loch Kirbister. *S.*—Lerwick; Neugles Water; Loch Brindister. Plankton of Loch Clickhimin.

145. *C. costatum*, Nordst. Long. 40μ; lat. 35μ; lat. apic. 20μ; lat. isthm. 14·5μ. *S.*—Bressay.

146. *C. formosulum*, Hoff. *O.* — Kirkwall; Hoy. *S.* — Bressay. Plankton of Neugles Water, and of Loch Asta and Clickhimin.

147. *C. variolatum*, Lund. *O.*—Hoy.

148. *C. pyramidatum*, Bréb. *O.*—Kirkwall; Hoy. *S.*—Scalloway. Plankton of Loch Beosetter, Bressay.

149. *C. Nymannianum*, Grun. *O.*—Hoy.

150. *C. granatum*, Bréb. *O.*—Kirkwall; Hoy. *S.*—Scalloway.

Var. *subgranatum*, Nordst *O.*—Plankton of Loch Kirbister. *S.*—Plankton of Loch Asta.

151. *C. Holmiense*, Lund. *S.*—Neugles Water.

152. *C. tetragonum*, Näg, var. *Lundellii*, Cooke. *S.*—Bressay, in a ditch.

153. *C. notabile*, Bréb. *O.*—Hoy. *S.*—Scalloway; Bressay.

154. *C. venustum* (Bréb.), Arch. *O.*—Stromness; Hoy. *S.*—Scalloway.

Var. *majus*, Wittr. *S.*—Scalloway.

155. *C. tetraophthalmum*, Bréb. *O.*—Finstown; Hoy. *S.*—Scalloway. Plankton of Loch Asta, and also of Loch Beosetter, Bressay.

156. *C. Botrytis* (Bory), Menegh. *O.*—Kirkwall; Stromness; Hoy. Plankton of Loch Kirbister. *S.*—Lerwick; Neugles Water. Plankton of Lochs Asta, Brindister, and Clickhimin. Bressay, in pools, and also in the plankton of Loch Beosetter.

Var. *tumidum*, Wolle. *S.*—Plankton of Loch Asta.

Long. 79μ; lat. 62μ; lat. isthm. 17μ.

157. *C. obtusatum*, Schmidle, in "Engler's Botan. Jahrbüch," 1898, Bd. xxvi., p. 38. [*C. undulatum*, var. *obtusatum*, Schmidle, in "Berichte Deutsch. Botan Gesellsch.," Bd. xi., 1893, p. 550, t. 28, f. 11.]

The specimens possessed rather smaller apices than those described by Schmidle. Long. 58–60μ; lat. 49–50μ; lat. isthm. 15·5μ. *S.*—Plankton of Loch Asta.

158. *C. ochthodes*, Nordst. *O.*—Near Kirkwall; Stromness; Hoy. *S.*—Lerwick; Loch Brindister; Bressay.

Var. *amœbum*, West. *O.*—Kirkwall; Hoy. *S.*—Near Scalloway; Bressay.

159. *C. margaritatum* (Lund), Roy and Biss. *O.*—Hoy; *S.*—Scalloway.

160. *C. Pseudobroomei*, Wolle, "Desm. U.S.," 1884, p. 86, t. 51, f. 36, 37.

Var. *convexum*, var. n. (fig. 22).

Var. marginibus lateralibus semicellularum convexis, angulis rotundatioribus; granulis ut in forma typica dispositis.

Long. 46μ; lat. 37·5μ; lat. isthm. 12·5μ; crass. 24μ.

S.—Near Lerwick.

This variety differs from all other forms of *C. Pseudobroomei* in the convex lateral margins and in the more rounded angles of the semi-cells.

We have given figures of forms of *C. Pseudobroomei* from Ceylon (*vide* "Trans. Linn. Soc.," bot. ser. 2, vi., 1902, t. 21, f. 4); Schmidle has also given figures of a German *Cosmarium* which he names "*C. Pseudobroomei*" (*vide* "Ber. der. Naturf. Ges. Freiburg," Bd. vii., 1893, t. 5, f. 2, 3), but the granulation he indicates is much too fine for this species.

161. *C. speciosum*, Lund. *O.*—Hoy. Plankton of Loch Kirbister. *S.*—Scalloway; Bressay.
162. *C. subspeciosum*, Nordst. *O.*—Kirkwall. *S.*—Scalloway. Plankton of Loch Beosetter, Bressay.
163. *C. globosum*, Buln. *S.*—Lerwick; Bressay.
164. *C. subarctoum* (Lagerh.), Racib., in "Rozpraw Wydz. matem.-przy. Akad. Umiej. Krakow," xxii., 1892, p. 385, t. 6, f. 24. [*C. globosum*, Buln., subsp. *subarctoum*, Lagerh., in Wittr., and Nordst, "Alg. Exsic.," fasc. 21, no. 567, 1883; Nordst, in "Öfvers. af K. Vet.-Akad. Forh.," 1885, no. 3, p. 9, t. 7, f. 5.]

   Forma *punctata* (fig. 24).

   Forma membrana distincte et irregulariter punctata.

   Long. 16–19μ; lat. 13·5–16μ; lat. isthm. 8·6–10·5μ; crass. 9–10μ.

   S.—Plankton of Loch Beosetter, Bressay.

   C. affine, Racib., is a very close ally of *C. subarctoum*, and would perhaps be better considered as one of the forms of it. The Desmid described and figured by Schmidle as "*Dysphinctium affine*, Racib., forma. *major*" (*vide* "Engl. Botan. Jahrbüch," Bd. xxvi., 1898, p. 20, t. 4, f. 16), lends further support to this view.
165. *C. pseudarctoum*, Nordst. *O.*—Hoy. *S.*—Plankton of Loch Asta.
166. *C. Regnesii*, Reinsch. *S.*—Near Scalloway.
167. *C. crenatum*, Ralfs. *O.*—Hoy. *S.*—Lerwick; Bressay.
168. *C. quadratum*, Ralfs. *O.* — Kirkwall; Hoy. *S.* — Lerwick; Scalloway.
169. *C. anceps*, Lund. *O.*—W. of Kirkwall; Hoy.
170. *C. pseudexiguum*, Racib. *S.*—Lerwick.
171. *C. obliquum*, Nordst. *O.*—W. of Kirkwall.
172. *C. pygmæum*, Arch. [*C. minutissimum*, Heimerl; *C. Heimerlii*, W. and G. S. West.] *O.*—Kirkwall; Finstown; Hoy (summit of Ward Hill).
173. *C. Sphagnicolum*, W. and G. S. West. *O.*—Finstown.
174. *C. abbreviatum*, Racib. *O.*—Finstown. *S.*—Plankton of Loch Asta, and also of Loch Beosetter, Bressay.
175. *C. quadrimamillatum*, W. and G. S. West. Long. 25–27μ; lat. 25–27μ; lat. isthm. 7μ. *S.*—Bressay, in a ditch.

   This species has only previously been recorded from near the Lizard, Cornwall. Hence it must be regarded as a western type.
176. *C. Regnellii*, Wille. *O.*—Kirkwall. *S.*—Lerwick; Bressay.
177. *C. Meneghinii*, Bréb. *O.*—Kirkwall. Plankton of Loch Kirbister. *S.*—Lerwick.

   Forma *octangularis*, Wille. *O.*—Kirkwall. *S.*—Lerwick; Scalloway; Neugles Water; Bressay. Plankton of Lochs Asta and Sandy.
178. *C. angulosum*, Bréb., var. *concinnum* (Rabenh.), W. and G. S. West. *O.*—Kirkwall; Hoy. *S.*—Plankton of Loch Asta.
179. *C. trilobulatum*, Reinsch. *O.*—Hoy. *S.*—Near Scalloway.
180. *C. difficile*, Lütkem. *O.*—Kirkwall; Hoy. *S.*—Scalloway.

   Var. *sublæve*, Lütkem. *O.*—Kirkwall; Hoy. *S.*—Scalloway. Plankton of Loch Beosetter, Bressay.
181. *C. læve*, Rabenh., "Flor. Europ. Algar. III.," 1868, p. 161; Nordst, in "Öfvers. af K. Vet.-Akad. Förh.," 1876, no. 6, t. 12, f. 4; G. S. West, in "Journ. Linn. Soc.," bot. xxxiv., 1899, p. 386, t. 10, f. 1–6.

   O.—Hoy. *S.*—Lerwick.

Var. *septentrionale*, Wille. *O.*—Hoy. *S.*—Lerwick.

Var. *cymatium*, var. n. (fig. 19).

Var. marginibus lateralibus semicellularum minute undulatis. Long. 24–27μ ; lat. 17–18μ ; lat. isthm. 4·6–5μ. *O.*—Hoy.

182. *C. goniodes*, W. and G. S. West, in "Trans. Linn. Soc.," bot. ser. 2, 1895, p. 70, t. 8, f. 8.

Var. *variolatum*, var. n. (fig. 18).

Var. semicellulis brevioribus, levissime attenuatis, angulis superioribus subrotundatis, apicibus levissime retusis ; a latere visis ovato-pyramidatis ; a vertice visis late ellipticis ; membrana punctulata, punctulis delicatissimis et multe distantibus ; cellulis fere tortis.

Long. 20–21·3μ ; lat. 10·6–12·2μ ; lat. isthm. 8·5–8·8μ ; crass. 8·5μ.

S.—Near Scalloway.

This variety stands nearer to *C. goniodes*, var. *subturgidum*, W. and G. S. West (in "Trans. Roy. Irish Acad.," xxxiii., sect. B, 1902, p. 41, t. 2, f. 12), than to the typical form. It is distinguished, however, by its shorter semi-cells, and its variolated cell-wall.

183. *C. Cucurbita*, Bréb. *O.*—Kirkwall ; Hoy. *S.*—Lerwick ; Scalloway ; Neugles Water.

184. *C. annulatum* (Nag), De Bary, var. *elegans*, Nordst. Long. 57·5μ ; lat. 25μ. *S.*—Scalloway.

Genus XANTHIDIUM, Ehrenb.

185. *X. antilopœum* (Bréb.), Kütz. *S.*—Neugles Water ; Loch Brindister ; Bressay.

Var. *depauperatum*, var. n. [*X. antilopœum*, forma, W. and G. S. West, "Scott. Freshw. Plankton I.," "Journ. Linn. Soc.," bot. xxxv., 1903, p. 539, t. 16, f. 1.]

Var. cellulis leviter inflatis, angulis lateralibus cellularum valde obtusis vel levissime truncatis ; spinis paucis (1–3 ad marginibus lateralibus semicellulæ unæquaque), brevioribus et tenuioribus, subirregulariter dispositis.

Long. sine spin. 46–55·5μ ; lat. sine spin. 43–50μ ; long. spin. 2–9·5μ ; lat. isthm. 9·5–14μ (figs. 15 and 16).

S.—Plankton of Neugles Water, Loch Brindister, and of Loch Beosetter, Bressay.

This variety differs from the type in the form of the semi-cells, and in the fewer, thinner, and irregularly disposed spines. The disposition and number of the spines is extremely variable, and is generally different on the two semi-cells of the same individual. It is such a constant feature of the Scottish plankton that we think it deserves a special varietal name.

186. *X. fasciculatum*, Ehrenb. *O.*—Kirkwall ; Hoy.

187. *X. concinnum*, Arch. *O.*—Finstown. *S.*—Lerwick.

Genus ARTHRODESMUS, Ehrenb.

188. *A. convergens*, Ehrenb. *O.*—Hoy. *S.*—Near Scalloway ; near outlet of Loch Beosetter, Bressay.

189. *A. Incus* (Bréb.), Hass. *O.*—Kirkwall ; Hoy. *S.*—Scalloway.

Var. *Ralfsii*, W. and G. S. West. *O.*—W. of Kirkwall.

Var. *intermedius*, Wittr. *S.*—Near Lerwick.

190. *A. triangularis*, Lagerh., in "Öfvers. af K. Vet.-Akad. Förh.," 1885, no. 7, p. 244, t. 27, f. 22. [*A. Incus*, var. *triangularis*, Lagerh., in "Nuova Notarisia," iv., 1893, p. 182.]

Long. 25–26μ; lat. sine spin. 20–24μ; cum. spin. 61–65·5μ; lat. isthm. 5·2–6μ; crass. 10·5–11μ.

S.—Both at the margins, and in the plankton of Loch Beosetter, Bressay.

The specimens were not quite typical in form, the apices of the semi-cells being straight or very slightly concave, thus resembling the var. *Americanum*.

Var. *subtriangularis* (Borge), Nob. [*A. Incus*, var. *subtriangularis*, Borge, in "Botaniska Notiser," 1897, p. 212, t. 3, f. 4; *A. triangularis*, var. *hebridarum*, W. and G. S. West, in "Journ. Linn. Soc.," bot. xxxv., 1903, p. 542.]

Long. 30–31·5μ; lat. sine spin. 23–25μ; cum spin. 75–78μ; lat. isthm. 8μ (fig. 36).

S.—Plankton of Loch Beosetter, Bressay.

The outline of this variety has been well figured by Borge, but he did not mention the scattered scrobiculations on the cell-wall. It is general in the plankton of the lakes in the West of Scotland and the Outer Hebrides.

Genus STAURASTRUM, Meyen.

191. *S. dejectum*, Bréb. *O.*—Kirkwall; Finstown. *S.*—Bressay. Plankton of Lochs Asta and Brindister, and also of Neugles Water.

Var. *inflatum*, West. *S.*—Plankton of Neugles Water, Lochs Asta and Brindister, and also of Loch Beosetter, Bressay.

192. *S. Dickiei*, Ralfs. *S.*—Loch Brindister.
193. *S. glabrum* (Ehrenb.), Ralfs. *S.*—Near Lerwick.
194. *S. curvatum*, West. *S.*—Plankton of Loch Asta.
195. *S. jaculiferum*, West. *O.*—Plankton of Loch Kirbister. *S.*—Plankton of Neugles Water and Loch Trebister.
196. *S. brevispinum*, Bréb. *S.*—Plankton of Loch Clickhimin, and of Loch Beosetter, Bressay.

Some forms of this species were noticed in the plankton of Loch Asta. They differed somewhat from more typical forms in the relative position of the mucros (fig. 32).

197. *S. cuspidatum*, Bréb. *O.*—Finstown. *S*—Lerwick.

Var. *maximum*, West. *S.*—Plankton of Neugles Water, Lochs Asta, Brindister, and Sandy. Bressay, both in ditches and in the plankton of Loch Beosetter.

198. *S. O'Mearii*, Arch. *O.*—Hoy.
199. *S. lunatum*, Ralfs, var. *planctonicum*, W. and G. S. West. *S.*—Plankton of Loch Brindister, and also of Loch Beosetter, Bressay.
200. *S. pelagicum*, W. and G. S. West. *S.*—Plankton of Loch Asta, and also of Loch Beosetter, Bressay.
201. *S. Avicula*, Bréb., var. *subarcuatum* (Wolle), West. *O.*—Kirkwall; Finstown. *S.*—Scalloway; Bressay.
202. *S. granulosum* (Ehrenb.), "Ralfs, Brit. Desm.," 1848, p. 217; W. and G. S. West, in "Trans. Roy. Irish Acad.," xxxii., 1902, p. 45, t. 2, f. 24.

[*Desmidium granulosum*, Ehrenb., 1839. *Phycastrum granulosum*, Kütz, "Spec. Algar.," 1849, p. 180. *Staurastrum lunatum*, Ralfs, var. *subarmatum*, West, in "Journ. Roy. Micr. Soc.," 1894, p. 10, t. 2, f. 47.]

The forms of this species noticed from the Shetlands were a little more inflated than usual, and the granulation was somewhat finer. The minute denticulations or spines at the angles were variable in length, and one or two were present at each angle (*vide* W. and G. S. West, *l.c.*, p. 46). In the vertical view the sides were straight or very slightly concave.

Long. 29–33μ; lat. sine mucr. 25–29μ; cum mucr. 27–34μ; lat. isthm. 9–12·5μ.

S.—Plankton of Loch Asta.

203. *S. aciculiferum* (West), Anders. *O.*—Hoy.

204. *S. furcigerum*, Bréb. *O.*—Finstown.

205. *S. Reinschii*, Roy. *O.*—Hoy.

206. *S. teliferum*, Ralfs. *O.*—Plankton of Loch Kirbister. *S.*—Bressay, in pools, and also in the plankton of Loch Beosetter.

207. *S. Saxonicum*, Buln. *S.*—Plankton of Loch Trebister.

208. *S. pilosum* (Näg), Arch. *S.*—Bressay. Plankton of Loch Trebister.

209. *S. hirsutum* (Ehrenb.), Bréb. *O.*—Kirkwall. *S.*—Near Lerwick; Scalloway.

210. *S. erasum*, Bréb. *S.*—Plankton of Loch Brindister, and also of Loch Beosetter, Bressay.

211. *S. muticum*, Bréb. *O.*—Kirkwall. *S.*—Neugles Water; Bressay.

212. *S. retusum*, Turn., in "Kongl. Sv. Vet.-Akad. Handl.," xxv., 1893, no. 5, p. 104, t. 13, f. 13.

Var. *boreale*, var. n. (fig. 30).

Var. minor, marginibus lateralibus semicellularum convexis, apicibus levissime retusis; semicellulæ a vertice visæ angulis late obtusis, lateribus subrectis vel levissime retusis; membrana glabra.

Long. 17·5–19μ; lat. 16·2–17·5μ; lat. isthm. 5·5μ. *O.*—Hoy. *S.*—In bog near Lerwick.

213. *S. orbiculare* (Ehrenb.), Ralfs. *O.*—Kirkwall; Finstown. *S.*—Lerwick; Scalloway; Bressay.

Var. *depressum*, Roy and Biss. *O.*—Finstown. *S.*—Plankton of Loch Asta.

214. *S. Bieneanum*, Rabenh. *O.*—Finstown.

215. *S. Sibiricum*, Borge. *S.*—Bressay.

The typical form of this species has not previously been recorded from the British Islands.

216. *S. dilatatum*, Ehrenb. *O.*—Kirkwall.

Var. *obtusilobum*, De Not. *S.*—Neugles Water; Bressay, in ditches, and also in the plankton of Loch Beosetter.

217. *S. alternans*, Bréb. *S.*—Plankton of Loch Asta.

218. *S. punctulatum*, Bréb. *O.*—Kirkwall; Hoy; *S.*—Lerwick; Scalloway; Bressay. Plankton of Loch Trebister.

219. *S. pygmæum*, Bréb. *O.*—Hoy. *S.*—Lerwick.

220. *S. Kjellmanii*, Wille. Long. 43μ; lat. 31μ; lat. isthm. 14μ. *S.*—Bressay, in a ditch.

221. *S. muricatum*, Bréb. *S.*—Near Scalloway.

222. *S. Meriani*, Reinsch. *O.*—Hoy. *S.*—Near Scalloway.

223. *S. brachiatum*, Ralfs. *S.*—Plankton of Loch Beosetter, Bressay.

224. *S. tetracerum*, Ralfs. *O.*—Kirkwall. *S.*—Neugles Water; Loch Brindister. Plankton of Loch Asta.

Forma *trigona*, Lund. *S.*—Bressay.

Var. *evolutum*, var. n. (fig. 31).

Var. processibus cellularum longioribus; semicellulis a vertice visis triangularibus, lateribus convexis, angulis in processus longos productis.

Long. sine proc. 10–11μ, cum proc. 27–40μ; lat. sine proc. 7·5–9·5μ, cum proc. 26–50μ; lat. isthm. 4·5μ.

S.—Plankton of Neugles Water and Loch Brindister, and also of Loch Beosetter, Bressay.

This variety occurred in considerable quantity, and the individuals varied much in the relative length of the processes. The cells were invariably twisted, the processes of one semi-cell alternating with those of the other.

225. *S. hexacerum* (Ehrenb.), Wittr. *O.*—Kirkwall; Hoy. *S.*—Near Lerwick: Scalloway. Plankton of Lochs Asta and Clickhimin. Bressay, in ditches, and also in the plankton of Loch Beosetter.

Var. *semicirculare*, Wittr. *S.*—Scalloway.

226. *S. cyrtocerum*, Bréb., var. *compactum*, var. n. (fig. 29).

Var. corpore semicellularum robustiori, processibus multe brevioribus.

Long. 36μ; lat. cum proc. 40μ; lat. isthm. 11μ.

S.—Plankton of Loch Trebister.

227. *S. inflexum*, Bréb. *O.*—W. of Kirkwall; Finstown; Hoy. *S.*—Scalloway.

228. *S. affine*, sp. n. (fig. 27).

S. submediocre, paullo longius quam latum (cum processibus), subprofunde constrictum; semicellulæ elliptico-subsemicirculares, ventre valde convexo, dorso leviter convexo, angulis in processus crassos breves denticulato-nodulosos subdivergentes productis, apicibus processuum quadrispinatis; a vertice visæ triangulares, lateribus leviter convexis, angulis in processus breves crassos denticulato-nodulosos productis; membrana minute granulata, granulis in annulis concentricis circa basin processuum dispositis.

Long. (sine proc.) 37–40μ; lat. sine proc. circ. 29–33μ; lat. cum proc. 44–55μ; lat. isthm. 10·5μ.

S.—Plankton of Neugles Water and of Loch Brindister.

This species occurred in abundance in the plankton of the above-mentioned lakes. Its distinctive characters are the large size of the body of the semi-cells, and the short, outwardly diverging processes, each of which possesses two rings of denticulations and four apical spines. It is perhaps nearest to *S. polymorphum*, Bréb., but is larger, of different relative proportions, and with different processes.

Borge has recently described a "*S. subpolymorphum*" (*vide* "Arkiv. för. Botan. utgif. af K. Sv. Vet.-Akad.," Bd. I., 1903, p. 107, t. 4, f. 13), but this is a smooth *Staurastrum*, which we are inclined to think is merely a South American form of *S. distentum*, Wolle (*vide* W. and G. S. West, "Some Desm. U.S," "Journ. Linn. Soc.," bot. xxxiii., 1898, p. 316, cum fig. xylogr., 6 *d–f*).

229. *S. polymorphum*, Bréb. *O.*—Kirkwall. *S.*—Scalloway; Lerwick; Neugles Water.

Var. *simplex*, var. n. (fig. 28).

Var. cellulis paullo longioribus (sine processibus); processibus leviter divergentibus cum annulo uno denticulorum; apicibus processuum spinis minutis 4 præditis; membrana reliqua glabra; cellulæ a vertice visæ quadrangulares.

Long. sine proc. 21–23μ; lat. sine proc. 12·5–15μ, cum. proc. 23–28·5μ; lat. isthm. 7·6μ.

S.—Near Lerwick, abundant amongst *Chlorobotrys regularis*, etc.

230. *S. crenulatum* (Näg.), Delp. *O.*—W. of Kirkwall.

231. *S. gracile*, Ralfs. *O.*—Plankton of Loch Kirbister. *S.*—Lerwick; Scalloway. Plankton of Loch Clickhimin, Neugles Water, and of Loch Beosetter, Bressay.

Var. *nanum*, Wille. *O.*—Kirkwall.

232. *S. boreale*, sp. n. (fig. 25).

S. parvum, circiter $1\frac{1}{2}$-plo latius quam longum (cum processibus), subprofunde constrictum; semicellulæ subcyathiformes, angulis superioribus in processus longos subhorizontaliter dispositos (vel levissime divergentes) productis, processibus cum annulis 4 denticulorum præditis, apicibus processuum trispinatis, apicibus semicellularum leviter subprotractis denticulatis et subrectis, ad basin extremum semicellularum cum annulo denticolorum 11–13 (viso 6–7); a vertice visæ triangulares, angulis in processus sublongos denticulatos productis, lateribus subrectis cum verrucis bidenticulatis 3, intra marginem unumquemque verrucis emarginatis 3 ornatis.

Long. 27–29μ; lat. cum proc. 43–46μ; lat. isthm. 7·5–8μ.

S.—Plankton of Loch Asta.

This small and elegant *Straurastrum* occurred in considerable quantity in the plankton of Loch Asta, and it is not very closely allied to any other British species of the genus. It should, perhaps, be compared with *S. Burmense*, Turn., and *S. galeatum*, Turn. (*vide* W. and G. S. West, in "Trans. Linn. Soc.," bot. ser. 2, vi., p. 190, t. 22, f. 19).

233. *S. paradoxum*, Meyen. *S.*—Scalloway. Plankton of Lochs Brindister, Trebister, and Sandy; also of Neugles Water, and of Loch Beosetter, Bressay.

From Loch Sandy the specimens were very variable with regard to the length of the processes. Long. sine proc. 22–28μ; cum proc. 36–42μ; lat. cum proc. 44–61μ; lat. isthm. 6μ (figs. 34 and 35).

From Loch Trebister some forms were noticed almost identical with others seen from Loch Laxadale, Harris, Outer Hebrides (*vide* W. and G. S. West, in "Journ. Linn. Soc.," bot. xxxv., 1903, p. 548, t. 18, f. 4). Long. sine proc. 27μ, cum proc. 39μ; lat. cum proc. 44–49μ; lat. isthm. 9μ. The specimens were quadrangular, and a little smaller than those previously seen from Harris (fig. 33).

234. *S. pseudopelagicum*, W. and G. S. West. *O.*—Plankton of Loch Kirbister.

235. *S. Manfeldtii*, Delp.

Long. 47–51μ; lat. cum proc. 64–69μ; lat. isthm. 14μ (fig. 26).

S.—Plankton of Lochs Sandy and Trebister, and also of Loch Beosetter, Bressay.

This species was particularly abundant from Loch Sandy, occurring in prodigious quantity amongst *Asterionella formosa* and *Melosira granulata*. The specimens agreed very well with Delponte's Italian ones, but the emarginate warts at the apex showed greater regularity. In the vertical view the sides of the semi-cells are smooth, and the margins of the processes are only gently undulate.

A few scattered granules were present at the base of each semi-cell, and there was a very slight basal swelling. *Vide* W. and G. S. West, in "Trans. Roy. Irish Acad.," xxxii., sect. B., 1902, p. 56, t. 1, f. 29).

236. *S. anatinum*, Cooke and Wills. *S.*—Plankton of Neugles Water and of Loch Brindister.
237. *S. proboscideum*, Arch. [*S. Borgeanum*, Schmidle.] *O.*—W. of Kirkwall. *S.*—Lerwick.
238. *S. asperum*, Bréb. *O.*—W. of Kirkwall.
239. *S. pileolatum*, Bréb., var. *Brasiliense* (Börges.), Lütkem. *S.*—Lerwick.
240. *S. margaritaceum* (Ehrenb.), Menegh. *O.*—Kirkwall; Ward Hill, Hoy (both 4- and 5-angular). *S.*—Lerwick.

Genus SPHÆROZOSMA, Corda.

241. *S. excavatum*, Ralfs. *S.*—Neugles Water.
242. *S. granulatum*, Roy and Biss. *S.*—Plankton of Loch Asta, and of Loch Beosetter, Bressay.
243. *S. vertebratum*, Ralfs. *S.*—Bressay, in a ditch.
    Var. *punctulatum*, W. and G. S. West. [*S. punctulatum*, West, in "Journ. Bot.," Dec. 1891, t. 315, f. 1 and 2.] *S.*—Near Scalloway.

Genus SPONDYLOSIUM, Bréb.

244. *S. pulchellum*, Arch. *O.*—Hoy.

Genus HYALOTHECA, Ehrenb.

245. *H. dissiliens* (Sm.), Bréb. *O.*—W. of Kirkwall; Stromness; Hoy. *S.*—Lerwick; near Scalloway; Bressay.
    Forma *tridentula*, Nordst. *S.*—Lerwick.
    Var. *hians*, Wolle. *S.*—Near Lerwick.
246. *H. mucosa* (Dillw.), Ehrenb. *S.*—Plankton of Loch Beosetter, Bressay.

Genus GYMNOZYGA, Ehrenb.

247. *G. moniliformis*, Ehrenb. *O.*—Hoy.

Order PROTOCOCCOIDEÆ.

Family CHÆTOPELTIDEÆ.

Genus CHÆTOSPHAERIDIUM, Klebahn.

248. *Ch. globosum* (Nordst.), Klebahn. *S.*—Neugles Water.

Family VOLVOCACEÆ.

Genus PANDORINA, Bory.

249. *P. morum* (Müll.), Bory. *O.*—Kirkwall. *S.*—Plankton of Loch Asta.

Genus EUDORINA, Ehrenb.

250. *E. elegans*, Ehrenb. *S.*—Bressay. Plankton of Loch Asta.

Family CHARACIEÆ.

Genus CHARACIUM, A. Br.

251. *Ch. Pringsheimii*, A. Br. *O.*—Kirkwall. *S.*—Lerwick.
252. *Ch. heteromorphum* (Reinsch), W. and G. S. West. *S.*—Scalloway.
253. *Ch. longipes*, Rabenh. *O.*—Kirkwall.

254. *Ch. falcatum*, Schröder, in "Forschungsber. Biol. Stat. Plön," vi., 1898, p. 23, t. 1, f. 5. Lat. cell. 4–5·2μ. *S.*—Scalloway.

This species was frequently observed in the collections from Scalloway, and is remarkable for the great curvature of the cells. It has not previously been recorded from the British Islands.

Family PLEUROCOCCACEÆ.

Genus PLEUROCOCCUS, Menegh.

255. *Pl. vulgaris*, Menegh. *O.* and *S.*—Very common everywhere.

Genus UROCOCCUS, Kütz.

256. *U. insignis* (Hass), Kütz. *O.*—Near Kirkwall; Stromness; Hoy. *S.*—Near Lerwick; plankton of Loch Brindister; Bressay.

Family HYDRODICTYACEÆ.

Genus PEDIASTRUM, Meyen.

257. *P. Boryanum* (Turp.), Menegh. *O.*—Near Kirkwall; Finstown; plankton of Loch Kirbister. *S.*—Near Lerwick, and at the margins of Neugles Water; Bressay, in ditches. Plankton of Neugles Water, Lochs Asta, Brindister and Clickhimin, and also of Loch Beosetter, Bressay.

Var. *granulatum* (Kütz), A. Br. *O.*—Plankton of Loch Kirbister. *S.*—Plankton of Lochs Asta and Clickhimin.

258. *P. glanduliferum*, Bennett. *S.*—Neugles Water; plankton of Loch Beosetter, Bressay.

259. *P. duplex*, Meyen. *O.*—Plankton of Loch Kirbister. *S.*—Plankton of Lochs Asta, Brindister and Clickhimin, and also of Loch Beosetter, Bressay.

260. *P. integrum*, Näg. *S.*—Plankton of Loch Beosetter, Bressay.

261. *P. tetras* (Ehrenb.), Ralfs. *O.*—Finstown. *S.*—Near Scalloway; Neugles Water; Bressay.

Family PROTOCOCCACEÆ (or AUTOSPORACEÆ).

Genus CŒLASTRUM, Näg.

262. *C. sphæricum*, Näg. *O.*—Ward Hill, Hoy. *S.*—Plankton of Loch Asta, and also of Loch Beosetter, Bressay.

263. *C. cambricum*, Arch. [*C. pulchrum*, Schmidle.] *O.*—Finstown. *S.*—Neugles Water.

264. *C. cubicum*, Näg. *S.*—Neugles Water.

Genus SORASTRUM, Kütz.

265. *S. spinulosum*, Näg. *O.*—Finstown. *S.*—Neugles Water.

Genus CRUCIGENIA, Morren.

266. *C. rectangularis* (Näg), Gay. *O.*—Finstown; pond near Kirkwall.

267. *C. irregularis*, Wille, "Algologische Notizen IV.," "Nyt Magazin for Naturvidenskb.," Bd. 38, Heft 1, p. 10, t. 1, f. 15. [*Willea irregularis*, Schmidle, in "Berichte Deutsch. Botan. Ges.," 1900, Bd. xviii., p. 157.]

Long. cell. 7–13μ; lat. cell. 4–9μ; diam. colon. 48–97μ (figs. 6 and 7).

S.—Plankton of Lochs Asta and Brindister, and also of Loch Beosetter, Bressay.

This interesting species was first found by Wille in Norway, both in ordinary collections and in the plankton. It only differs from *C. rectangularis* (Näg.), Gay, in the irregularity of its colonies, and in the total absence of pyrenoids.

Schmidle has recently placed this Alga under a new genus—*Willea*, but a comparison of the colonies with those of *C. rectangularis* does not support this view. All the cells in a large colony of the latter species do not possess pyrenoids, and *the only distinction of importance* between these two species is the irregularity of the cell-division in Wille's species.

Genus SCENEDESMUS, Meyen.

268. *S. bijugatus* (Turp.), Kütz. *O.*—W. of Kirkwall; Hoy. *S.*—Near Lerwick; Scalloway; Bressay. Plankton of Loch Asta.

269. *S. obliquus* (Turp.), Kütz. *O.*—Kirkwall. *S.*—Near Lerwick.

270. *S. quadricauda* (Turp.), Bréb. *O.*—Kirkwall; Finstown. Plankton of Loch Kirbister. *S.*—Lerwick; Neugles Water. Plankton of Lochs Asta and Clickhimin. Bressay, in ditches and in the plankton of Loch Beosetter.

Var. *abundans*, Kirchn. *S.*—Bressay. Plankton of Loch Asta.

271. *S. denticulatus*, Lagerh. *O.*—W. of Kirkwall; near Finstown. *S.*—Near Lerwick; Bressay. Plankton of Loch Asta.

272. *S. acutiformis*, Schröder, in "Forschungsber. Biol. Stat. Plön," v., 1897, p. 17, t. 2, f. 4.

Var. *Brasiliensis*, nob. [*S. brasiliensis*, Bohlin, in "Bihang till K. Sv. Vet.-Akad. Handl.," Bd. 23, No. 7, 1897, p. 22, t. 1, f. 26–27; *S. acutiformis*, Schröd., var. *spinuliferum*, W. and G. S. West, "Freshw. Alg. Koh Chang," "Botanick Tidsskrift," Bd. 24, 1901, p. 98, t. 4, f. 46–49.]

Long. cell. sine spin. 20–27μ; lat. cell. 5–8μ; long. spin. 1·5–3·8μ (figs. 8 and 9).

S.—Plankton of Loch Asta.

This variety undoubtedly combines the characters of *S. denticulatus*, Lagerh.; and *S. acutiformis*, Schröder, and could be placed equally well as a variety of either species.

Genus ANKISTRODESMUS, Corda.

273. *A. falcatus* (Corda), Ralfs. [*Rhaphidium fasciculatum*, Kütz; *Rh. polymorphum*, Fresen., var. *falcatum*, Rabenh.] *O.*—Finstown. *S.*—Near Lerwick; near Scalloway. Plankton of Neugles Water, and also of Loch Beosetter, Bressay.

Var. *acicularis* (A. Br.), G. S. West. [*Rhaphidium aciculare*, A. Br.; *Rh. polymorphum*, Fresen, var. *aciculare*, Rabenh.] *O.*—Kirkwall. Plankton of Loch Kirbister. *S.*—Near Lerwick; near Scalloway; Neugles Water. Plankton of Loch Clickhimin.

Var. *mirabilis*, G. S. West. [*Rh. polymorphum*, Fresen, var. *mirabile*, W. and G. S. West.] *S.*—Near Scalloway. Plankton of Lochs Sandy and Trebister, and also of Loch Beosetter, Bressay.

Var. *spiralis* (Turn.), G. S. West. [*Rh. spirale*, Turn.] *S.*—Plankton of Loch Asta.

274. *A. Pfitzeri* (Schröder), G. S. West. [*Rh. Pfitzeri*, Schröder.] *S.*—Plankton of Loch Asta, and of Loch Beosetter, Bressay.

Genus CLOSTERIOPSIS, Lemm.

275. *Cl. longissima*, Lemm., in "Forschungsber. Biol. Stat. Plön," vii., 1899, p. 29, t. 2, f. 36–38. [*Closterium pronum*, var. *longissimum*, Lemm. (not *Rhaphidium longissimum*, Schröder).]

O.—Near Finstown.

Var. *tropicum*, nob. [*Rhaphidium longissimum*, Schröd., var. *tropicum*, W. and G. S. West, in "Trans. Linn. Soc.," bot. ser. 2, 1902, p. 198.]

Long. 320–370μ; lat. 6–6·5μ; lat. apic. 1–1·2μ (fig. 1).

S.—Plankton of Loch Asta.

The specimens observed were a little longer than those observed from Ceylon, but otherwise very similar. The apices were very much prolonged, but never setiform. The chloroplast contained about 12 pyrenoids.

Genus KIRCHNERIELLA, Schmidle.

276. *K. obesa* (West), Schmidle. *S.*—Plankton of Neugles Water.

Genus OOCYSTIS, Näg.

277. *O. solitaria*. Wittr. *O.*—Near Kirkwall; Hoy. *S.*—Near Lerwick; near Scalloway.
278. *O. elliptica*, West. *O.*—Kirkwall.
279. *O. crassa*, Wittr. *S.*—Plankton of Loch Asta.
280. *O. parva*, W. and G. S. West. *S.*—Plankton of Loch Asta.
281. *O. asymmetrica*, W. and G. S. West. *O.*—Pond near Kirkwall.
282. *O. apiculata*, West. *S.*—Plankton of Loch Asta.

This species was first described from Sphagnum-pools in the Orkney Islands (*vide* West, in "Journ. Bot.," April 1893, t. 333, f. 7, 8).

Genus NEPHROCYTIUM, Näg.

283. *N. Agardhianum*, Näg. [inclus. *N. Nägelii*, Grun]. *O.*—Kirkwall. *S.*—Plankton of Loch Beosetter, Bressay.
284. *N. lunatum*, West. *S.*—Plankton of Loch Asta.

Genus EREMOSPHÆRA, De Bary.

285. *E. viridis*, De Bary. *O.*—Near Kirkwall; Hoy.

Genus TETRAËDRON, Kütz.

286. *T. regulare*, Kütz. *O.*—Near Kirkwall.

Some of the specimens had the angles furnished with short spines, but others were destitute of spines. Diam. 23–43μ.

287. *T. minimum* (A. Br.), Hansg. *S.*—Plankton of Loch Asta.

Genus DICTYOSPHÆRIUM, Näg.

288. *D. Ehrenbergianum*, Näg. *O.*—Stromness; Hoy. *S.*—Plankton of Loch Asta.

Genus BOTRYOCOCCUS, Kütz.

289. *B. Braunii*, Kütz. *O.*—Near Kirkwall. *S.*—Near Lerwick; Bressay.

Genus INEFFIGIATA, W. and G. S. West.

290. *I. neglecta*, W. and G. S. West. *O.*—Kirkwall ; Finstown. *S.*—Near Lerwick ; Neugles Water. Plankton of Lochs Asta and Clickhimin. Bressay, in ditches, and also in the plankton of Loch Beosetter.

Genus SCHIZOCHLAMYS, A. Br.

291. *S. gelatinosa*, A. Br. *O.*—Kirkwall. *S.*—Neugles Water.
292. *S. delicatula*, West. *O.*—W. of Kirkwall.

Genus SPHÆROCYSTIS, Chodat.

293. *Sph. Schroeteri*, Chodat. *S.*—Plankton of Neugles Water, and of Lochs Asta, Sandy and Brindister.

Genus GLŒOCYSTIS, Näg.

294. *G. gigas* (Kütz), Lagerh. *O.*—Near Kirkwall. Plankton of Loch Kirbister. *S.*—Near Lerwick ; near Scalloway ; plankton of Lochs Asta and Clickhimin. Bressay, in ditches, and also in the plankton of Loch Beosetter.
295. *G. vesiculosa*, Näg. *O.*—Kirkwall ; Finstown. *S.*—Near Scalloway ; Neugles Water.

Class HETEROKONTÆ.

Order CONFERVALES.

Family TRIBONEMACEÆ.

Genus CHLOROBOTRYS, Bohlin.

296. *Chl. regularis* (West), Bohlin. *O.*—Near Kirkwall ; Finstown ; Hoy. *S.*—Near Lerwick ; near Scalloway ; Neugles Water ; Bressay.

Genus OPHIOCYTIUM, Näg.

297. *O. Arbuscula* (A. Br.), Rabenh. *O.*—Near Kirkwall. *S.*—Bressay
298. *O. graciliceps* (A. Br.), Rabenh. *S.*—Near Lerwick.
299. *O. majus*, Näg. *O.*—Kirkwall ; Finstown ; Stromness.
300. *O. bicuspidatum* (Borge), Lemm. *O.*—Near Kirkwall.
301. *O. parvulum* (Perty), A. Br. *O.*—Kirkwall ; Finstown.

Genus TRIBONEMA, Derbes and Solier.

302. *T. bombycinum* (Ag.), Derb. and Sol. [*Conferva bombycina*, Ag.] *O.*—Near Kirkwall ; Hoy. *S.*—Near Lerwick ; Scalloway.
Forma *minor* (Wille), G. S. West. [*Conferva bombycina*, forma *minor*, Wille.] *S.*—Lerwick ; Bressay.

Class BACILLARIEÆ.

Order CENTRICÆ.

Family MELOSIRACEÆ.

Genus MELOSIRA, Ag.

303. *M. granulata* (Ehrenb.), Ralfs. *S.*—Near Lerwick. Plankton of Neugles Water, Lochs Brindister, Clickhimin and Sandy, and also of Loch Beosetter, Bressay.

Order PENNATÆ.

Family TABELLARIACEÆ.

Genus TABELLARIA, Ehrenb.

304. *T. flocculosa* (Roth) Kütz. *O.*—Kirkwall ; Finstown ; Stromness ; Hoy. Plankton of Loch Kirbister. *S.*—Scalloway ; near Neugles Water. Plankton of Neugles Water, Lochs Brindister and Trebister, and also of Loch Beosetter, Bressay.

305. *T. fenestrata* (Lyngb.), Kütz. *O.*—Finstown. Plankton of Loch Kirbister. *S.*—Neugles Water and plankton of Loch Brindister. Bressay, in ditches and in plankton of Loch Beosetter.

Var. *asterionelloides*, Grun. *O.*—Plankton of Loch Kirbister. *S.*—Plankton of Loch Brindister, and of Loch Beosetter, Bressay.

Family MERIDIONACEÆ.

Genus MERIDION, Ag.

306. *M. circulare*, Ag. *O.*—In a well at Finstown ; Hoy.

Family DIATOMACEÆ.

Genus DIATOMA, D.C.

307. *D. elongatum*, Ag. *O.*—Finstown. Plankton of Loch Kirbister. *S.*—Scalloway ; Lerwick (a short, thick form).

308. *D. hiemale* (Lyngb.), Heib. *O.*—Finstown.

Var. *mesodon* (Kütz), V.H. *O.*—Kirkwall, in pond in a quarry.

Family FRAGILARIACEÆ.

Genus FRAGILARIA, Lyngb.

309. *F. capucina*, Desmaz. *O.*—Kirkwall.

310. *F. mutabilis* (W. Sm.), Grun. *O.*—W. of Kirkwall. *S.*—Near Lerwick. Plankton of Loch Trebister.

311. *F. Crotonensis* (A. M. Edw.), Kitton. *O.*—Plankton of Loch Kirbister. *S.*—Plankton of Loch Asta.

312. *F. construens* (Ehrenb.), Grun, var. *binodis*, Grun. *S.*—Near Scalloway.

Genus SYNEDRA, Ehrenb.

313. *S. Ulna* (Nitzsch), Ehrenb. *O.*—Finstown ; Hoy. *S.*—Near Lerwick.

314. *S. pulchella*, Kütz. *O.*—Near Kirkwall ; Stromness. Plankton of Loch Kirbister. *S.*—Near Lerwick. Plankton of Loch Sandy.

315. *S. Vaucheriæ*, Kütz. *S.*—Near Lerwick.

316. *S. radians* (Kütz.), Grun. *O.*—Moor pool near Stromness ; Hoy. *S.*—Neugles Water ; near outlet of Loch Beosetter, Bressay.

Genus ASTERIONELLA, Hass.

317. *A. formosa*, Hass. *S.*—Near Lerwick. Plankton of Neugles Water, Lochs Asta, Brindister, Trebister and Sandy, and also of Loch Beosetter, Bressay.

Family Eunotiaceæ.

Genus eunotia, Ehrenb.

318. *E. pectinalis* (Kütz), Rabenh. *O.*—Near Kirkwall; Finstown; Hoy. *S.*—Near Lerwick; Scalloway.
319. *E. prærupta*, Ehrenb., forma *curta*, V. H. *O.*—Hoy.
  Var. *inflata*, Grun. *O.*—Near Kirkwall.
320. *E. Arcus*, Ehrenb. *O.*—Hoy.
321. *E. gracilis* (Ehrenb.), Rabenh. *S.*—Near Lerwick; near Scalloway.
322. *E. major* (W. Sm.), Rabenh. *O.*—Hoy. *S.*—Near Scalloway.
323. *E. diodon*, Ehrenb. *S.*—Near Scalloway; Neugles Water.
324. *E. lunaris* (Ehrenb.), Grun. *O.*—Near Finstown. *S.*—Lerwick; near Scalloway.
325. *E. biceps* (W. Sm.), G. S. West. [*Synedra biceps*, W. Sm.; *E. flexuosa*, Kütz, var. *bicapitata*, Grun.] *S.*—Bressay, in ditches.

Family Achnanthaceæ.

Genus achnanthes, Bory.

326. *A. coarctata* (Bréb.), Grun. *O.*—Plankton of Loch Kirbister.
327. *A. flexella* (Kütz), Bréb. [*Cocconeis Thwaitesii*, W. Sm.] *O.*—Kirkwall; Hoy. *S.*—Near Lerwick; Bressay.
328. *A. Biasolettiana*, Grun. *O.*—Well at Finstown.
329. *A. exilis*, Kütz. *O.*—Near Kirkwall; Hoy. *S.*—Near Lerwick; Neugles Water.
330. *A. lanceolata* (Bréb.), Grun. *O.*—Finstown. *S.*—Near Scalloway.

Family Cocconeidaceæ.

Genus cocconeis, Ehrenb.

331. *C. Placentula*, Ehrenb. *O.*—Stromness. *S.*—Neugles Water. Plankton of Loch Asta.
332. *C. Pediculus*, Ehrenb. *O.*—Kirkwall; Finstown; Hoy.

Family Naviculaceæ.

Genus navicula, Bory.

333. *N. nobilis* (Ehrenb.), Kütz. *O.*—Near Kirkwall (very abundant among *Eremosphæra viridis* and *Tetmemorus granulatus*); Hoy. *S.*—Near Lerwick; near Scalloway.
334. *N. major*, Kütz. *O.*—Kirkwall; Hoy. *S.*—Plankton of Loch Asta. Bressay, in ditches, and in the plankton of Loch Beosetter.
335. *N. viridis*, Kütz. *O.*—Near Kirkwall; Hoy. Plankton of Loch Kirbister. *S.*—Near Lerwick; near Scalloway; Neugles Water. Plankton of Loch Clickhimin, and also of Loch Beosetter, Bressay.
336. *N. lata*, Bréb. *O.*—Kirkwall.
337. *N. alpina* (W. Sm.), Ralfs. *O.*—Near Kirkwall. *S.*—Near Lerwick; near Scalloway. Plankton of Loch Beosetter, Bressay.
  In some of the collections this species was very abundant.
338. *N. divergens* (W. Sm.), Ralfs. *O.*—W. of Kirkwall.
339. *N. Brebissonii*, Kütz. *O.*—Kirkwall. Plankton of Loch Kirbister.
340. *N. Tabellaria* (Ehrenb.), Kütz. *O.*—Kirkwall; Finstown; Hoy.
341. *N. gibba* (Ehrenb.), Kütz. *O.*—Near Kirkwall; Hoy. *S.*—Scalloway.

342. *N. appendiculata* (Ag.), Kütz. *S.*—Lerwick.
343. *N. mesolepta*, Ehrenb. *O.*—Kirkwall ; Hoy. *S.*—Near Lerwick ; Scalloway.
   Var. *Termes* (Ehrenb.), V. H. *S.*—Near Scalloway.
344. *N. Legumen*, Ehrenb. *S.*—Bressay.
345. *N. oblonga*, Kütz. *O.*—Finstown.
346. *N. peregrina* (Ehrenb.), Kütz. *O.*—Finstown.
347. *N. gracilis*, Kütz. *O.*—Moor pool near Stromness. *S.*—Near Lerwick.
348. *N. viridula*, Kütz. *S.*—Lerwick ; Scalloway.
   Forma *minor*, V. H. *S.*—Neugles Water.
349. *N. radiosa*, Kütz. *O.*—Near Kirkwall ; Finstown ; Stromness ; Hoy. Plankton of Loch Kirbister. *S.*—Near Scalloway ; Bressay.
350. *N. cryptocephala*, Kütz. *O.*—Near Kirkwall. *S.*—Scalloway.
351. *N. rhynchocephala*, Kütz. *O.*—Near Kirkwall. *S.*—Scalloway ; Bressay.
   Var. *rostellata*, (Kütz. ?), V. H. *O.*—Hoy.
352. *N. Gastrum* (Ehrenb.), Donk. *O.*—Kirkwall. *S.*—Lerwick.
353. *N. tumida*, W. Sm. *O.*—Near Finstown.
354. *N. Semen*, Ehrenb. *O.*—Hoy.
355. *N. dicephala*, Ehrenb. *O.*—Hoy. *S.*—Near Lerwick.
356. *N. elliptica*, Kütz. *O.*—Near Kirkwall ; Finstown ; Stromness ; Hoy. Plankton of Loch Kirbister. *S.*—Scalloway ; Lerwick ; Neugles Water. Plankton of Loch Asta (very abundant).
357. *N. pusilla*, W. Sm. *S.*—Plankton of Loch Beosetter, Bressay.
358. *N. cuspidata*, Kütz. *O.*—Pond near Kirkwall. *S.*—Bressay.
359. *N. exilis* (Kütz), Grun. *O.*—Hoy. *S.*—Near Lerwick ; Bressay.
360. *N. Amphisbæna*, Bory. *O.*—Finstown.
361. *N. limosa*, Kütz. *O.*—Kirkwall ; Finstown ; Hoy.
362. *N. Iridis*, Ehrenb., var. *Amphirhynchus* (Ehrenb.), De Toni. *O.*—W. of Kirkwall.
   Var. *affinis* (Ehrenb.) V. H. *O.*—Finstown ; Stromness. Plankton of Loch Kirbister.
363. *N. contenta*, Grun., var. *biceps*, V. H. *O.*—Hoy, on wet rocks.
   This species is often found on the leaves and bark of trees in damp climates.

Genus STAURONEIS, Ehrenb.

364. *St. Phœnicenteron*, Ehrenb. *O.*—Finstown. *S.*—Near Scalloway. Plankton of Loch Asta.
365. *St. anceps*, Ehrenb. *O.*—Kirkwall. *S.*—Near Lerwick ; near Scalloway ; Bressay.

Genus VANHEURCKIA, Bréb.

366. *V. rhomboides* (Ehrenb.), Bréb. *S.*—Near Scalloway ; Lerwick.
   Var. *Saxonica* (Rabenh.), G. S. West. [*Frustulia saxonica*, Rabenh. ; *Navicula crassinervia*, Bréb.] *O.*—Near Kirkwall ; Hoy. *S.*—Near Lerwick ; near Scalloway ; Neugles Water. Plankton of Lochs Clickhimin and Trebister.

Genus AMPHIPLEURA, Kütz.

367. *A. pellucida*, Kütz. *O.*—Kirkwall ; Finstown. *S.* — Bressay. Plankton of Loch Trebister.

Genus GYROSIGMA, Hass.

368. *G. attenuatum* (Kütz), Rabenh. *S.*—Plankton of Loch Asta.
369. *G. acuminata* (Kütz),——. *O.*—Moor pool near Stromness.
370. *G. Spencerii* (Queck), O. K. *O.*—Near Kirkwall.

Genus MASTOGLOIA, Thwaites.

371. *M. Smithii*, Thwaites. *O.*—Finstown. S.—Near Scalloway.

Family GOMPHONEMACEÆ.

Genus GOMPHONEMA, Ag.

372. *G. acuminatum*, Ehrenb. *O.*—Kirkwall; Stromness; near Finstown; Hoy. *S.*—Near Lerwick; Bressay.
373. *G. constrictum*, Ehrenb. *S.*—Bressay.
   Var. *capitatum* (Ehrenb.), V. H. *S.*—Lerwick.
374. *G. intricatum*, Kütz. *O.*—Hoy. *S.*—Near Lerwick; near Scalloway; Bressay.
   Var. *Vibrio* (Ehrenb.), V. H. *O.*—Plankton of Loch Kirbister.
375. *G. olivaceum* (Lyngb.), Kütz. *O.*—Hoy. Plankton of Loch Kirbister. *S.*—Near Lerwick.

Family COCCONEMACEÆ.

Genus COCCONEMA, Ehrenb.

376. *C. Ehrenbergii* (Kütz), G. S. West. [*Cymbella Ehrenbergii*, Kütz.] *O.*—Hoy. *S.*—Bressay, in ditches.
377. *C. cuspidatum*, (Kütz), G. S. West. [*Cymbella cuspidata*, Kütz.] *O.*—Finstown; Stromness; Hoy. *S.*—Scalloway.
   Var. *naviculiformis* (Auersw.) *S.*—Lerwick.
378. *C. delicatulum* (Kütz), nob. [*Cymbella delicatula*, Kütz]. *O.*—Kirkwall; Hoy. *S.*—Scalloway; Bressay.
379. *C. affine* (Kütz), nob. [*Cymbella affinis*, Kütz.] *O*—Plankton of Loch Kirbister. *S.*—Scalloway; Bressay.
380. *C. gastroides* (Kütz), nob. [*Cymbella gastroides*, Kütz.] *O.*—Kirkwall; Hoy.
381. *C. lanceolatum*, Ehrenb. *O.*—W. of Kirkwall. Plankton of Loch Kirbister.
382. *C. cymbiforme*, Ehrenb. *O.*—Near Finstown; Stromness. *S.*—Lerwick.
383. *C. Cistula*, Ehrenb. *O.*—Near Finstown; Stromness; Hoy. *S.*—Lerwick.
384. *C. helveticum* (Kütz), nob. [*Cymbella helvetica*, Kütz.] *O.*—Hoy. *S.*—Near Lerwick; Bressay.
385. *C. tumidum*, Bréb. *O.*—Finstown.
386. *C. ventricosum* (Ag.), nob. [*Cymbella ventricosa*, Ag.] *S.*—Near Lerwick.
387. *C. obtusum* (Greg.), nob. [*Cymbella obtusa*, Greg.] *O.*—Hoy.
388. *C. cæspitosum* (Kütz.), G. S. West. [*Encyonema cæspitosum*, Kütz.] *S.*—Neugles Water.
389. *C. gracile* (Rabenh.), G. S. West. [*Encyonema gracile*, Rabenh.] *O.*—W. of Kirkwall; Hoy.

Genus AMPHORA, Ehrenb.

390. *A. ovalis*, Kutz. *O.*—Near Kirkwall; Finstown; Hoy. Plankton of Loch Kirbister. *S.*—Near Lerwick; Neugles Water. Plankton of Lochs Asta and Clickhimin.

Genus EPITHEMIA, Bréb.

391. *E. turgida* (Ehrenb.), Kütz. *O.*—Near Kirkwall; Finstown. *S.*—Plankton of Loch Asta.
392. *E. Sorex*, Kütz. *O.*—Finstown.
393. *E. gibba*, Kütz. *O.*—Kirkwall; near Finstown. *S.*—Near Scalloway; Neugles Water. Plankton of Loch Asta. Bressay, in ditches, and also in the plankton of Loch Beosetter.
    Var. *ventricosa* (Kütz), V. H. *O.*—Pond near Kirkwall; Finstown. *S.*—Bressay.
394. *E. Argus* (Ehrenb.), Kütz. *O.*—Near Kirkwall; Finstown; Hoy.
    Var. *alpestris* (W. Sm.), Rabenh. *O.*—Near Finstown; Stromness.
395. *E. gibberula* (Ehrenb.), Kütz. *O.*—Finstown. *S.*—Lerwick; near Scalloway.
396. *E. Zebra* (Ehrenb.), Kütz. *O.*—Kirkwall; Hoy. *S.*—Near Lerwick; near Scalloway.

Family NITZSCHIACEÆ.

Genus NITZSCHIA, Hass.

397. *N. constricta* (Kütz), Pritch. *O.*—W. of Kirkwall.
398. *N. Sigmoidea* (Ehrenb.), W. Sm. *O.*—Pond near Kirkwall; Finstown; Hoy. *S.*—Near Scalloway; Bressay.
399. *N. vermicularis* (Kütz), Grun. *S.*—Scalloway.
400. *N. linearis* (Ag.), W. Sm. *S.*—Near Lerwick. Plankton of Loch Brindister.
401. *N. subtilis*, Grun. *S.*—Bressay.
402. *N. Palea* (Kütz.), W. Sm. *O.*—Kirkwall; Stromness. Plankton of Loch Kirbister. *S.*—Lerwick; Scalloway. Plankton of Lochs Asta and Trebister.

Genus HANTZSCHIA, Grun.

403. *H. Amphioxys* (Ehrenb.), Grun. *S.*—Scalloway.

Family SURIRELLACEÆ.

Genus CYMATOPLEURA, W. Sm.

404. *C. Solea* (Bréb.), W. Sm. *O.*—Stromness; Hoy.
405. *C. elliptica* (Bréb.), W. Sm. *O.*—Plankton of Loch Kirbister. *S.*—Neugles Water. Plankton of Loch Asta.

Genus SURIRELLA, Turpin.

406. *S. biseriata*, Bréb. *O.*—Kirkwall; Hoy. *S.*—Near Lerwick; near Scalloway; Neugles Water; Bressay.
407. *S. linearis*, W. Sm. *O.*—W. of Kirkwall; Hoy. Plankton of Loch Kirbister. *S.*—Neugles Water. Bressay, in ditches, and also in the plankton of Loch Beosetter.
408. *S. robusta*, Ehrenb. *S.*—Plankton of Loch Clickhimin.
    Var. *splendida* (Ehrenb.), V. H. *S.*—Plankton of Neugles Water, Lochs Asta and Brindister, and also of Loch Beosetter, Bressay.
409. *S. ovalis*, Bréb., var. *ovata* (Kütz.), V. H. *S.*—Near Lerwick.
    Var. *minuta* (Bréb.), V. H. *O.*—Hoy.

Var. *angusta* (Kütz.), V. H. *O.*—W. of Kirkwall; Hoy. *S.*—Lerwick; near Scalloway.

Var. *pinnata* (W. Sm.), V. H. *S.*—Near Lerwick.

410. *S. spiralis*, Kütz. *O.*—Near Kirkwall.

Genus CAMPYLODISCUS, Ehrenb.

411. *C. Hibernicus*, Ehrenb. *S.*—Plankton of Loch Asta.

Class MYXOPHYCEÆ.

Sub-class GLAUCOCYSTIDEÆ.

Family GLAUCOCYSTACEÆ.

Genus GLAUCOCYSTIS, Itzigsohn.

412. *G. Nostochinearum*, Itzigsohn. *S.*—Near Scalloway.

Sub-class ARCHIPLASTIDEÆ.

Order HORMOGONEÆ.

Family STIGONEMACEÆ.

Genus HAPALOSIPHON, Näg.

413. *H. intricatus*, West. *S.*—Neugles Water.

Genus STIGONEMA, Ag.

414. *St. ocellatum* (Dillw.), Thur. *O.*—Kirkwall. *S.*—Near Scalloway.
415. *St. turfaceum* (Eng. Bot.), Cooke. *S.*—Near Scalloway.
416. *St. minutum*, Hass. *S.*—Loch Beosetter, Bressay.

Family SCYTONEMACEÆ.

Genus TOLYPOTHRIX, Kütz.

417. *T. lanata* (Desv.), Wartm. *S.*—Near Scalloway.
418. *T. tenuis*, Kütz. *O.*—Kirkwall. *S.*—Lerwick.

Family NOSTOCACEÆ.

Genus NOSTOC, Vauch.

419. *N. microscopicum*, Carm. *O.*—Near Kirkwall. *S.*—Near Scalloway; Neugles Water.

Genus ANABÆNA, Bory.

420. *A. oscillarioides*, Bory. *O.*—In pond near Kirkwall, among *Rhizoclonium hieroglyphicum*.
421. *A. circinalis*, Rabenh. *S.*—Plankton of Neugles Water, Lochs Asta, Brindister and Clickhimin.

Family OSCILLATORIACEÆ.

Genus SCHIZOTHRIX, Kütz.

422. *S. penicillata* (Kütz.), Gom. Crass. fil. 26–36μ; crass. trich. 4·3–4·7μ. *S.*—Near Scalloway.

Genus PHORMIDIUM, Kütz).

423. *Ph. autumnale* (Ag.), Gom. *O.*—Kirkwall. *S.*—Scalloway.
424. *Ph. uncinatum* (Ag.), Gom. *O.*—Near Stromness.
425. *Ph. laminosum* (Ag.), Gom. *S.*—In ditches, Bressay.
426. *Ph. tenue* (Menegh.), Gom. *O.*—W. of Kirkwall. *S.*—Lerwick.

Genus OSCILLATORIA, Vauch.

427. *O. limosa*, Ag. *S.*—Bressay.
428. *O. tenuis*, Ag. *O.*—Finstown ; Hoy. *S.*—Plankton of Lochs Asta and Sandy, and also of Loch Beosetter, Bressay. Neugles Water.
429. *O. formosa*, Bory. *O.*—Hoy, in stream.
430. *O. ornata*, Kütz. Crass. trich. 10μ. *S.*—Near Scalloway.

Family RIVULARIACEÆ.

Genus CALOTHRIX, Ag.

431. *C. parietina*, Thur. The specimens were somewhat narrower than usual. Crass. fil. 9·5–12μ ; crass. trich. 6·5–8μ. *O.*—Near Kirkwall. *S.*—Near Scalloway.

Order COCCOGONEÆ.

Family CHROCOCCACEÆ.

Genus MERISMOPEDIA, Meyen.

432. *M. æruginea*, Bréb. *S.*—Plankton of Loch Asta, Brindister, Clickhimin and Trebister.
433. *M. elegans*, A. Br. *S.*—Plankton of Loch Brindister, and also of Loch Beosetter, Bressay.
434. *M. glauca* (Ehrenb.), Näg. *O.*—W. of Kirkwall ; Finstown ; Hoy. *S.*—Near Scalloway ; Neugles Water. Bressay, in ditches, and also in the plankton of Loch Beosetter.

Genus CŒLOSPHÆRIUM, Näg.

435. *C. Kützingianum*, Näg. *S.*—Near Lerwick ; Bressay. Plankton of Lochs Asta, Brindister and Neugles Water.
436. *C. Nägelianum*, Unger. *S.*—Plankton of Loch Brindister.

Genus MICROCYSTIS, Kütz.

437. *M. elabens* (Bréb.), Kütz. *S.*—Plankton of Loch Beosetter, Bressay.
438. *M. prasina* (Wittr.), Lemm. *S.*—Plankton of Neugles Water, and of Loch Beosetter, Bressay.
439. *M. Flos-aquæ* (Wittr.), Kirchn. *S.*—Plankton of Lochs Brindister and Clickhimin.
440. *M. stagnalis*, Lemm. *S.*—Plankton of Neugles Water and Loch Asta.

Genus GLŒOCAPSA, Kütz.

441. *Gl. Ralfsiana* (Hass.) Kütz. *S.*—At the margins of Loch Beosetter, Bressay.

Genus APHANOCAPSA, Näg.

442. *A. Grevillei* (Hass.), Rabenh. *O.*—W. of Kirkwall.

Genus CHROCOCCUS, Näg.

443. *Ch. turgidus* (Kütz.), Näg. *O.*—Near Kirkwall; Hoy. *S.*—Near Lerwick; Scalloway; Bressay. Plankton of Lochs Asta and Brindister.
444. *Ch. cohærens* (Bréb.), Näg. *S.*—Plankton of Loch Beosetter, Bressay.
445. *Ch. limneticus*, Lemm. *S.*—Plankton of Neugles Water.
446. *Ch. pallidus*, Näg. *O.*—Near Kirkwall. *S.*—Near Lerwick. Plankton of Loch Beosetter, Bressay.
447. *Ch. minor* (Kütz.), Näg. *S.*—Lerwick; Neugles Water. Plankton of Loch Sandy.

EXPLANATION OF PLATES.

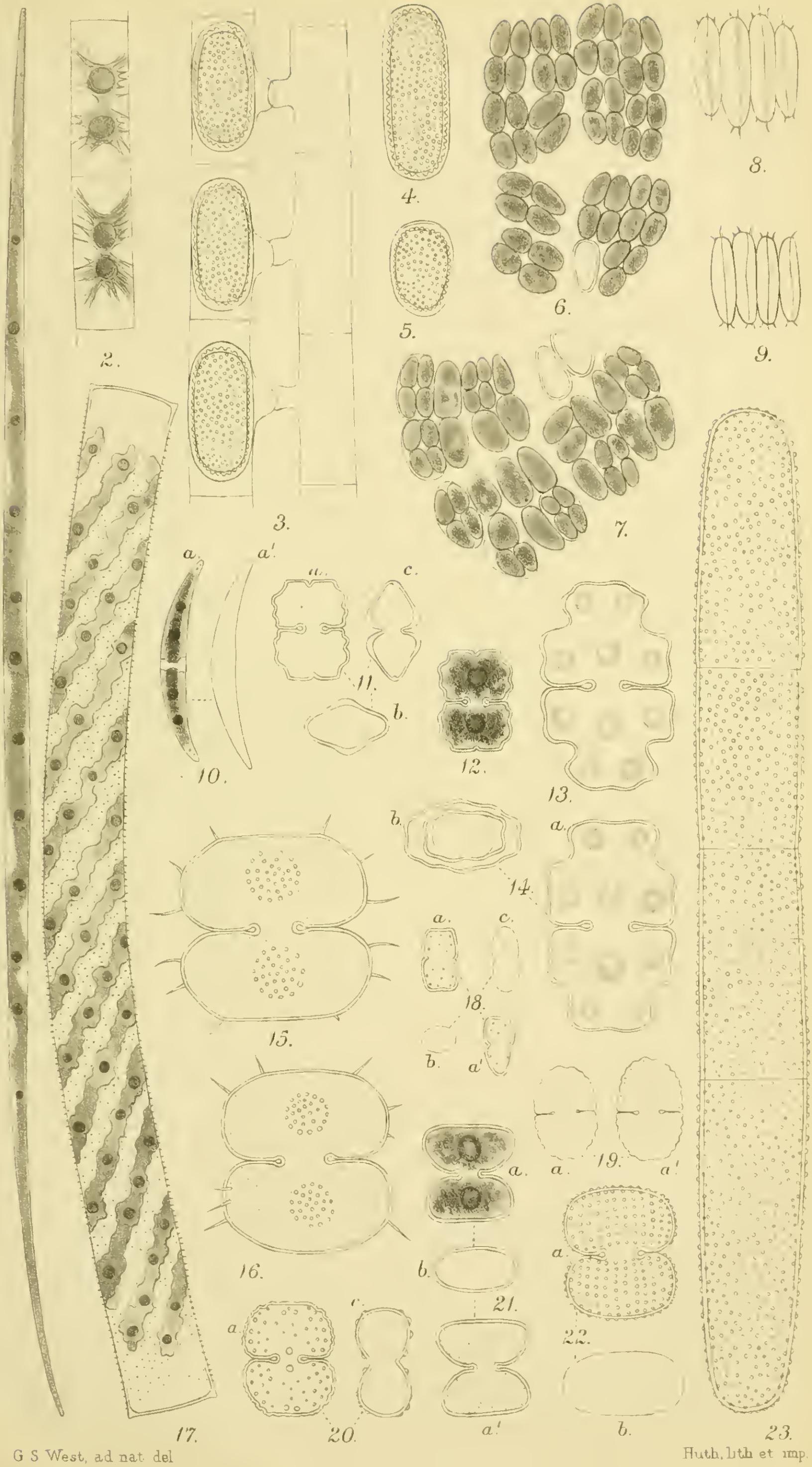
a, a′, a″ . . . front view of cell (a fronte visa).
b, b′ . . . . vertical view of cell (a vertice visa).
c . . . . side view of cell (a latere visa).

PLATE I.

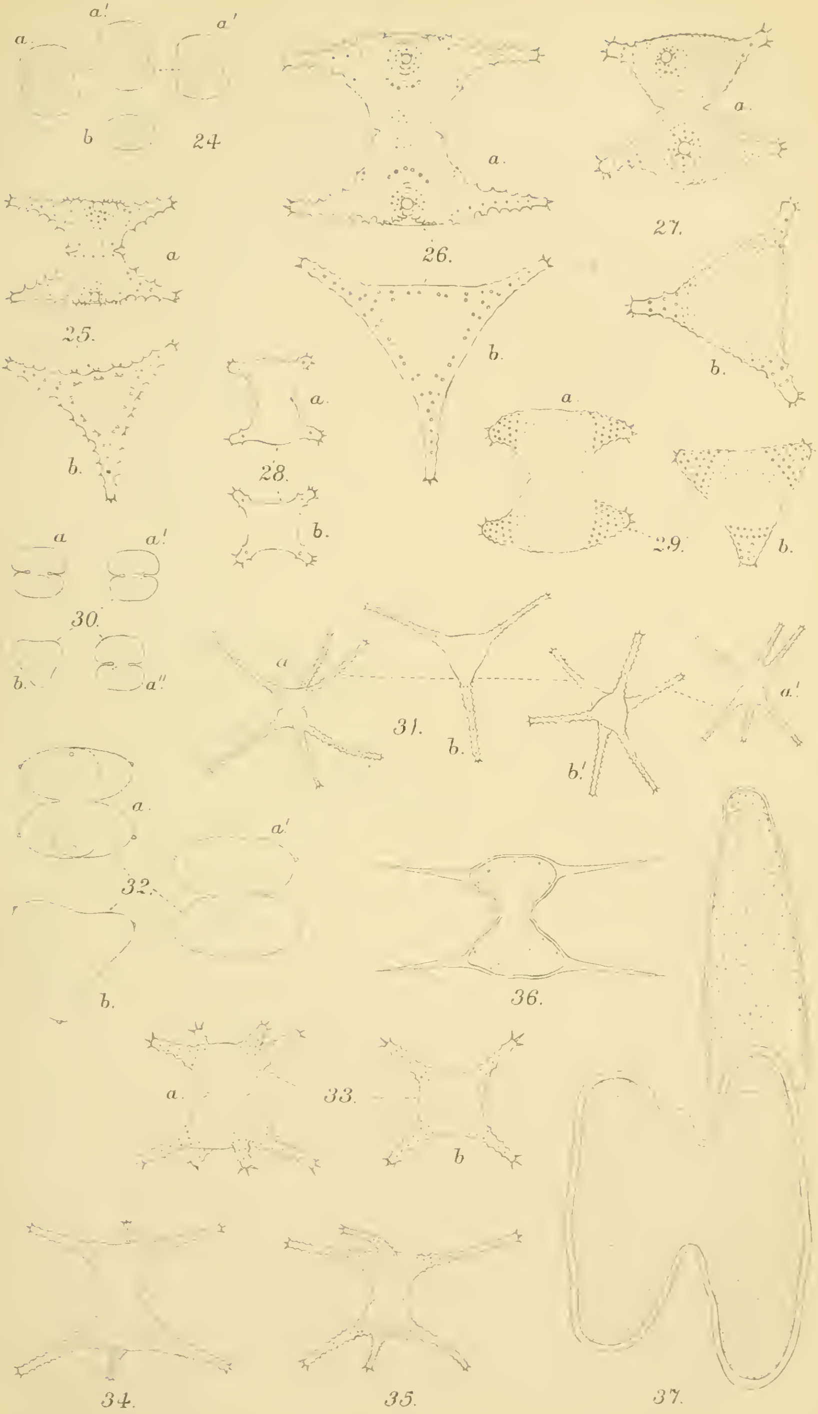
Fig. 1. *Closteriopsis longissima*, Lemm., var. *tropicum*, nob. × 520.
„ 2–5. *Zygnema stellinum* (Vauch.), Kütz., var. *cylindrospermum*, var. n. × 520.
„ 6–7. *Crucigenia irregularis*, Wille. × 500.
„ 8–9. *Scenedesmus acutiformis*, Schröder, var. *Brasiliensis*, nob. × 520.
„ 10. *Closterium exile*, sp. n. × 400.
„ 11–12. *Euastrum montanum*, sp. n. × 520.
„ 13–14. „ *pectinatum*, Bréb., var. *inevolutum*, var. n. × 430.
„ 15–16. *Xanthidium antilopæum* (Bréb.), Kütz, var. *depauperatum*, var. n. × 520.
„ 17. *Genicularia Spirotænia*, De Bary. × 520.
„ 18. *Cosmarium goniodes*, W. and G. S. West, var. *variolatum*, var. n. × 400.
„ 19. „ *læve*, Rabenh., var. *cymatium*, var. n. × 500.
„ 20. „ *isthmochondrum*, Nordst., var. *pergranulatum*, var. n. × 400.
„ 21. „ *subcontractum*, sp. n. × 400.
„ 22. „ *Pseudobroomei*, Wolle, var. *convexum*, var. n. × 400.
„ 23. *Penium margaritaceum* (Ehrenb.), Bréb., var. *irregularius*, var. n. × 520.

PLATE II.

Fig. 24. *Cosmarium subarctoum* (Lagerh.), Racib., forma *punctata*. × 520.
„ 25. *Staurastrum boreale*, sp. n. × 520.
„ 26. „ *Manfeldtii*, Delp. × 520.
„ 27. „ *affine*, sp. n. × 520.
„ 28. „ *polymorphum*, Bréb., var. *simplex*, var. n. × 400.
„ 29. „ *cyrtocerum*, Bréb., var. *compactum*, var. n. × 520.
„ 30. „ *retusum*, Turn., var. *boreale*, var. n. × 400.



G S West, ad nat. del Huth, Lth et imp.



G. S West ad nat del.

Huth, lith et imp

Fig. 31. " *tetracerum*, Ralfs, var. *evolutum*, var. n. × 520.
" 32. " *brevispinum*, Bréb., forma. × 520.
" 33. " *paradoxum*, Meyen, form from Loch Trebister. × 520.
" 34, 35. " " forms from Loch Sandy.
" 36. *Arthrodesmus triangularis*, Lagerh., var. *subtriangularis* (Borge), nob. × 520.
" 37. *Tetmemorus granulatus* (Bréb.), Ralfs. Abnormal zygospore. × 400.

Dr. R. Stewart MacDougall communicated some notes by J. Greg. Nicolson, on rare Caithness Plants, with exhibition of specimens, including *Carex salina*, var. *kattegatensis*, *Primula scotica*, *Oxytropis uralensis*, and *Hierochloe borealis*. An interesting discussion followed.

Some Rare Caithness Plants. With Notes.
By J. Greg. Nicolson.

Geographically Caithness is the most northern county of the mainland. It is triangular in shape, Duncansby Head forming the apex, and is separated geologically from its neighbour Sutherlandshire by a line of broken-down schists that run from end to end of the base, and formed at one time the western "march" of Lake Orcadie. Caithness was part of the bed of that old-world lake. The county is accordingly comparatively flat towards the north, and is of the Old Red formation, the huge faults between the flags and sandstones being filled with boulder clay.

Botanically Caithness is of particular interest, as Alpine forms occur on the seashore and the lowlands, and are so modified by the high latitude and by their low-lying habitats as to give the botanist exceptional difficulty in determining the various species. Some of the specimens submitted show this peculiarity well. It may be noted that the title of this contribution is somewhat ambiguous, as plants may be scarce in Caithness and common farther south, or plentiful in the county and rare elsewhere. Both sides are touched upon slightly.

Carex salina (Wahlenb.), var. *kattegatensis* (Fr.).—Two extensive beds of Carex in the lower part of Wick river were supposed to be *Carex riparia* from their general appearance—although it was noticed that they looked rather small and pale.

A specimen sent by me to Edinburgh in the 80's was not recognised by Professor Dickson, who examined my collection. In 1884 a single specimen was sent to A. Bennet, among others. He observed that it was a strange plant, and on consulting other botanists found it to be *Carex salina*, var. *kattegatensis*, common in Sweden, but not hitherto reported as found in this country. From further specimens forwarded (1885), the naming has been confirmed. The plant was so common that it used to be mown to make "bog hay" for farm purposes; but probably the recent river improvements—the banking and deepening of the sandbank on which the Carex grew—must have worked havoc among its ranks.

Primula scotica (Hook.).—Very abundant on Keiss Links, Caithness, and on other bare coast pasture-lands. The plant flowers two or three times a year, and the supposed variety *acaulis* is only the latest growth when the plant is considerably exhausted. From Keiss, Wick, and other localities, I have many specimens which have a tall scape of the previous flowering still standing, and acauline flowers beneath on a branch of the same root stock. The flowers on the scape were of course withered, but the scape itself was fresh when gathered. The local name for *P. scotica* is "Dusty Miller." The sessile flowers and intermediate stages may be plainly seen in the specimens submitted. Garden-transplanted specimens grow of larger size for a few months, exhibit the same characteristics of flowering, etc., but die off on the approach of winter.

Hierochloe borealis (Roem. and Schult.).—"Holy grass"—so called from its use in Turkish cemeteries—was discovered by Robert Dick on the banks of Thurso river. It has also been reported from the Clova Hills in Forfarshire. In Dick's herbarium in Thurso museum specimens are so marked. In the "Trans. Edin. Bot. Soc.," 1854, will be found an account of the localities where Dick got the *Hierochloe*. Some of the specimens of the plant submitted were gathered quite recently in the vicinity of Dick's discovery, but the grass is extremely rare.

Mimulus luteus (Linn.).—Only one variety is noted in the London Catalogue, 9th edition, but there seem to be two in

Caithness. The Wick sort is slender, and sparingly branched with yellow flowers, but the Newton ($1\frac{1}{2}$ miles distant) specimens have large leaves, spotted flowers, and are much more branchy.

Saxifraga tridactylites (Linn.).—Found abundant at the mouth of the Burn of Dunnet, near Dunnet Head. It grows on braes, close to the sea-sand. For an interesting dispute about this plant, see Smiles' "Life of Dick."

Thalictrum majus (Cranz).—Specimens of the supposed *T. majus* having been sent to Bennet, the latter says in "The Journal of Botany," 1882:—"Some slight doubt may attach to this plant—the fruit being too near 'minus,' but the exposed and northern situation may have stunted the development of the fruit late in autumn." In 1885 Messrs Hanbury and Fox took a botanical tour through Caithness, and had those plants pointed out to them at Reay. They thought the *T. majus* to be only luxuriant specimens of *T. maritimum*; the difference being due to shelter and soil—the stunted form growing on the top of a hillock and the larger in the sheltered hollow at its side.

Ranunculus aquatilis (var.)—Of the various species or varieties that have at one time or other been included under *R. aquatilis*, there is a variety growing in a pond at Shorelands (a mile or so from Wick) which the late H. C. Watson called *R. trichophyllus* (Chaix), and another in the ditches between Wick and Staxigoe—which corresponds to the description of *R. Baudotii* (Godronii), var. *confusus*, in Hooker's "Flora." The Staxigoe specimens vary much, and on comparing them with the descriptions and figures in "Sowerby's English Botany," one seems to have a choice between calling them intermediate forms of *R. Drouetii* (Schulz), *R. Baudotii vulgaris*, and *R. Baudotii confusus*, or supposing that the differences between those is imaginary. Specimens from Sibster ($1\frac{1}{2}$ miles from Wick), which appear identical with the Staxigoe ones, have been named *R. heterophyllus* (Fries) by A. Bennet.

Ranunculus arvensis (Linn.).—The only specimen ever found in Caithness. It was probably introduced with garden seeds, as it grew in a bed of carrots.

Sisymbrium Sophia (Linn.).—Once found by Dick on a ballast heap near Thurso.

Erodium cicutarium.—A specimen was found by me near Wick manse in September 1881.

The above three specimens are illustrative of the absence of plants in Caithness that are fairly common farther south.

Arctostaphylos alpina (Spreng.) found by self (5th June 1884) on Morven, the highest mountain in the county (2300 ft.)

Dick got some specimens on Ben Dorrery. The plant is not at all common. *Arctostaphylos Uva-ursi* is, on the contrary, fairly plentiful.

Loiseleuria procumbens.—This is the first specimen found in Caithness. It grew on the top of Morven, on the east side, near a "well" or natural spring. The plant, growing in small patches, was found by me on 5th June 1884.

Oxyria digyna (Hill), rare.

Draba incana is "four miles from Thurso," so marked by Dick. As a matter of fact, Dick's herbarium is more ornamental than useful as a contribution to the botany of the county. He seems to have taken a positive pleasure in concealing localities, as in the case of *Osmunda*, etc.

This plant is to be met with on the brae above the road at Latheronwheel (17 miles S. of Wick), and also on the top of the Hill of Yarehouse (6 miles S. of Wick).

Oxytropis uralensis (DC.) till recently was only to be found on the sea-cliffs at Downreay, in the N.W. of the county, and even there it is by no means plentiful.

Hieracium prenanthoides (Vill.).—Named by A. Bennet. Found at Gillock, near Wick.

Hieracium crocatum (Fr.), also *fide* Bennet. Found near Thurso.

Potamogeton filiformis (Nolte).—Loch of Yarehouse.

Potamogeton prælongus (Wulf.).—Loch of Yarehouse.

Carex aquatilis, var. *elatior* (Bab.) *vel Watsoni.*—Abundant on Wick river, and fairly common on Thurso river.

Carex flava, var. *Œderi* (sub. sp.) (Retz.).—Found at Shinval by me, and so named by Professor Dickson. Dr. Davidson says that this plant is common at the loch of Winless (an inland loch five miles or so from Wick).

Carex flava, minor (Townsend).—Found at Gillock, among grass at the foot of the braes just above Gillock House. Also called *Carex flava*, var. *œdocarpa* (Anders.) in Mr.

Crawford's "Chart of the British Carices," but as yet I have not been able to find its equivalent in the Lond. Cat., 9th edition.

Carex incurva (Lightf.).—One of Dick's discoveries. It is pretty common at the Water of Wester (N. of Wick), between the bridge and the sea, in what is often practically salt water. It also grows on Reay Links and at Shinval (a place in the S. W. of Caithness, and several miles inland).

Deyeuxia strigosa (Kunth.).—A Scandinavian species, its native habitat being wet, boggy marshes in Lapland, Finland, etc. It was found by Dick at Loch Durran, and was taken by him to be *Calamagrostis lapponica*, but Professor Balfour named it *C. stricta*. The draining of the loch was supposed to have rendered the plant extinct, but it has been found since.

Addendum.

Hymenœa Courbaril.—W. Indian locust. The seeds are imbedded in a mealy pulp, which is used as food. Nat. order Leguminosæ.

This specimen was found at low tide among the seaweed and shells between Huna and John o' Groats. It appears to have been carried from the West Indies by the Gulf Stream. It is not the only West Indian or Gulf of Mexico product that has reached Caithness in that way.

Geo. Lorimer, Esq., exhibited a photograph of abnormal flower of *Digitalis alba*. Several members cited instances of similar abnormalities in this and other genera.

Dr. R. Stewart MacDougall showed fruits of *Trapa bicornis* found in tanks in N. India.

Mr. Nicolson, Mr. Lorimer, and Dr. MacDougall received the thanks of the Meeting.

MEETING OF THE SOCIETY,

Thursday, December 8, 1904.

Professor I. BAYLEY BALFOUR, F.R.S., President, in the Chair.

A. C. M. BELL, Esq., W.S., East Morningside House, was proposed as a Resident Fellow of the Society by ALEX. COWAN, Esq., and seconded by Professor BAYLEY BALFOUR, F.R.S.

Mr. WM. B. BOYD read an obituary notice of the late Dr. A. P. AITKEN. The paper dealt chiefly with the career of Dr. Aitken, his connection with the Botanical Society, and his various publications in separate departments of Science.

AN OBITUARY NOTICE OF THE LATE DR. ANDREW PEEBLES AITKEN, D.Sc. By WILLIAM B. BOYD.

Dr. Andrew Peebles Aitken, Professor of Chemistry in the Royal (Dick) Veterinary College, and Lecturer on Agricultural Chemistry in the University of Edinburgh, died at his residence, 38 Garscube Terrace, Murrayfield, on Sunday, 17th April 1904. He was a native of Edinburgh, and was educated at its university, where he graduated as Master of Arts in 1867, as Bachelor of Science in the department of Physical Science in 1871, and as Doctor of Science in the department of Chemistry in 1873.

After leaving the university he studied at Heidelberg, and on his return to this country was appointed assistant to Professor Crum Brown and Demonstrator of Practical Chemistry in Edinburgh University. In 1875 Dr. Aitken was appointed Professor of Chemistry in the Royal (Dick) Veterinary College—a post which he continued to occupy up to his death.

He was elected a Fellow of the Botanical Society of Edinburgh on the 12th January 1871, and Foreign Secretary on 11th December 1884. On the 13th November he read a paper on "Astragalus mollissimus," and, on the 10th

December 1891, on "The Roots of Grasses in Relation to their Upper Growths" (with two plates). On the 14th November 1895 he was elected President of the Botanical Society; and on retiring, on 12th November 1896, gave a Presidential Address, on "The Nitrogenous Food of Plants." At the close of his year of office he was re-elected president for another year; and at its close, on the 11th November 1897, his Presidential Address was on "Symbiosis: The power possessed by certain leguminous plants of assimilating the free nitrogen of the air, and of converting it into their own albuminoid tissue." On the 14th January 1897 he exhibited an apple, showing carpellary proliferation; and on the 10th March 1898, he read a paper on "The Relation between the Colour of Daffodils and Composition of the Soils in which they are grown." These seem to include all his contributions to our "Transactions"; but the great amount of work which he had to perform in other relations, particularly in connection with the Highland and Agricultural Society, prevented him from giving that attention to purely botanical investigation, which in his hands would certainly have been fertile in result.

Dr. Aitken was an original member of the Scottish Alpine Botanical Club, and held the appointment of minstrel during all the years of his membership. He was a man of most genial and happy temperament, and his presence was always much appreciated by the members. During the latter years of his life, when, owing to delicate health, he was unable to be present, he was much missed. He was a delightful singer, with a sweet and sympathetic voice, and was the author of many botanical songs, which were much enjoyed by the club. He was a good all-round botanist; and the excursions on the Scottish mountains, which usually lasted for about a week, were much enjoyed by him. He was present on that memorable occasion in Glen Spean, when the club discovered, for the second time in Britain, that rare plant *Saxifraga cæspitosa*, which had, about fifty years before, been discovered on Ben Aan, but the exact locality of which had been quite lost sight of, till it was refound by two or three of the members of this club growing in great beauty and luxuriance. He was also at a meeting at Braemar, when the club discovered that very rare plant *Sagina Boydii*, which turned out to be new to science, and which, unfortunately, has never been refound since. One excursion to the Swiss Alps I well remember, when we stayed for several days at Zermatt, revelling in the rare vegetation to be found there; and, after crossing the St. Theodule Pass, we found our way to Aosta, thence to Cormayeur, from which point we enjoyed a delightful walk round Mont Blanc to Chamonix. He was a capital linguist, and never at a loss either in French or German.

Dr. Aitken was also a member of the Botanical Society Club, where many of his botanical songs (which were originally composed for this club) were sung and much enjoyed after dinner. A few of the favourites were "The Kail Yaird," "The wee Flourie that hasna got a Name," and the "Bonnie wee Moscatelle." At these dinner meetings his merry, happy, and genial manner was much appreciated.

He was also a Fellow of the Royal Society of Edinburgh, the Institute of Chemistry, the Society of Chemical Industry, the American Chemical Society, the Royal Scottish Arboricultural Society, and the Scottish Meteorological Society. Dr. Aitken was appointed, in 1894, Lecturer on Agricultural Chemistry in the University of Edinburgh, and previous to that he held the appointment of Examiner in Chemistry in the same university.

I here add a few notes by Mr. J. Wyclif Black, assistant to Dr. Aitken in his chemical laboratory. The analytical work carried on by Dr. Aitken was, in its main branches, of an agricultural nature. He was analyst for several counties and burghs in Scotland, and the work which these places contributed was entirely confined to samples taken under the Food and Drugs Act. He also carried on a great amount of analytical work in connection with water-supplies, and was constantly employed as an expert witness in litigations under the Rivers' Pollution Prevention Act. Among the many cases with which he was connected I may mention the following: Spey Pollution case, Nith Pollution case, Almond Pollution case, and Braid Burn Pollution case. He also had a general consulting practice, which brought many diverse cases before his notice.

With regard to Dr. Aitken's publications, the great proportion were connected with agriculture. The greater number of them are to be found in the "Transactions" of the Highland and Agricultural Society. In the year 1879, Dr. Aitken delivered, in the chambers of that Society, a series of lectures on chemistry as applied to agriculture, extracts from which appeared in the "North British Agriculturist" of that year. For the last three years Dr. Aitken delivered another course of lectures on "Feeding and Fodder," under the auspices of Edinburgh and East of Scotland Agricultural College. He also conducted a course of chemistry for the gardeners at the Royal Botanic Gardens. At the time of his death he was conducting an experiment on the improvement of pasture, and also an investigation into the composition of frosted and unfrosted oats.

Dr. Aitken was an exceedingly able lecturer. His never-failing energy, quickness of perception, clearness of speech, and happiness of expression, were invaluable in imparting his knowledge to others, which he did with an ease and attractiveness rarely equalled; and the order he preserved in the class-room was remarkable, and was attained without any apparent effort. He was also one of the most accessible of men, always ready to give help and advice to any one requiring it.

The great work of Dr. Aitken's life was, however, much more closely connected with the Highland and Agricultural Society of Scotland, where he held the appointment of chemist to the Society for a period of about twenty-seven years. I am indebted to Dr. Robert Shirra Gibb, one of the directors of the Society, and also a member of the Science Committee, for the following notes on Dr. Aitken's connection with this Society and with agriculture generally. Dr. Andrew P. Aitken was appointed consulting chemist to the Society in 1877. His work, previous to that date, had been of such a kind as to indicate that he was the most suitable, in fact, the only suitable, candidate for the post then vacant. He had studied chemistry, from the agricultural point of view, both in Germany and in our own country; and had, at that early period, gained, in large degree, the confidence and regard of many of the more prominent farmers of that day, by whom he was being consulted on various matters of a chemical and botanical nature in connection with their farm operations.

When he entered on the work, under the science department of the Highland and Agricultural Society, he was already known to most of the members of that department; and his genial kindly manner, his ready humour and witty asides, soon made him the fast friend of all; while his enthusiasm, power of work, and splendid capacity for organisation, carried the department forward till it was the leading Agricultural Experimenting Institution in this country. Many of the deductions from the experiments then conducted, as reported on by Dr. Aitken in the "Transactions" of the Highland and Agricultural Society, are monuments of his power of mastering detail, and his facility for racy, clear, and succinct expression. As chemist to the Society, he had the control of experimenting work undertaken by the Society, which took two forms—first, on stations farmed for the time by the Society; second, on plots on various farms all over the country, whenever farmers were willing to take the trouble to conduct experiments.

The first consisted of (*a*) a field at Harelaw, near Longniddry, in East Lothian; and (*b*) a field at Pumpherston, West Lothian. The former was soon given up, as the soil was found to be in too high a state of cultivation to give the minute results required. The Pumpherston station was kept on for seven years; and the reports of the cropping and manuring on that station are most interesting and instructive, and are being corroborated every year by experiments in other parts, though they were then only partially understood, and were, from a scientific point of view, considerably in advance of the time. We have, however, travelled a good way since then. Many of Dr. Aitken's conclusions at that time are being now paraded by other workers as the results of original investigation.

The second part of Dr. Aitken's experimental work consisted in organising and reporting on the various experiments of a local character conducted all over the country from Caithness to Wigtownshire. These, up to the time of the doctor's lamented death, numbered twenty-five (specially scheduled and detailed), besides numerous lesser experiments, and each was conducted by probably an average of twenty to thirty farmers, many of them being carried on for a series of years, entailing visits, weighings, reports, etc.

The amount of work done in this connection alone was in every sense great; great in its inception, great in its execution, and great in its results, which it is not yet possible to estimate. The more purely chemical portion of Dr. Aitken's work for the Highland and Agricultural Society, and through it for the farmers of Scotland, presented one of its most useful features in the organisation of the work of local analytical associations. These were brought into touch with the Science Department of the Society by the giving of grants, in aid of analytical work done by them, on condition that it was reported to the Society's chemist, to be tabulated and reported on by him.

Faulty manures and feeding-stuffs were specially inquired into; and when no adequate reason was assigned for a deficiency, the defaulter's name and the circumstances of the case were published in the "Transactions." The result of this work was practically to banish fraud for a time out of the manure market; and was the cause, to a large extent, of inducing the Government to pass the Fertilizers and Feeding-Stuffs Act. For the improvement of this Act, a Departmental Committee of the Board of Agriculture has been sitting, of which Dr. Aitken was a member. This committee has not yet reported; and the death of Dr. Aitken will be a serious loss to them, when they come to consider their report.

The publication of the names of parties selling deficient manures or feeding-stuffs was recognised by those in the trade who wished honest dealing as an excellent measure of protection for them, and farmers recognised in Dr. Aitken the man who saved them from being defrauded in many ways. The confidence reposed in Dr. Aitken by the manure and feeding-stuff merchants was of a very cordial and enduring nature, and he was welcomed as an honest final arbitrator in many disputes; and to the end he had the assistance of the trade in annually drawing up a schedule of commercial values, called the "Unit Schedule," which has been a great help to many a farmer in his purchases.

In 1878 an International Agricultural Congress was held in Paris. To this a report was sent from the Highland and Agricultural Society on the "State of Agriculture in Scotland" at the time. In this report Dr. Aitken contributed an article on the "Application of Science to Agriculture." The "Transactions" of the Highland and Agricultural Society, from 1877 to the last volume, 1904, give evidence of the immense amount of work, and that of the most valuable kind, which Dr. Aitken was able to perform. No one required to point out work for him; he was continually on the lookout for some new field of operation and inquiry; and few inquiries of a scientific nature were conducted during the whole of that time without his being asked to aid in carrying them out. He wrote papers on various subjects, many of them new to the agricultural world, such as, "Ground Felspar Rock as a source of Potash," "Fish Dried as a Fodder for Cattle," etc.

One specially valuable inquiry was into the nature and feeding quality of various grasses; the nature of their growth—deep-rooting, or otherwise. This extended over some years, and was carried out in the most painstaking, thorough, and enlightened manner. For the last two years Dr. Aitken has written a summary of the results obtained from experiments carried out under the auspices of the agricultural colleges, and kindred institutions, throughout the country, and thus all the lessons of value from the experiments have been noted and put into such form as to be most easily referred to when wanted—a specially useful piece of work.

The loss the agricultural community of Scotland have sustained by the death of Dr. Aitken is not easily estimated, and will be felt for many a day yet to come. He rests from his labours, but his works do follow him. He is dead, but they live.

Mr. Alexander Cowan read his report on the Scottish Alpine Club Botanical Excursion in 1904.

Scottish Alpine Botanical Club Meeting, 1904.

Messrs. W. B. Boyd, President; Rev. Dr. Paul, Vice President; G. H. Potts; A. H. Evans; Alex. Cowan, Honorary Secretary; also Ll. J. Cocks and A. C. M. Bell, visitors.

The club met on Monday, July 11th, and travelled from the Waverley Station by the forenoon train to Beauly, and thence drove to the Glenaffaric Hotel, Cannich, which had been decided upon as the place of meeting; Mr. Boyd, President of the Club, having arranged with Mrs. Chisholm, proprietor of the forests of Affaric and Benula, and through Messrs. Innes & Mackay, Inverness, with the shooting tenants, Sir Peter Walker and Captain Quintin Dick, for permission for the club to visit Mam Soul and the adjacent hills, for botanical purposes, not later than the second week of July. This stipulation necessitated the meeting being held at least a fortnight earlier than usual, which was probably an unsuitable date for most of the members; but the committee thought it well to take advantage of this opportunity of visiting a locality new to the club.

The road, after leaving the station at Beauly, followed the course of the river Beauly as far as Struy, after which it led up Strath Glass. The weather was very fine, and the drive was much enjoyed. Some of the gorges through which the river Beauly flows were much admired. Soon after leaving Beauly Station a large number of plants of *Goodyera repens* were seen growing in a fir wood; but, during the drive of seventeen miles to Cannich, no other plants of special interest were observed; but large quantities of ferns, and especially of the lemon-scented fern, *Lastrea montana*, were seen by the side of the road, in great luxuriance; so that if the district was not to prove exceptionally rich in the rarer Alpines, there was evidence of abundant scope for the energies of those of the party interested in the varietal forms of British ferns. On arrival at the hotel, comfortable quarters were found by the members of the party.

As it had been arranged to visit Mam Soul on the following day, and as this entailed a drive of about twelve miles up Glenaffaric, a very early start was decided on, the members leaving the hotel in a brake soon after 6.30. The weather was again very fine, and the drive up Glenaffaric much enjoyed. On arriving at Affaric Shooting Lodge, the party was met by Mr. Alexander Maclaren, head stalker, who had arranged to send two of his stalkers to act as guides, who were found of great assistance by the members. A path skirted the base of the mountain for about three miles before the ascent proper was begun. The ascent was greatly facilitated by a path used by stalkers, and up which the president rode on a pony to near the top of the mountain. During the day two golden eagles were seen, and a large number of deer. The following Alpine plants were found:—

Azalea procumbens, *Athyrium alpestre*, *Allosorus crispus* (at 3500 feet), *Cerastium trigynum*, *Carex pulla*, *Carex vaginata*, *Carex rigida*, *Cornus suecica*, *Caltha palustris*, *Drosera anglica* and *rotundifolia*, *Epilobium alpinum*, *Epilobium alsinefolium*, *Gnaphalium supinum*, *Luzula arcuata*, *Listera cordata*, *Oxyria reniformis*, *Ranunculus acris*, *Silene acaulis*, *Salix herbacea*, *Statice armeria*, *Solidago Virga-aurea*; and two forms of *Carex*, one at least of which was new to the members, were found, in addition to the commoner Alpine plants. The day was clear; and a very fine view, indeed, of the hills on all sides, including Ben Nevis, was enjoyed by the party. The long descent to the shooting lodge, where the conveyance had been left, was found much more tiring than the ascent, and it was past nine o'clock in the evening before the party reached the hotel, having had a more than usually hard day's outing. It was therefore decided that the following day, Wednesday, the 13th July, should be spent quietly in the neighbourhood of Cannich, where *Pyrola minor*, *Drosera anglica*, *Carex curta*, *Lobelia Dortmanna*, *Nymphæa alba* (at over 1000 feet), *Sibbaldia procumbens* were found, in addition to which more than one plant of *Lastrea montana*, var. *truncata*, was found; also a plant of a very curious form of this fern, which has not yet received a distinguishing name.

On Thursday, July 14th, an early start was made by brake to Benula, fifteen miles distant, up Glen Cannich, in order to climb Scuir-na-Lapich; and as part of the ascent led through the forest of Cozac, tenanted by Mr. J. Bradley Firth, leave was very kindly granted by this gentleman to visit his ground as well. The day was cool and well adapted for climbing; but, unfortunately, when nearing the top, it came on very misty and cold. The members were accompanied by the head stalker of Benula forest, Mr. Donald Finlayson, and his brother, to both of whom the members are much indebted for their kind assistance during the day, and whose ponies were ridden by Messrs. Boyd and Potts over the most difficult part of the ascent. Not far from the top the members were fortunate enough to find *Arctostaphylos alpina*. The following plants were also found:—*Cornus suecica*, *Juncus trifidus*, *Solidago Virga-aurea*, *Cerastium trigynum*, *Saxifraga aizoides* and *hypnoides*, *Silene acaulis* with golden foliage, also two small Alpine forms of *Hieracium*; and a plant of what is expected to prove a white flowered form of *Azalea procumbens* was found by Mr. Boyd. The summit of the mountain was clothed in thick mist, and no view whatever could be obtained from it. During the descent of the mountain a large snow-drift was met with in a corry; and near it, among rocks, great quantities of *Lastrea dilatata*, var. *alpina*, and *Athyrium alpestre* were found in all the different stages of growth. One member of the party was fortunate enough to discover a crested form of *Athyrium alpestre*, which fern had never previously been found, other than normal in outline, with the exception of var. *flexile*, of which a plant was also found in the same corry by another member of the party. The crested form above alluded to not only shows the cresting on the apex of every frond, but the pinnæ also show signs of developing crests; so that when the fern has grown to its full size—it being only a small specimen at present—it will no doubt prove a great acquisition. On reaching the stables at Cozac Shooting Lodge, where the conveyance had been left, the members were invited into the lodge, and were most hospitably entertained at tea by Mr J. Bradley Firth, the tenant of the forest. This kindness was very much appreciated after the cold day on the mountain, especially in view of the long drive home.

Friday, the 15th July, was again spent quietly in the neighbourhood of the hotel. *Pyrola secunda* was here found, also *Genista anglica*, as well as further plants of the truncate form of *L. montana*, the type of the latter fern being found in great numbers and luxuriance.

On Saturday, the 16th, the meeting broke up, the members making an early start, in order to catch the morning train back to Edinburgh, a most enjoyable week having been spent in a district which had never previously been visited by the club.

The PRESIDENT communicated a paper on the "Bromeliaceæ," with special reference to the water-carriage in certain forms. The paper was illustrated by lantern slides.

On the suggestion of the President, it was agreed that a definite statement of the discovery of *Sagina Boydii* be put on record in the "Proceedings" of the Society.

Dr. Borthwick exhibited photographs of Prop-roots of Laburnum, of a peculiar Witches' Broom on *Pinus*, and of an abnormal form of Pea.

Mr. J. Rutherford Hill exhibited a branch of *Hippophaë rhamnoides* in fruit.

The Honorary Assistant-Secretary showed certain plants from Dartmoor, and the fruit of *Afzelia africana*.

The cordial thanks of the Society were given to those who had contributed papers or exhibits.

MEETING OF THE SOCIETY,

Thursday, January 12, 1905.

Professor I. BAYLEY BALFOUR, F.R.S., President, in the Chair.

The following candidates were proposed as Resident Fellows:—

EDUARD ESSED, Esq., 16 Johnstone Terrace, Edinburgh. Proposed by W. W. SMITH, M.A., seconded by A. W. BORTHWICK, D.Sc.

A. J. ROSS, Esq., M.A., B.Sc., 177 Dalkeith Road, Edinburgh. Proposed by Professor BAYLEY BALFOUR, F.R.S., seconded by W. W. SMITH, M.A.

LEONARD C. SCOTT, Esq., 6 Leopold Place, Edinburgh. Proposed by W. W. SMITH, M.A., seconded by A. W. BORTHWICK, D.Sc.

And as a Non-Resident Fellow:—

The Rev. J. J. MARSHALL LANG AIKEN, B.D., The Manse, Ayton, Berwickshire. Proposed by W. B. BOYD, Esq., seconded by Dr. WM. CRAIG.

A. C. M. BELL, Esq., W.S., was balloted for and duly elected.

The TREASURER, ROBERT BROWN, Esq., C.A., submitted the following Statement of Accounts for the Session 1903–1904:—

INCOME.

Annual Subscriptions, 1903–1904; 55 at 15s.	£41	5	0
Do. 1902–1903; 1 at 15s.	0	15	0
Contribution as Non-Resident Fellow	3	3	0
Fee for Diploma	0	7	0
Transactions sold	2	5	0
Subscriptions to Illustration Fund	10	1	0
Interest on Deposits in Bank	2	7	2
	£60	3	2
Balance—Being Excess of Expenditure over Income,	21	15	6
	£81	18	8

EXPENDITURE.

Printing (including Transactions for Session 1902–1903, £56, 6s. 0d.)	£75	16	9
Rooms for Meetings, Tea, etc.	4	7	6
Stationery, Postages, Carriages, etc.	1	9	5
Fire Insurance on Books, etc.	0	5	0
	£81	18	8

STATE OF FUNDS.

Amount of Funds at close of Session 1902–1903				£129	10	2
Deduct—Decrease during Session 1903–1904, as above				21	15	6
Amount of Funds at close of Session 1903–1904, subject to expense of printing Transactions for Session 1903–1904				£107	14	8
Being :—Sum in Current Account with Union Bank of Scotland, Ltd.	£48	9	5			
Do. on Deposit with Union Bank of Scotland, Ltd.	122	7	2			
Due by Treasurer	6	9	10			
	£177	6	5			
Less sums outstanding	69	11	9			
As above				£107	14	8

Note.—Subscriptions in arrear, 1903–1904, £7, 10s.

EDINBURGH, *3rd January* 1905.—I hereby certify that I have audited the Accounts of the Treasurer of the Botanical Society of Edinburgh for Session 1903–1904, and have found them correct. I have also checked the foregoing Abstract, and find it correct.

ROBT. C. MILLAR, C.A., *Auditor.*

The abstract shows a deficit on the year's working. This was attributed to the expense of the Transactions. The delay in publication was another factor tending to irregularity in subscriptions, and a probable cause of fall in income. It was agreed that the whole matter be referred to the Council for careful consideration.

On the motion of the PRESIDENT, the Accounts were accepted, and the cordial thanks of the Society given to the TREASURER, and to the AUDITOR, R. C. MILLAR, Esq., C.A.

A paper by L. J. COCKS, Esq., on the "Mosses and Hepatics collected during Excursion of Scottish Alpine Botanical Club in 1904," was communicated by ALEX. COWAN, Esq. The species were enumerated, and contained several new records for the vice-counties concerned.

NOTES ON THE MOSSES AND HEPATICS. By L. J. COCKS.

The hills investigated proved to be comparatively poor in mosses. Mam Soul in particular, on account of the dry nature of its surface, was disappointing, the scarcity of hygrophilous species being very noticeable. The most noteworthy plants obtained were as follows:—

Polytrichum sexangulare, Flörke.	Summit of Mam Soul (3800 ft.).
Campylopus Schimperi, Milde.	Mam Soul and Scour na Lappaich.
Dicranum Starkei, W. and M.	,,
,, *molle*, Wils.	Scour na Lappaich.
,, *asperulum*, Mitt.	,,
Grimmia Mühlenbeckii, Schimp.	Glen Affric.
Aulacomnium turgidum, Schwaeg.	Scour na Lappaich.

The only Scottish localities from which this plant is already recorded are in Perthshire.

Conostomum boreale, Swartz.	Mam Soul.
Philonotis adpressa, Ferg.	,,
Webera albicans, var. *glacialis*, Schimp.	,,
Hypnum hamulosum.	
,, *callichroum*.	

In the hepaticæ I am able to report better results. The total number of species collected is 35, of which 18 are new vice-county records, viz., 9 for v.-c. 96 (Easterness), and 9 for v.-c. 106 (East Ross).

The best ground was undoubtedly the fine south-east corrie of Scour na Lappaich. The snow was still covering a large part of this, and I have little doubt that under other conditions and with longer time for investigation still better results might be obtained.

I have submitted all the hepatics gathered to Mr. Symers M. Macvicar, and think the list as revised by him is of sufficient interest to be given in full, as, so far as I can find, no previous records from these localities exist.

**Metzgeria conjugata*, Lindb.	
,, *pubescens*, Schrank.	
*†*Pallavicinia Blyttii*, Mörck.	Mam Soul and Scour na Lappaich.
†*Gymnomitrium concinnatum*, Light, var. *intermedium*, Limpr.	Sour na Lappaich.

Gymnomitrium obtusum, Lindb.	Mam Soul.
* ,, *varians*, Lindb. (*Cesia conferta*, Limpr.)	Mam Soul.
**Marsupella erythrorhiza*, Limpr.	Mam Soul.
* ,, *emarginata*, Ehrh.	
,, *aquatica*, Lindenb.	
**Nardia compressa*, Hook.	
,, *scalaris*, Schrad.	
**Aplozia sphærocarpa*, Hook.	
†*Anastrophyllum Donianum*, Hook.	
Lophozia Lyoni, Tayl.	
† ,, *lycopodioides*, Wallr.	Scour na Lappaich.
,, *Floerkii*, Web. and Mohr.	
†*Anastrepta orcadensis*, Hook.	Scour na Lappaich.
**Plagiochila spinulosa*, Dicks.	
,, *asplenioides*, L., var. *major*, Nees.	
Mylia Taylori, Hook.	
†*Harpanthus Flotowianus*, Nees.	Scour na Lappaich.
Cephalozia bicuspidata, L.	
Bazzania tricrenata, Wahl.	
†*Pleuroclada albescens*, Hook.	Scour na Lappaich.
Blepharostoma tricophyllum, L.	
Anthelia julacea, L.	
Ptilidium ciliare, L.	
Diplophyllum albicans, L.	
† ,, *taxifolium*, Wahl.	
**Scapania nimbosa*, Tayl.	Mam Soul.
† ,, *ornithopodiodes*, With.	Scour na Lappaich.
,, *purpurascens*. Hook.	
,, *paludosa*, C. Müll.	Scour na Lappaich, at about 3000 ft.
,, *gracilis*, Lindb. (*S. resupinata*, Carr.)	
,, *curta*, Mart.	

N.B.—Plants marked * are now first noted for v.-c. 96, and those marked † for v.-c. 106.

Pallavicinia Blyttii grew plentifully in the corrie of Scour na Lappaich above referred to, on slopes where the snow had recently melted, and in small quantity on the summit of Mam Soul among *Polytrichum sexangulare*.

Scapania nimbosa, of which only a few stems were found (amongst Hylocomium loreum, Rhacomitrium lanuginosum, and other mosses) on a rock by a stream which runs down from Mam Soul to Glen Affric, had only been known to occur at one spot in Ireland (Brandon Mountain, Co. Kerry), where it was discovered by Dr. Taylor in 1813, until in 1898 Mr. S. M. Macvicar gathered it at Moidart, West Inverness. It has also been found on Ben Laoigh, Perthshire. (See "Hepaticæ of the Breadalbane Range," by P. Ewing, in "Annals of Scottish Natural History," Oct. 1903.)

Pericles Joannides, Esq., and Dr. R. Stewart MacDougall contributed a note on *Puccinia graminis*. From his own observations on the disease in Egypt, Mr. Joannides gave several instances of the continued existence of the *Puccinia* during several years without the usual presence in the life-cycle of the teleutospore condition and consequent æcidium stage on the barberry.

Notes on Puccinia graminis. By P. Joannides.

The rust of wheat—this well known and much dreaded pest, so destructive to the wheat crops of all the wheat-growing countries of the world—is caused by the parasitic fungus *Puccinia graminis*, which belongs to the order Uredineæ. Of this family almost 2000 species have been described ; they are parasitic between the cells of the host. This fungus, like some others of its allies, is extremely interesting as affording an example of heterœcism, *i.e.* it appears in one or more forms on one host, and deserting this host it appears in other forms on another and not related host. The two hosts are the wheat-plant and the barberry.

The vegetative portion of the fungus is not visible to the naked eye— the mycelium ramifying through the intercellular spaces of the affected parts of the host plant, and also sending out haustoria into the substance of the cells. When maturity is reached, spores are produced, which, bursting through the epidermis of the host, give rise to the rusty appearance so characteristic of these fungi.

This fungus produces several kinds of spores.

The teleutospores produced on wheat late in the summer are invested with a thick wall, and are dormant spores serving to tide the fungus over the winter. When weather permits, early in the spring these spores germinate, forming what is often called a promycelium, which gives rise to sporidia. It is believed that these sporidia cannot infect a wheat-plant, but that the barberry is necessary as the next host.

The mycelium in the barberry gives rise to two sets of structures—spermogonia on the upper surface and æcidia on the lower. The flask-shaped bodies on the upper surface of the barberry leaf produce a great number of so-called spermatia—whose destiny is unknown, although artificially they have been made to germinate.

Bright red patches begin to show on the under side of the leaves. These are cup-like fructifications known as "cluster cups," or æcidia. By the rupture of the epidermis the æcidiospores escape, and being carried to the leaf of a wheat or rye plant, germinate, giving rise to a mycelium which lives inside the wheat-leaf. The mycelium in the grass develops still another kind of spore—the uredospore. These, owing to their colour, give, when they break through the epidermis, a rusty colour to the grass. It is essential now to mark that these uredospores, if carried to wheat and other grasses, are capable of germination on these—that is, they are capable of giving rise to the same form of the disease as that which produced them. Uredospores thus serve to spread rapidly the disease, and they keep on being produced until a sudden check is brought about by the first signs of the approaching winter. This factor of temperature, with its relation to physiological drought, is interesting and noteworthy. Towards the end of the summer, then, the mycelium on the wheat, ceasing to produce uredospores, gives rise instead to dark thick-walled double-headed teleutospores in the form of which the fungus, as we have already seen, has the power of hibernating.

Assuming that the weather keeps on being genial, or at least the winter be not so cold as in Britain, and all the other environmental conditions remain the same, is it not possible that the uredospores may continue the life-history of the pest on wheat and other grasses without the production of teleutospores and the intervention of the second and different host?

The fact that in some warm countries the disease flourishes in spite of the absence of the barberry plant, first prompted me to make a series of field observations with the intention of by-and-by carrying out further and more elaborate experiments to test the theory that in warm climates, if the winter be sufficiently mild, it is possible that the fungus can go on perpetuating itself on the wheat and allied grasses without the need of an intermediate host.

During the interval of four years the following observations were made in wheat fields situated in various parts of Egypt, and which at one time or another were affected by rust.

1. In the country of Behera noteworthy observations were made in two fields.

(*a*) A field in the vicinity of Alexandria. Sheltered. Wheat was grown during the years 1897, 1899 and 1900, and suffered from rust all round.

(*b*) A large field near Abouhommos.

After a mild winter with occasional winds during the winter 1896–97, the attack of rust was general. Grasses and plants of wheat growing in sheltered canals and drains showed the uredospore stage in winter time. During the years 1898–99, winters being severe and the field exposed, rust did make its presence in the wheat crops in spring, but it was of a weak nature and seemed unable to cause any damage, notwithstanding the fact that later in the season the conditions were very favourable. But it seemed as if two successive cold winters had entirely exhausted the fungus. On careful examination in the canals, drains, and all sheltered spots, no uredospores could be found in the winter as during 1896–7.

2. Several observations made in various fields in the north-eastern portion of the delta, showed that rust affected certain fields year after year, and uredospores were common in winter.

In this part of the country the minimum temperature seldom if ever falls very low, the climate being on the whole damp and genial. Strong northerly and westerly winds often sweep over the country, but these do not materially affect the fungus; on the contrary, they help, if anything, to spread it.

3. In Simbellawen, two fields, which after the mild winter of 1896–97 were heavily damaged by rust, were almost entirely free from the pest in 1899, and particularly the less sheltered one.

4. In Hehya a field was infested with rust during the season of 1897, the disease never being noticed again in that field. The field was a good one, exposed, highly situated, and well drained. It belonged to a native, who took no measures whatever to combat the disease after it made its appearance in 1897.

5. In the neighbourhood of Zagazig a field was found to

suffer severely year after year, the land being under a two-course rotation—wheat being one of the two crops grown annually. The field was low-lying, well sheltered, and badly drained. After a spell of very cold weather in the year 1899, on examination uredospores were found in plenty.

6. In a rust-infested field near Shebin el Kanater, after a spell of keen frost during January 1898, only teleutospores could be found. The following year the wheat crop was almost free from rust.

7. A field near Galiub in 1897 was badly infested. After the cold winter of 1898–99 the crop suffered but little.

8. Near the Barrage, Cairo, three fields were badly infested with rust during 1897–98. After the cold weather of the two following winters the wheat crops suffered just as much. Barberry plants were found cultivated in a neighbouring garden, and this may account for the flourishing condition of the pest.

9. In Bulag-el-Dakrur:—

(*a*) One well-sheltered field showed rust (uredo stage) in the middle of winter during the year 1899—a year hardly a favourable one to the fungus. The crop was an exceptionally early one.

(*b*) Another field, not a mile distant from the former, though it did suffer with rust during 1897, was quite free from rust during the two following seasons. The disappearance of the disease cannot be accounted for unless it was due to the severity of the weather. During these two winters the potato crops had been completely destroyed by a several-nights' frost.

10. In the Ghizeh province five observations were made.

During 1897 all five fields suffered heavily.

In 1898, after a dry, cold winter, two fields particularly exposed were practically free from rust.

During 1899–1900, after an exceptionally cold winter, one of the most exposed fields was found to be suffering badly with rust in the spring, the others being practically free. This was the only contradictory observation I made, and infection in this case may have been brought about by seed.

11. A sheltered field of wheat in Matarieh during the cold winter 1899–1900, on examination proved to be suffering

with rust. Both uredospores and teleutospores were found on the wheat plants.

In all the above places I failed to find any plant, allied to the barberry or not, which might play the rôle of the intermediate host. Æcidiospores, it is true, may be carried from Southern Europe by the prevalent northerly winds, but nearly all my observations go to show that the wind after all is not so responsible—at least where long distances over sea are concerned—for the spread of the disease as it was once supposed to be the case.

For if the spread of the rust on wheat is mainly due to æcidiospores brought by the wind, severe cold should not tend to reduce the spread and activity of the fungus. And yet this is the case—for cold, as we have seen, not only checks, but in many instances even tends to exterminate, the disease.

The life-history of this dreaded fungus is undoubtedly wrapped up in mystery as yet, and affords a field for further investigation and research. Until we succeed in solving the question and becoming fully acquainted with the nature, mode of attack, and life-history in general of the fungus, we cannot possibly hope to find the necessary measures for combating successfully the disease.

The PRESIDENT read a paper on "Physiological Drought as a principle in Gardening." By means of actual plants and of a series of lantern slides, he illustrated the important part water plays in plant life and structure, and more particularly pointed out that in the treatment of many garden plants the question of physiological drought was of the greatest importance.

Mr. ROBERT ADAM contributed an interesting series of slides of British Plants in Nature, and Dr. BORTHWICK, a further series of Fungi in their natural habitat.

MEETING OF THE SOCIETY,

Thursday, February 9, 1905.

Professor I. BAYLEY BALFOUR, F.R.S., President, in the Chair.

PERICLES JOANNIDES, Esq., 81 Gilmore Place, Edinburgh, was proposed as a Resident Fellow of the Society by Dr. R. STEWART MACDOUGALL, and seconded by W. W. SMITH, M.A.

The following candidates were balloted for and duly elected Resident Fellows of the Society:—

EDUARD ESSED, Esq.
A. J. ROSS, Esq., M.A., B.Sc.
LEONARD C. SCOTT, Esq.

As a Non-Resident Fellow:—

The Rev. J. J. MARSHALL LANG AIKEN, B.D.

Professor JAMES W. H. TRAIL, F.R.S., as retiring President, gave a valedictory address on "Herbaria and Biology." In his paper Professor Trail supported strongly the making of Herbaria and local lists—he considered them of very great value for teaching purposes, and dissented entirely from the views expressed at the Southport meeting of the British Association upon their value. The President subsequently spoke in support of Professor Trail's view. The cordial thanks of the Society were given to Professor Trail for his interesting address.

HERBARIA AND BIOLOGY.

The British Association Report of the meeting at Southport (1903, pp. 420–429), in the Report of the Committee on "The Teaching of Botany in Schools," gives an instructive example of the swing of the pendulum in science, as in other fields of human progress, from one extreme towards the opposite. In this document is much with which we must heartily agree, especially those who have, as students and as teachers of botany, learned from experience that plants must be studied as living things; that personal investigation alone can gain a knowledge worth acquiring; that a too copious vocabulary of technical terms is a dead weight on true progress; that questions of priority of nomenclature are unsuitable to all but a few advanced students; that problems of synonymy are, let us hope, an incumbrance of only a temporary stage of the science; and, above all, that the acquisition by a student of a love for the study and of the habit of investigation is worth far more than a knowledge, however extensive, gathered only from the work of others. Not less fully must we agree that the aims of botanical instruction formerly were far too limited, and that a living interest has been brought in by the discoveries of Charles Darwin and others, who have opened up new aspects of the science, and have widened our conceptions of it. The complaint that the nutrition of green plants was long almost ignored in courses of instruction has too much truth in it. But, while there is much in the report with which we can fully agree, opinions are expressed that might have been more happily stated, and that appear to be liable to misinterpretations of an unfortunate kind, and that, apparently authorised by botanists of so deservedly high repute, might have very unfortunate results. The following quotations from the report show its attitude with regard to herbaria and, incidentally, to museums and local lists of plants:—

"Students of botany have been encouraged to spend most of their time upon the characters by which the British flowering plants are distinguished from one another, the ultimate purpose being apparently a more perfect knowledge of their distribution within these islands. The scientific product of local lists has by no means justified the time and labour bestowed upon them, and their educational effect has been depressing instead of stimulating."

"It is a mark of the present immaturity of the Nature Knowledge movement that whenever a fresh attempt is made to stimulate the teacher, it is accompanied by a great display of dried plants, diagrams, lantern slides, models, slices of useful woods, lists of species observed, with their dates, and maps of distribution. All these are dead products, and only indicate that some one has been taking pains. Those teachers who fix their attention upon the living plant and its activities will have little need of bought appliances."

"We have a poor opinion of drying plants as an incentive to the study of botany. The dried plant is an inadequate substitute for the living and growing plant, and finds its principal use in the authentication of botanical discoveries made in distant lands. The habit of collecting plants for the herbarium may be hostile to the close study of the environment, and confirm the pernicious belief that the thing of chief importance is to be able to name a plant as soon as you see it. One lamentable result of that rapacity of collectors is that our native flora has become sensibly impoverished of late years. There is little gain to science by way of compensation. Amateur herbarium botanists have not, in our own time and country, done much to solve important questions of any kind; and they often propagate the misleading notion that rare species are better worth attention than common ones. The rarity of a plant is a reason, not for gathering a flower and drying it, but for letting it alone, unless, indeed, you can accomplish some important and unselfish purpose only by its sacrifice."

"In our opinion, both herbaria and museums are indispensable to scientific progress. They have their uses even to children, and many naturalists have begun by collecting. But there are things more advantageous and more appropriate to the first stage of botanical study than the accumulation of a pile of wild-flowers, dried and named. School collections, illustrating the dispersal of fruits and seeds, the shapes of leaves in connection with bud folding and exposure of the largest possible surface to light, resistance to drought or cold, etc., may be made to gratify the collecting instinct in a harmless way, and at the same time to promote definite inquiries. It is the mechanical habit of collecting for selfish ends, and without any scientific purpose, that we wish to discourage."

The last of the paragraphs quoted should probably be accepted as the committee's estimate of the true value of herbaria and museums, inserted to prevent the view that herbaria, and to a less extent museums, are of little if of any value—a view that might be held as advocated in the previous pages of the report. But, even thus safeguarded, the whole report is an indictment of the investigation of local floras and of the formation of private or other small herbaria, and may readily be interpreted as a condemnation of the time and labour spent on these as useless, if not worse. It assumes an antithesis between such collections and the biological study of plants.

An opinion so expressed, the judgment of a committee of botanists themselves in the front rank of investigators in the science, might well be regarded as decisive; and, in face of it, to speak of herbaria and local lists along with biology, might almost be regarded as quixotic or due to ignorance or prejudice. Yet I venture to hold that the preparation of herbaria and of local lists affords opportunities to do really excellent biological work; and that to undervalue, still more to give up, such work is to cut oneself off from an important and valuable means of botanical training and investigation. Botanists in the past gave too little heed to plants as living things, and valued too highly the ability to describe specimens in technical language and to name them fluently, as if that ability comprised the science, and botany suffered in consequence. But that should be a warning of the evil that must result from the failure to recognise that botany requires the services of many workers, and is built up of the results acquired along varied paths of investigation. All must ultimately suffer if any one part is undervalued and disparaged; and at present there appears to be a considerable danger of the worth and true place of systematic and descriptive botany being overlooked in the reaction from the former tendency to regard them as almost alone worth study. My concern at present, however, is not to defend what will continue to be regarded as an essentially valuable part of botany, but to discuss for a little the place and worth of herbaria, and how they can be made most useful aids in the study of plants as living things.

The views expressed by the committee appear to be based upon the estimate expressed in the words that a herbarium "finds its principal use in the authentication of botanical discoveries made in distant lands"; and this is supported by the following statements: "The habit of collecting plants for the herbarium may be hostile to the close study of the environment, and confirm the pernicious belief that the thing of chief importance is to be able to name a plant as soon as you see it." "But there are things more advantageous and more appropriate to the first stage of botanical study than the accumulation of a pile of wild-flowers, dried and named." "It is the mechanical habit of collecting for selfish ends, and without any scientific purpose, that we wish to discourage."

From these and other passages in the report may be gathered the committee's conception of herbaria: and in that conception there is little to commend them to favour or to justify the belief that they can be of real service as aids in the study of plants.

But is this conception fair or right? Is it wise thus to limit the objects aimed at in the formation of a herbarium, and to discourage what has been found so helpful in the past? Has the herbarium ceased to deserve the high place assigned to it by Linnæus in the words, "Herbarium præstat omni Icone, necessarium omni Botanico"? Or may it not become useful in education and in research in a degree far beyond that attained in either public or private herbaria? Is there a natural antagonism between the study of plants as living things and the formation of a herbarium? May not the herbarium and the biological studies be found to assist each other in a most helpful way? I believe that they can and should be so related; and that it would be little less than a disaster to botanical investigation were the view to be accepted that the formation of herbaria is opposed in any respect to biological investigation, or to the true aims of botanical research. Herbaria are still necessary to every botanist—to the biologist not less than to the systematist. The question to be answered is not "Are herbaria a waste of time and labour—incumbrances to be thrown aside?" but "How can herbaria be made most useful to botanical progress?" To answer the latter question aright it is clearly needful to consider what should be the aim or aims in forming one; what it should illustrate; what it should contain; what methods of procuring and of preparing its contents are necessary or desirable; and what expenditure of time, labour, and material resources will probably be required to secure some fair measure of success. If the aim is merely to accumulate "a pile of wild-flowers, dried and named," especially of rare species or varieties, for the mere love of possession, without ulterior thought of information to be gained from them, the gain to science is *nil*, and there may have been harm done by the collecting of rare forms; but the collector cannot be held (even in this, the least worthy type of collecting) to have wasted time and labour uselessly. The habits of observation, and the familiarity with plants in their habitat, required to permit of forming a herbarium, have stimulated powers that will remain a real gain even to those that never advance the progress of botany as a science.

The formation of a herbarium, while travelling in some country very imperfectly explored, if at all previously, may have to be so restricted as to serve only "in the authentication of botanical discoveries made in distant lands." But such a herbarium (though all that the circumstances will permit to be formed, and though far more worthy in its motive than the first mentioned) is yet far from fulfilling the ideals that should be kept in view in the formation of one where conditions permit of expressing that ideal in actual practice, however imperfectly.

For a number of years the potential value of herbaria has appeared to me to surpass the actual value of any example known to me; and the desire to gain a clearer conception of what to aim at in forming a herbarium has been much with me, and has aided me greatly in gaining a knowledge of the plants themselves. I can with confidence say that my experience appears to have been very different from that of the authors of the report quoted above. Both the preparation of local lists and the selection and preservation of plants to build up a herbarium have brought to me a keener interest in the study of living plants in their natural environments, and a quickened power of observation, that have added greatly to the pleasure and profit of the study to myself, and have made me more able to help my students. The experience of one may, and probably will, be that of others; and in the hope of helping others, I venture to state my views regarding herbaria and their relations to biology.

Why should herbaria be formed?—Although "the dried plant is an inadequate substitute for the living and growing plant" in botanical education, it does not follow that a herbarium is useless to the teacher and pupils, or that a most valuable appliance should be discarded because it may be improperly used. No experienced teacher will resort to dried plants when living examples can be obtained for use by the pupils. But it is often desirable to add to the information obtainable from the living specimens by reference to structures not present in the particular stage of growth (*e.g.* fruits, seedlings), or to compare with the living plants the corresponding parts of plants of the same species grown in different environments, or of allied species, or of plants of other kinships, but of very similar aspect. Thus, to both teacher and pupil the herbarium becomes a most useful supplement to the living plants. Further, the herbarium becomes a very valuable biological record when it contains series of specimens that illustrate, in a far more trustworthy way than descriptions and figures alone could, the progress of continued experiments and observations on the interactions of plants among themselves, and as affected by their environments. From such carefully prepared and preserved records much information may be expected with regard to the evolution of the various forms of plants. The practical value of such knowledge in agriculture, gardening, and forestry is self-evident.

Akin to such investigations, though regarded from another standpoint, is the endeavour to appreciate the effects produced by man upon the flora of a country, and for this also a herbarium is of very great value. It is true that the greed of mere collectors has endangered the survival, or even has led to the local extinction of a few rare or very local plants; but local rarity or extinction has been caused far more often by man in other and less evident ways, of which frequently no record survives, or, if it does, it is due to the local lists or the local herbarium, which fill a useful, if relatively inconspicuous place in botanical research. How great the changes due to man have been in local floras can scarcely be realised even after diligent investigation; but their interest and importance render them worthy of study.

Still another reason for the formation of a herbarium has been already alluded to. It is that (except where undertaken wholly to gratify the mere desire of collecting for the sake of possession) it affords a useful training to the person who forms it.

That a herbarium "finds its principal use in the authentication of botanical discoveries made in distant lands" is a statement based on a singularly narrow view of its true value in botanical education and research.

What should a herbarium contain?—Dried specimens must be found in the herbarium; and it is sometimes assumed that they alone form it; but to be of full value it must include much besides dried plants. The answers to the question must depend very largely upon the objects that herbaria are intended to serve. To a certain extent, all have a few characteristics in common; but special characteristics distinguish various types among them, and require different methods of treatment. Common to all are the features that the specimens should have been selected to illustrate the points specially desired; that they should be carefully preserved, retaining form and colour as far as possible; that they should be accompanied on the sheets by drawings and descriptions of characters that are lost in the dried specimens, or are hard to be made out from them; and that their arrangement should render access to them easy.

The differential features of herbaria will depend on the special aim in view in the formation of each. Many specialised types may be found useful, differing greatly among themselves and from the ideal or generalised type, which, to a certain extent, includes features of all the specialised types, omitting other features. A few examples of limited herbaria may be indicated. Some of them are of great use in educational work. The aim in some is to illustrate structure (of stems, roots, leaves, stipules, fruits, etc.); in others, function (means of climbing, organs of defence, of nutrition, methods of pollination, of distribution, of reproduction, etc.); in others, diseases or injuries and their causes, whether physical or living; in others, the uses of plants to man (yielding foods, fibres, medicines, etc.); in others, the results of variations in environment, natural or experimental; in others, to illustrate groupings by habitat, or by geographical or other data. These and very many other motives may give origin to collections relatively small, but most valuable as aids to students, and not less so to biological research. Of each the value is chiefly dependent on the intelligence and care exercised in the selection and preservation of specimens, and on the fulness and clearness of the explanations and drawings that accompany these specimens. Such a herbarium should be noteworthy for thoroughness of execution rather than for its extent.

Each specialised herbarium should have an underlying aim or idea which it is designed to illustrate, and to which other considerations should be subordinate. Thus they can readily be combined into larger collections to any extent, and both usefully and advantageously. But their value lies in the merit of the conception that guides the formation of each, and in the care exercised in giving material form to the guiding idea. Thus, if it is desired to illustrate the principles of classification, a large collection of plants, merely dried and mounted, will be far less useful than fifty or a hundred species carefully selected for the purpose, illustrated with preparations of the various parts in so far as they can be shown in the dried state, supplemented by drawing of obscure features, and by descriptions or notes calling attention to the characters distinctive of the grades in classification, and of those that are merely based on resemblances and do not indicate kinship of species. For the purposes of such herbaria, common plants, as affording abundant material from which to select the most suitable, are to be preferred to rare species, in all but the few cases where the latter supply links that have ceased to exist elsewhere.

Let us now turn for a little to the type of herbarium that more nearly corresponds to the generally accepted meaning of the word, and clearly that intended by the committee of the British Association in its estimate of the chief value of a herbarium. It consists of a more or less extensive collection of dried plants, the work of its owner (to whom it may possess a very special value as recalling pleasant holidays or well-spent efforts), or built up by the labours of many workers, and brought together from many lands. The value to botanical research of the great national herbaria, and of many private ones, is recognised by every botanist. The loss to science would be very great were any one of these great herbaria destroyed; and their preservation is looked on as a public duty. They have been indispensable in the advance of botanical research, and contain materials for long-continued investigations into geographical distribution and systematic botany. But their very extent and resources make it impossible for individual botanists to hope to rival the great herbaria in these fields, or to pursue these studies at a distance from such collections. A botanist confined to any part of the British Islands, or, indeed, to almost any part of Europe, has little prospect nowadays of discovering additions to the genuine native flora of the country, and still less of finding a species not previously known. Yet a herbarium, to illustrate the existing flora of the region, is likely to be of both interest and real value, if the specimens are authenticated with information of locality and date of collection, nature of habitat, relation to man (introduced, favoured or threatened by him), and relative frequency. Such herbaria afford records of great service for comparison with the flora of the same area in later years. All the more is this the case where human industry is rapidly changing the environment, both physical and organic, new plants, and occasionally new animals, being introduced by accident or intentionally, and greatly affecting the chances of success or failure of the native flora.

Such a herbarium faithfully representative of the flora of a limited area is of more real worth than one composed of rare species, and is seldom liable to the charge of endangering the existence of rare species.

But do even the largest and best of existing herbaria fulfil all that might be desired of them? The answer can scarcely be in the affirmative. Indeed, it is not possible for them to be built up on a single ideal, composed as they are of the gatherings of many hands, in every part of the world, often brought together in great difficulties, when no choice of materials could be exercised. The great herbaria must contain much that is too precious to be thrown away, but that does not fit into any scheme of selection. In private herbaria, and in the smaller public ones, a definite plan should guide the selection and treatment of their contents, that plan differing according to whether the collection is to be representative of a geographical district or of a larger or smaller group of plants. Within the limits determined it should be as nearly perfect as it can be made; that is, it should supply all the information that it is possible to bring within these limits. Reduced to definite terms this means that the aim should be to give in the herbarium, in so far as the conditions allow, a full and true representation of the life-history of each species contained in it. A few species so treated, and gradually added to as occasion allows, will be found of far greater interest than a large number of specimens collected because of their rarity. Indeed, the chief value of the latter type of herbarium is merely to authenticate the fact that certain species have been found within a given area, while it is liable to the charge of tending to the extinction of rare species.

But where the aim is to illustrate life-histories well the commoner species are to be preferred, inasmuch as they afford an abundant supply of material, often in varied environments. It is difficult to conceive of work more likely than the formation of a life-history herbarium to suggest problems of vital importance in the investigation of plants as living beings, and to throw light on these problems and on the relations of plants to their physical environments and to other organisms as friends or as foes.

It may be asked what a representation of a species such as is here advocated means. Briefly it may be expressed as all that can throw light on the species, from the origin of the individual until its decay, its morphology and internal structure, its nutrition, the adaptations by which it gains advantages or defends itself from injury in its struggle for existence, the dangers that it encounters, the injuries it suffers, the methods of multiplication or reproduction by which the species, as distinct from the individual, is preserved and enabled to hold its place or to spread more widely its reactions to changed environments, its tendencies to variation, its relationships with other plants, either of kinship or of mere resemblance, the associates it prefers, the partnerships it may form, the species it shuns, its relations with man, and other points of view that it would be tedious to enumerate.

One or two concrete examples may help to make clearer this conception of a herbarium. It matters little which plants are selected for exposition, each requiring to be considered by itself, and treated so as to bring out its salient features. Charlock (*Brassica Sinapistrum*) may be taken as an example. The development of the embryo during germination may serve as the starting point. Too small to be easily followed in dried examples of seeds, it should be shown in drawings; and the young plants dried should be shown in various stages of development from the earliest period of independent life (with only root, hypocotyledon and cotyledons visible) up to full maturity and death. The condition in which the plants pass the winter should be represented. The entire plants should be prepared to show all the organs visible at each period of life, and they should be selected to show the range of diversity within the species as regards roots, stems, leaves, and flowers. With each specimen should be a brief statement of habitat, exposure, soil, and food in it, and relationship to other specimens if grown as members of a series or for experimental aims. The inflorescence should be well shown, along with dissections of the flower and of its parts, with drawings of parts too small to be clearly observed in the dry state, and brief notes to draw attention to any points requiring or deserving explanation. The development of the flower should be shown, also the ovary and ovules; and the young embryos should have their development illustrated by drawings and brief explanations. So with the mature fruit and seed, the rupture of the fruit and the distribution of the seeds. The internal structure of these several parts should be indicated by sketches and brief explanations; and the organs of nutrition (root and leaf) should be well shown, being simple in this plant. The hairs on each part should be sketched and their uses indicated. The forms of hard waste ground, of agricultural soil, and so on, should be shown, as illustrating effects of environment and nutrition. The close connection between this plant and man's occupancy of soil in Scotland should be indicated, with a brief note of its chief associates and its importance as a weed. As regards taxonomy, the cover should bear on it the synonymy of the plant; and one or more sheets should be given to a series of preparations to illustrate the characters of the various grades of classification, from species through genera to family at least, these preparations being accompanied by drawings and descriptions. A few examples from other species liable to be mistaken for charlock (*e.g. Raphanus Raphanistrum*, and some species of *Brassica*) may find a place, with notes calling attention to their distinctive features.

The injuries done to seedlings by various beetles, and to older plants by gall-making beetles on roots, by caterpillars, by grubs mining in the leaves, by beetles in flowers or in fruits, are all of importance to the plants' welfare, and should be shown by injured parts, and by figures of the insects. The fungus parasites are not less important, including such forms as *Plasmodiophora Brassicæ*, *Peronospora parasitica*, *Cystopus candidus*, and others, and should be similarly noticed, as also the connection of both the insects and the fungi, with turnips, cabbage, and other cultivated species of *Brassica*, increasing the hurtfulness of charlock as a weed.

The whin or gorse (*Ulex europæus*) may be treated from most of the points of view mentioned under charlock, but it exhibits certain features in addition, such as the marked fleshiness of cotyledons, the three-lobed early leaves, the adaptations of stems and leaves for defence and for special habitats, the influence on structure of a moist atmosphere, the woody stems, the symbiotic association with bacteria for nutrition in the root-tubercles, th highly specialised flowers and mode of pollination, among others less peculiar.

The insect-capturing plants, the mycorhiza-symbionts, the partial and the complete parasites, and many others, afford striking examples of other extremely curious types; but the charlock may suffice (as representative of the great majority of plants) to show in how many aspects each may and should be regarded.

It may be objected that to commence a herbarium on so extensive a plan is to undertake a work impossible of completion. In a sense that is true; and to me it appears a very real advantage that the herbarium should be planned to expand with each advance of our knowledge in botany, and also to give efficient aid in opening up new fields of inquiry. So planned, the motive to go on continues unchecked, for each step of progress only leads on to others not previously within sight.

I venture to think that such a herbarium as that suggested will be found a most valuable instrument in promoting the study of *living* plants, in its formation no less than in its constant usefulness.

The President gave a communication on *Saxifraga Grisebachii* and its allies, illustrated by both living and dried specimens.

Mr. R. D. Cole forwarded for exhibition a specimen of *Taxus baccata* from a bog in Ireland.

Mr. SYMINGTON GRIEVE exhibited photographs of Knaur on oak;

Mr. F. C. CRAWFORD, *Fumaria occidentalis* of Pugsley;

Mr. R. L. HARROW, peculiar root-growth on Rhododendron, which had formed in a drain pipe; *Potamogeton Drucei*, and a witches' broom on *Myrsine africana*.

Mr. L. STEWART showed Fasciation on Lopezia and on Reinwardtia. Also the Leaf of *Dracontium Gigas*.

The thanks of the Society were given to these gentlemen.

MEETING OF THE SOCIETY,

Thursday, March 9, 1905.

Professor I. BAYLEY BALFOUR, President, in the Chair.

On the motion of the PRESIDENT, the Fellows of the Society recorded in the minutes their deep sense of the loss they have experienced through the death of Mr. PATRICK NEILL FRASER, who for a long period gave freely his services to the Society as its Treasurer, and throughout his life promoted its interest in many ways. They desire to express their sincere sympathy with Mrs. Neill Fraser and family in their bereavement. (A copy of the record in the minutes was sent to Mrs. Neill Fraser by the HONORARY ASSISTANT-SECRETARY.)

Mr. PERICLES JOANNIDES was duly elected a Resident Fellow of the Society.

Mr. WILLIAM YOUNG read a paper on the "Alpine Flora and Rarer Plants of Glenshee," and exhibited a series of dried specimens in illustration of the same.

THE ALPINE FLORA AND RARER PLANTS OF THE GLENSHEE DISTRICT. By WILLIAM YOUNG.

Glenshee is situated in the extreme north-east corner of Perthshire—vice-county 89. It is best approached from Blairgowrie, from which it is distant about twenty miles. The hills on either side of the glen are of no great height—only from 2400 and 2600 feet above sea-level. The scenery is picturesque rather than grand. At the head of the glen is the Spittal, consisting of the inn, a few houses, and parish church. Here the glen branches; one arm—Glen Beag—striking due north, and through it runs the coach road to Braemar. The other branch is called Glen Lochaidh, which also gives off a branch parallel to Glen Beag, Glen Tatnich. There is no turnpike road through Glen Lochaidh, but a more or less well-marked footpath leads the pedestrian into Glen Tilt. There is also a footpath over the hills to the west of Glenshee, leading to Pitlochry. The Spittal of Glenshee lies at an elevation of 1000 feet above sea-level; therefore the air is bracing and healthful—an ideal holiday resort, "far from the madding crowd." It is quite among the mountains; yet the botanist, who does not care for climbing, will find plenty to interest him among the sub-alpine plants by the roadsides, by the margins of the streams, or among the marshes of the three glens which converge at the Spittal. The botanist who aspires may attain to the 3000 feet line without difficulty; or he who essays rock-climbing will find stiff bits in plenty in the Glens of Caenlochan or Corrie Ceanmor, and sufficient use for an alpenstock to warrant one being carried.

Generally speaking, the locality is dry. I suppose, because the rain clouds from the Atlantic have discharged themselves of a large portion of their moisture on the higher mountains of Argyllshire and west Perthshire before reaching this district. The nearer rocks are the metamorphic rocks of the Highlands, composed chiefly of graphitic mica-schist and black slate, and are quite dry; consequently on them the cryptogamic flora is meagre and deficient in species, and the phanerogamic restricted and stunted. Some marshy ground on Ben Gulabin, two deep ravines at the head of Glen Beag, branching off to east and west, are the only places worth visiting for mosses and hepatics. One has to get into Caenlochan in Forfarshire, or into Corrie Ceanmor in south Aberdeen, to botanise really good wet rocks. The marshes at the head of Caenlochan are very good for carices and hepatics. The rocks have flowering plants in abundance.

There are comparatively few trees in the glens above the Spittal. Fir, birch, oak, and hazel are the chief, and they are much scattered. Above 1200 feet there are no trees at all, except in the gorges. In Caenlochan, at 1600 feet, there is a dense fir wood. The trunks are quite bare of mosses and hepatics, even foliaceous lichens are conspicuous by their absence — another indication of the comparatively dry climate. But you must not think it rains but seldom. I have lived there for a week, and it rained every day. Sleet and hail are not uncommon events in the middle of July. Then it is bitterly cold, and botanising is not a pleasure.

My experience of Glenshee as a botanical centre was gained in the course of four visits. First in 1889, which was my first introduction to Alpine botany after meetings of the East of Scotland Union of Naturalists' Societies held in Alford. Three of us walked from Ballater by Loch Muick, Dhû Loch, Carn Bannock, Glen Callater, Glen Clunie, and Glen Beag, arriving at the hotel in the small hours of the morning. The plants I gathered on this visit were named for me by Dr. John Macfarlane, a fellow townsman, once a prominent fellow of this Society, and now of Philadelphia, U.S.A. On that occasion we met Mr. William West of Bradford, and had several outings with him. Then in 1890, after the Montrose meetings of the Union, we were accompanied by Mr. Barclay and Mr. Meldrum of the Perthshire Naturalists' Society. Next in 1897, Mr. Ewing, F.L.S., President of the Glasgow Natural History Society and I explored the district for grasses and carices. In 1904 we were back again, accompanied by Mrs. Ewing, who is a splendid hill-climber and an enthusiastic botanist. This last visit was almost wholly occupied with searching for hepatics, assisting Mr. Macvicar in his records of their distribution in Scotland. As I had no idea, on any of these occasions, of making a record list of the flowering plants of the district, this paper cannot claim to be anything like complete in that respect. I have therefore made it more of the descriptive and less of the catalogue type, which I trust will not offend any of the traditions of this venerable Society.

I propose taking you, in imagination, first to Caenlochan (a tramp of about ten miles), the richest in Alpine plants in the district. Starting from the hotel at 8 A.M. we walk up Glen Beag, which is shut in at its upper end by the conical-shaped mass of the Cairnwell. A gradual rise of 1000 feet takes place in six miles, the summit of the mountain rising 1060 feet higher. The pass is very narrow; practically room only for the burn at the bottom of the "V," made by the hills on either side. By the roadside we notice abundance of our native edelweiss—*Gnaphalium supinum*. Near the summit of the road, and on the steepest part of it, there are two awkward acute angles in the road, forming the letter Z, called the Devil's Elbow—a most difficult place to negotiate with a coach and four. A little further on and we are standing on the watershed between Tay and Dee. Leaving the road we begin to ascend Meal Odhar, lying to the east. There is a steady rise of 1000 feet to the top of the ridge connecting it with Glas Maol. On the slopes and knolls there is any quantity of *Loiseleuria procumbens*; and among the heather the cloudberry, *Rubus Chamæmorus*, is plentiful, as also *Melampyrum sylvaticum*, var. *montanum*, and *Hypericum pulchrum*. Cushions of *Silene acaulis* overhang the rocks and boulders. At the summit is the cairn in which the boundary lines of the three counties of Perth, Forfar, and Aberdeen meet. By the side of the fence, and on the Perthshire side of it, is a marsh in which these plants of *Carex rariflora* were gathered. This station, the only one in the county, was first discovered by Mr. Ewing. Crossing the ridge a well-marked sheep-track leads round the Corrie of Glas Maol, where the Alpine species of the grasses *Phleum* and *Alopecurus* used to be plentiful, but very few were visible last year. Near a spring *Cochlearia Grœnlandica* was gathered, and very fine clumps of the lovely blue *Veronica alpina* were seen. In July last there were two large patches of snow in the Corrie. We walked this way six times, and on each occasion saw numbers of ptarmigan. In one covey there were twenty-two full-grown birds—a most unusual sight, as one seldom meets with more than two or four in the mountains. Climbing up the eastern side of the Corrie the ground is seen to be covered with *Salix herbacea* and *Potentilla Sibbaldi*. In a few minutes the bogs at the head of the famous glen are reached. Here carices are plentiful. Among them some curious forms of *curta* and *echinata* occur. *Carex approximata* was found here by Mr. Ewing some years ago. He also found a curious form of *aquatilis*. I have also seen it *in situ*. When growing, the stem has the appearance of a corkscrew. He named it "spiralis," but it has not yet been admitted by the authorities. From the edge of the rocks a view of the whole glen can be had, with its amphitheatre of precipices rising several hundred feet from the stream, which is the river Isla at its source. On the grassy places the herd of deer may generally be seen browsing, sometimes as many as 200 of them.

The rocks at the head of the Corrie are composed of a slaty-black schist, which weathers very rapidly, and becomes like clay, resembling very closely the blaze from coal-pits.

They are dripping-wet rocks, rising in shelves or narrow ledges, on which the rare Alpine plants grow. *Gentiana nivalis* is the most noteworthy. It is scarce, but *Dryas octopetala* and *Erigeron alpinum* are plentiful, likewise *Saxifraga oppositifolia*, *Veronica alpina*, *Potentilla rubens*, *Sedum roseum*, *Cerastium alpinum*, with the Alpine form of *trivialis* and *Luzula spicata*, together with several rare species of *Hieracium* and *Salix* in abundance. Of carices, *atrata*, *vaginata*, *capillaris*, *rigida*, and *pulla* are the most frequent. Between this clay or slaty-black schist and an adjoining mass of chlorite schist there is a narrow dyke of red granitic friable rock, which is much weathered, and forms a large scree, through which a small stream percolates. In this gravelly bed *Thlaspi alpestre* and *Veronica fruticans*, as well as the *Epilobia*, *alsinefolium*, and *anagallidifolium*, flourish. *Saxifraga nivalis* is found on the chlorite schist on the other side of the gully. In this glen, at an elevation of 3000 feet, in moist, sheltered places, some of our lowland plants find a congenial home. *Lychnis dioica*, *Geranium sylvaticum*, *Angelica sylvestris*, and *Geum rivale* are the most conspicuous. The campion has very bright pink petals, and the geranium very dark purple, both much more vivid than in the same low-country plants. The plants themselves are strong, even rank. Alpine plants, in general, have brightly coloured and relatively large flowers. Their period of blooming is short, consequently the vegetative part is small, so that the energy of the plant is put into the flower. They are adapted to their environment, for dwarf plants are less liable to injury from storms of wind. They are more easily protected by a covering of snow, and they can better utilise the heat of the earth. Alpine plants are mostly perennials, so that the ripening of seed is not of so much importance. One notable exception is *Gentiana nivalis*, which is an annual. This may account for its scarcity in some seasons. Few plants may have had time to ripen their seed the autumn before. I have seen it several times in Ben Lawers. In some seasons one could count them by dozens; in others it took some searching to find one or two plants, and they were poor things, with a single bloom, and only one inch high. A few species of plants perpetuate themselves by means of bulbils or by becoming viviparous. Of the former the best example is *Saxifraga* *cernua*, found in this country only on the top of Ben Lawers; of the latter method, *Polygonum viviparum* is a common example. *Poa alpina*, a rare grass, is generally viviparous.

Canness Glen is a branch of Caenlochan. Their united streams form the river Isla. *Lactuca alpina* has been recorded from Canness, but I have never visited it. A mile or two farther east is the knoll called Little Culrannoch, at the head of Glen Doll, where the rare *Lychnis alpina* is associated with the sea-side plants, *Armeria maritima* and *Cochlearia officinalis*.

Due north from this, and on the other side of the watershed, lies Corrie Ceanmor, whose loch drains into Loch Callater and thence into the Dee. It is impossible to do this Glen and Caenlochan in one day—to Corrie Ceanmor and back is about twenty-four miles. We are now in Aberdeenshire, and the rocks are granitic. They are very precipitous. Flowering plants are scarce. *Saussurea alpina* grows luxuriantly on some of the ledges. *Thalictrum alpinum* and *Rubus saxatilis* are plentiful, and there are a number of willows—*myrsinites*, *reticulata*, and *lapponum*, *lanata* perhaps being the most noteworthy. The Cyperaceæ are more common, as *Carex vaginata*, *atrata*, *panicea*, *capillaris*, and *rupestris*, the rarest of all. Many years ago Sadler found *Carex frigida*, and I suppose it has been found by no one else. Last year we spent an hour or two looking for it, without success. I have seen Sadler's specimen in the Botanic Garden herbarium here. I am not in a position to say whether it is a good species or not; but I have gathered plants of binervis, which very closely resemble it in general appearance. *Juncus bi-* and *tri-glumis* frequently occur; *castaneus* has also been recorded, but I have not come across it here. There is a large quantity of the parsley fern growing among the debris of one of the screes. The holly fern and the green spleenwort are plentiful everywhere; and on many of the grassy ledges the moonwort may be seen, as well as *Athyrium alpestre*, on the slopes. *Saxifraga hypnoides*—a common plant on our rockeries—has its home high up on the rocks; and festoons of *oppositifolia* are on every hand, though blooms are generally scarce in the month of July. The variety *Drummond-Hayi* of *Rhinanthus Crista-galli*, named by Dr. Buchanan White after his friend, is also found here.

Lochnagar can scarcely be considered in the Glenshee district, as it is about fifteen miles distant on the map. To walk there from Glenshee is a good twenty miles stretch. In July 1897, Mr. Ewing and I left the Spittal at eight o'clock one morning, and drove to the foot of the Cairnwell. We ascended Meal Odhar, and walked round the Corrie as I have described going to Caenlochan. On the east side we kept to the left hand, and ascended to the ridge, where we struck a stony footpath over the top of Carn-na-Glasha. Great screes run down into the Corrie, and extensive snow-drifts are usually lying there as late as July. Following the ridge passing close to the edge of Corrie Ceanmor we next ascended the Tolmount, then on to Fafernie, where we could see down Glen Callater, with the houses of Braemar in the distance. From Carn Bannock, the next hill, a magnificent view can be had to every point of the compass. Perhaps the grandest piece of scenery in the whole district is from this point eastwards. At our feet lies the tiny Dhû Loch, its waters looking as black as ink, with a silver edging of white sand all round it. Frowning down upon it on both sides are precipitous crags, the one to the north being the White Mount—a spur of Lochnagar. Further on, Loch Muick lies shimmering in the summer sun. We soon reached the pony-track up the side of Lochnagar. We searched in vain for *Carex approximata* in the well-known station. Passing over the summit the great ravine was descended and the rocks in it were explored. Some fine plants of *Saxifraga rivularis* were gathered, as also *Gnaphalium norvegicum*. *Lactuca alpina* was also growing vigorously on the same slope. When we regained the summit we were enveloped in dense mist and the day was gone. It was about 6 p.m. We had these twenty miles of hill country to traverse. While daylight lasted, in spite of the mist, we made good progress, guided by compass and map. With the fall of darkness a gale sprang up, bringing heavy showers of rain and sleet, making us decidedly uncomfortable when exposed to its full force on the ridges. We clung closely to the deer-fence for guidance, thus making the journey much longer, as we had to follow its windings from hill-top to hill-top. It led through bogs occasionally, where the going was somewhat heavy. Scatheless we descended rocky places, of which we had been afraid to attempt the ascent in broad daylight. About eleven o'clock there was a lull in the storm, and we were delighted to discern the straight line of the fence by the roadside at the foot of the Cairnwell. The remainder of our journey (six miles) was performed in a terrific thunderstorm. Rain came down in torrents, making the road ankle-deep in liquid mud which raced down the steeper parts with great force. The lightning flashed in the darkness with dazzling brilliancy, and the loud crashes of thunder overhead reverberated among the hills in an awe-inspiring manner. About half-past one we reached the hotel, finding the inmates and visitors in a great state of excitement over our delayed return. They were arranging a search party, when, fortunately for them, we walked in. Next day, when we showed them what we had gone for—these plants of *Gnaphalium norvegicum*—I have no doubt they considered it a great waste of energy. The landlord declared the plants grew in plenty by the dyke-side, a few yards from the hotel. He referred to the species *sylvaticum*; similar, but quite distinct from *norvegicum.*

For those who do not care for these long excursions, there is plenty of sub-alpine plants on the low ground to interest the botanist, and with less hard work. As I have already said, the rocks close by are very dry, so there is nothing to be found on them. Behind Ben Gulabin, *Betula nana* grows in marshy ground in considerable quantity; and on the rising ground near at hand, *Rubus Chamæmorus* in splendid and abundant fruit was noticed last July, also a few plants of *Pyrola secunda* and *Cornus suecica.* In 1885, Mr. Ewing gathered in the neighbourhood *Epipactis atro-rubens*, but the station has been lost. *Galium sylvestre*, recorded by Dr. Buchanan White in 1886, we also failed to meet with. By the road-side, both above and below the hotel, *Alchemilla alpina* is common, as also some of the grasses, as *Avena pratensis*, var. *alpina*, *Sieglingia decumbens*, and *Deschampsia cæspitosa*, var. *alpina.*

Glen Lochaidh once contained a plant now extinct—*Thlaspi alpestre.* Dr. B. White records having seen it here in August 1886—only a few plants; and he adds, "As it appears to be very scarce, it is to be hoped that botanists will give it a chance of becoming more abundant." Whether botanists have despised that hope I know not. It is certain the plant has vanished from Glen Lochaidh. As it grew on a scree, it may have been overwhelmed by a fall of rock after severe frost.

Cnicus heterophyllus, the melancholy thistle, with its tall, solitary purple heads, is a striking feature on the river banks. *Carex ovalis*, var. *bracteata*, occurs in large tufts mixed with stems of the normal form. *Saxifraga aizoides* and *Oxyria digyna* may be found by the margins of the streams among the gravel. In Glen Tatnich, *Habenaria albida* occurs in the meadows. In the marshes, *Veronica scutellata* is not uncommon. In a deep gorge, in one of the hill-sides, *Vicia sylvatica* was overhanging the torrent in magnificent clumps. Here, also, I gathered very fine specimens of *Saussurea alpina*.

By the road-side, near the hotel, *Meum athamanticum* attracts one by its powerful aroma. In marshy ground *Tofieldia palustris* and *Triglochin palustre* may be seen. The common rock-rose is very plentiful on the dry banks. *Trientalis Europæa*, *Trollius Europæa*, *Genista anglica*, *Potentilla sylvestris*, and *Antennaria dioica* are also worthy of mention. The usual species of *Vaccinium* and *Erica* are to be found all over the hill-sides. There is one Alpine conspicuous by its absence, *Linnæa borealis*. *Lycopodium annotinum* is also absent, though *clavatum* and *alpinum* are very frequent.

Many of these plants are found in all the localities I have mentioned; but, for obvious reasons, I have, with few exceptions, only recorded them here as from one. Some others, such as critical species of *Hieracium* and of *Salix*, I have not referred to, because many of them, although I have specimens in my herbarium, I have not gathered myself.

Mr. YOUNG received the very cordial thanks of the meeting for his interesting communication.

Dr. R. STEWART MACDOUGALL gave an account of the Woodpecker in its relation to Forestry, and exhibited specimens of wood which had suffered from the attack of this bird. An interesting discussion followed.

The PRESIDENT contributed a note on *Erica Tetralix*, L., subsp. *Mackayi*, Hook., *flore pleno*, Crawford's Heath.

Mr. R. N. RUDMOSE BROWN exhibited two plants from Gough Island, *Lomaria boryana* and *Spartina arundinacea*, collected during the voyage of the Scottish Antarctic Expedition, 1902–4.

Mr. F. C. CRAWFORD showed *Carex binervis*, var. *Sadleri*;

Mr. H. F. TAGG, a large sclerotium of *Polyporus Mylittæ* (Blackfellows' Bread);

And Dr. BORTHWICK, a large collection of the Cones of the Abietineæ.

The cordial thanks of the meeting were tendered to the above gentlemen for their exhibitions.

MEETING OF THE SOCIETY,

Thursday, April 13, 1905.

Professor I. Bayley Balfour, President, in the Chair.

Dr. A. W. Borthwick gave notice of a motion regarding the time of meeting of the Society during the winter session.

Mr. William Young read a paper on the "Hepatics of Glenshee."

The Hepatics of the Glenshee District. By William Young.

This paper contains the results of a week spent in Glenshee in the month of July 1904 for the purpose of working up the hepatic flora, and, if possible, adding to the records of their distribution at present being collected by Mr. Symers M. Macvicar. I am much indebted to him for examining and naming all the plants herein mentioned, and so they may be regarded as authentic.

The localities visited were the same as those described in my communication at last meeting on the Alpine flora of the district. There is, therefore, no need for a lengthened description of the features of the country, either geologically or otherwise, on this occasion. Briefly, the nett results were to add 12 new records of species and varieties for East Perthshire—vice-county, 89; 6 for Forfarshire—v.-c., 90; and 5 for South Aberdeenshire—v.-c., 92.

One of the records for v.c. 89 was also new to Scotland. This was *Cephaloziella Jackii* (Limpr.) It is only a few years since it was discovered in Britain, as Spruce in his monograph of "Cephalozia," published in 1882, gives no British station for it. Cooke's "Handbook" of 1894 does not mention it. Lett, however, in 1904 quotes it from three provinces—Cornwall, the Mersey, and the Lake Districts. It was gathered at the head of Glen Beag among the roots of a juniper bush growing by the side of a boulder. When returning the specimen Mr. Macvicar wrote me: "As it is an addition to Scotland,

and is a minute plant, I sent a piece to Mr. Pearson, who has confirmed my naming, so that you may be at ease about it being correct. It is a nice addition to our flora." It has since been gathered by Miss Macvicar in Dumfriesshire.

Of the 12 new records for v.c. 89, 10 were gathered in the course of one afternoon in a single locality—a marsh between Ben Gulabin and Carn Mor at an elevation of 2000 ft. Of these there are two which are sufficiently rare to deserve special mention—*Lophozia socia* (Nees), and *Harpanthus Flotowianus*, Nees. *Lophozia socia* has only been found in four vice-counties in Scotland. *Harpanthus* was plentiful by the side of rills in the marsh. It is easily distinguished by the small round notch at the apex of the leaf. This plant was discovered in Shetland by Mr. John Sim in the year 1878, and was fully described by Mr. Pearson in the "Transactions" of this Society for 1879. It was then called "a new British hepatic." Five years earlier, however, it had been gathered by the Rev. Mr. Ferguson in Aberdeenshire, and named *Jungermania bantriensis*. The error was discovered by Mr. Macvicar. The other records for the county were:—

Aplozia pumila (With.)
Lophozia bicrenata (Schmid.)
Lophozia Floerkii, var. *Baueriana*
Sphenolobus exsectæformis (Breidl.)
Cephalozia connivens (Dicks.)
Odontoschisma Sphagni (Dicks.)
Pleuroclada albescens and
Nardia obovata

This single afternoon's outing yielded some 40 species in all. Of course this includes some which are common everywhere, and one continually comes across them on the hills, such as *Frullania Tamarisci*, *Nardia scalaris*, *Lophozia ventricosa*, *Diplophyllum albicans*, *Lejeunea cavifolia* (Ehrh.), etc. There were a few, however, which, though not records for the county, may be mentioned:—*Cephalozia pleniceps; Cephalozia leucantha*, Spruce; *Lophozias, bantriensis* and *gracilis; Sphenolobus minutus; Scapania uliginosa*, and *Chiloscyphos pallescens*. The two *Mylias*, *Taylori* and *anomala*, were very common.

This marshy ground seemed a likely place for *Pleurozia purpurea*, but a diligent search failed to reveal it, and it remains a desideratum for East Perth. It is strange that in the western part of the county it should be plentiful, and stranger still that it has been gathered in Forfar to the east and in Aberdeen to the north. However, Mr. Macvicar says this plant is very rare in North-East Scotland, and possibly does not occur in v.-c. 89. He has seen only one specimen from Clova, and one from Ben Macdhui. He found it in one place near Aviemore.

A whole day was spent in Glen Beag on the rocks forming the west side. They are decidedly dry, consequently hepatics are scarce. *Madotheca rivularis*, Nees, and *Acolea obtusa* (Lindb.), were the only species of which I took specimens. *Lophozia Floerkii* was one of the commonest in all the localities visited. *Riccia sorocarpa* was found on the soil at the foot of the rocks, and *Lophozia bicrenata* was fairly abundant on the soil by the roadside associated with *Cephaloziella divaricata*. In a small gorge at the foot of Carn nan Sac a quantity of *Cololejeunea calcarea* (Lib.) was scraped from the smooth, wet, under-surface of an overhanging rock, and large tufts of *Lophozia Mulleri* and its variety *bantriensis* were pretty frequent. A few stems of *Scapania æquiloba* (Schwaegr.) and *Kantia Sprengelii* (Mart.) were picked up, as well as some of the commoner *Lophozia barbata*, *Aplozia riparia*, and *Scapania undulata*.

Glen Tatnich, which lies on the other side of Ben Gulabin from Glen Beag, was rather disappointing. We walked up about two miles, but the right kind of habitat for hepatics seemed wanting. Probably further on towards Loch nan Ean, or within the corrie of Glas Thulachan, would be more productive. *Radula Lindbergii*, Gottsche, was our best find in Glen Tatnich, followed by *Frullania fragilifolia*. Both were growing on shaded rocks. The latter is easily named in the field by wetting the tip of one's finger and pressing it on the plant, when the leaves are readily detached. *Diplophyllum ovatum* and *Metzgeria conjugata* were got on the rocks in a little ravine, and *Scapania subalpina* among the gravel by the margin of the stream. *Hygrobiella laxifolia* occurred on the moist banks of some of the rills from the hillsides

In Glenshee itself the only work done was during a morning constitutional on the road down from the hotel. A casual glance at the bank and drystone dyke on top of it yielded *Lophozia alpestris* and *Aplozia pumila*, and the variety *gracillima* of *crenulata.* This last was one of the records for the county.

We fully expected to find some of the rare alpine hepatics in Canlochan and Corrie Ceannmor, but whether they did not exist, or our attention being divided between looking for them and flowering plants, especially *Gentiana nivalis*, we may have overlooked them, it is certain we did not get a very favourable impression of either locality. At the head of Canlochan, on the slopes, the soft clayey soil, which in winter will be readily displaced by sliding snow or heavy rain, does not afford a sufficiently permanent and stable footing to the cryptogamic plants. There is no humus, such as there is at the back of Ben Lawers on the rising ground above Loch na Chait. In Canlochan, where harder parts of the rock have resisted weathering, they project in spurs and ledges on the top of which carices and hawkweeds luxuriate, and the sides are so crumbly that mosses and hepatics cannot establish themselves. Hepatics need abundance of moisture, and for those which affect rock surfaces, a hard yet porous quality of rock, which absorbs moisture readily but parts with it slowly. There seem to be the extremes of bad conditions in Canlochan and Ceannmor: in the former soft and friable rock; and in the latter hard crystalline, non-porous, granitic rock. The records for v.c. 90 consisted of *Gymnomitrium varians* (Lindb.) (formerly *Acolea conferta*), *Gymnomitrium crenulatum*, *Harpanthus Flotowianus*, *Scapania uliginosa*, and *Lophozia alpestris*, var. *gelida*. *Gymnomitrium varians* was found as very small black tufts on stones. *Harpanthus* was very common in its usual habitat by the side of running water. *Pallavicinia Blythi* (Morck.) was in fine fruit on a bank near the Glen, and much stronger than specimens from various localities in the Killin district. *Anthelia Juratzkana*, *Bazzania triangularis*, and *Radula Lindbergii* were all scarce, whereas in West Perthshire they are often met with. We searched for hours for a hepatic which was first found by Mr. Macvicar a year or two ago on Ben Lawers, and since then in several localities in West Perthshire. I had the pleasure of finding it on Ben Laiogh two years ago, so I knew what to look for. It grows as isolated stems in wet grassy ground by the side of streamlets above 3000 ft. If we failed to find *Sphenolobus politus* we found another equally important, viz., *Scapania paludosa*, C. Müll., which has raised some discussion. At first sight it looks like *Scapania irrigua*, but it is larger, and more lax in habit. The keel of the leaves is highly arched, and the postical lobe is often toothed. It agrees with the description and Plate in the "Bulletin de L'Herbier Boissier" for 1903 by Karl Müller. Mr. Macvicar reports it was gathered in Clova in 1876 by the Rev. Mr Ferguson, and last summer by Mr Cocks on Scuir nan Lapaich.

Mr. Macvicar, in the "Journal of Botany," says he has identified it in collections where it had been labelled as *Scapania undulata* or *uliginosa*. So there are additional records from Braemar, Croall, 1856; Ben Wyvis, Barker, 1872; and Sehiehallion, Carrington, 1882. It seems to be an Alpine species, as we found it at 3000 ft.—the same elevation as that at which Mr. Cocks found it. "The chief points to be remembered when searching for it are that it is a marsh plant, growing in large grass-green or yellow-green masses, and is very flaccid. The position of the plant is rather doubtful. It combines some characters of *S. undulata*, *irrigua*, and *uliginosa*. I am inclined to think it nearer *S. irrigua* than the others. Herr Müller is probably right in making a species of it, as it is difficult otherwise to know where to place it. It is widely spread in Europe, and has been found in New Hampshire, U.S.A." Mr. Macvicar also mentions that a form found by Mr. Ewing and myself last year in Canlochan is the variety *vogesiaca*, C. Müller, which has hitherto only been found in four localities in the Vosges mountains. He sent a piece to Schiffner, who confirms the naming, and says it is "absolutely identical with Müller's original specimen."

In Corrie Ceannmor *Gymnomitrium concinnatum* was very common, along with *obtusum* of the same genus, and *Anthelia julacea*. The only records were *Anthelia Juratzkana* and *Gymnomitrium concinnatum*, var. *intermedium*. I cannot understand why *coralloides* was absent, as it occurs on rocks with *concinnatum* frequently in the Western ravine of Lawers. *Scapania purpurascens* was very plentiful. Most brilliantly coloured clumps of it, extending to three or four square feet, were seen with water constantly percolating through the mass. *Scapania curta* and *Marsupella aquatica* complete the list for the corrie. The latter was growing in about three inches of water on the margin of the loch. In this same county of South Aberdeen, near the patch of snow on the side of Glas Maol, we gathered *Pleuroclada albescens*, and on a stone Mr. Ewing gathered a small tuft which contained *Marsupella Sprucei* (Limpr.), *Gymnomitrium adustum*, var. *olivacea* (Spruce), and *Lophozia alpestris*, var. *gelida*, a mixture of rarities very difficult to separate out. The *Pleuroclada* and the *Marsupella* were records, and, along with the variety *heterostipa* of *Lophozia inflata*, complete the five new records for v.-c. 92.

Mr. George West showed an interesting series of Aquatic Phanerogams from Scottish lochs, pointing out the marked effect of habitat upon many forms. He also showed a series of rare Aquatic Mosses.

Mr. William Evans read a short paper on the occurrence at Low-Level of *Oligotrichum incurvum*.

The above gentlemen received the cordial thanks of the meeting for their communications.

The President exhibited a series of Bergenia saxifrages;

Mr. W. B. Boyd, *Andromeda hypnoides*, and a green double snowdrop.

Mr. James Whytock exhibited a fine collection of flowers from Dalkeith Palace Garden, and a number of varieties of apples to illustrate methods of keeping.

Mr. Symington Grieve showed a plant of *Trichocolea tomentella*, and Mr. R. L. Harrow, a series of Alpine plants in flower.

The above exhibitors were cordially thanked by the meeting.

MEETING OF THE SOCIETY,

Thursday, May 11, 1905.

Professor I. Bayley Balfour, President, in the Chair.

Dr. A. W. Borthwick introduced his motion regarding the hour of meeting of the Society during the winter months. Mr. Alex. Cowan seconded the motion. It was announced that those members who had communicated their opinion previously by letter to the Honorary Assistant-Secretary were, without exception, in favour of the motion. On appeal to the meeting the motion was declared to be carried without dissent.

It was remitted to the Council to discuss the details of the arrangement.

Mr. John Inch, junior, Howburn, Biggar, was proposed as a Resident Fellow of the Society by W. W. Smith, M.A., and seconded by A. W. Borthwick, D.Sc.

The President exhibited a series of Alpine Plants in flower.

Dr. A. W. Borthwick showed Raspberry buds attacked by the caterpillar *Lampronia rubiella*. He pointed out that grubs on species of Ribes were also very prominent this year ; a large number of plants consequently have had to be destroyed by burning.

The Honorary Assistant-Secretary exhibited some fruits and seeds from Mauritius, and a piece of wood bored by Teredo navalis.

Mr. H. F. Tagg showed a series of diagrams illustrating plant diseases. In connection with this exhibit a specimen of Larch was brought forward by Dr. A. W. Borthwick, showing attack by Nectria.

Mr. Potts exhibited a series of seedlings.

MEETING OF THE SOCIETY,

Thursday, June 8, 1905.

Professor I. Bayley Balfour, President, in the Chair.

The death of Dr. Delpino of Bologna, Foreign Fellow of the Society, was intimated.

Mr. John Inch, junior, Howburn, Biggar, was balloted for as a Resident Fellow and duly elected.

Mr. R. N. Rudmose Brown read a paper on "The Botany of the South Orkneys." He pointed out that the flora of these islands consisted chiefly of mosses and lichens, as was to be expected. The grass reported by Weddell as a native of these islands, Mr. Brown believed to have been a lichen. Of the twelve species of lichens found, Mr. Brown exhibited one—*Placodium fruticulosum*, Darbish., which is new to science.

The Botany of the South Orkneys. By R. N. Rudmose Brown, B.Sc., C. H. Wright, F.L.S., and O. V. Darbishire.

I. Introductory. By R. N. Rudmose Brown, B.Sc., Botanist of the Scottish National Antarctic Expedition.

The small group of islands known as the South Orkneys are situated between 60° and 61° S. and 44° and 47° W., about 600 miles S.E. by E. of the Falkland Islands, and about 200 miles east of the nearest islands of the South Shetlands. They were discovered in 1821 by Powell in the sloop "Dove," and were subsequently visited by Weddell in the brigs "Jane" and "Beaufoy" in 1823, by Dumont d'Urville in the "Astrolabe" in 1838, and by Larsen in the whaler "Jason" in 1893.

In February 1903 the Scottish National Antarctic Expedition in the ship "Scotia" made a landing on Saddle Island—the most northerly island of the group—on their way to the south. In the end of March the same year the

"Scotia" returned to the islands to winter, and spent eight months at Laurie Island. The group consists of two large islands—Coronation and Laurie Island, and many smaller ones. Coronation Island, or mainland, is the westerly, and Laurie Island the easterly. It was on the latter island, in the south of which Scotia Bay is, that the greater part of the botanical collections were made. These two islands are separated from one another by two small islands and Washington and Leethwaite Straits. Of the outlying islands the most important is Saddle Island, lying about eight miles north of Laurie Island. Ailsa Craig, mentioned several times in this paper, is a large rocky crag standing at the mouth of Scotia Bay. Deep bays run into the land from north and south, separated by narrow rocky peninsulas or steep and lofty mountain-ranges. All the valleys are choked with glaciers, despite the relatively small gathering-ground on the heights above, and what little exposed rock is visible is precipitous in the extreme. It is only here and there that a few acres of more or less level ground are to be found on the lower slopes or at sea-level. Although in a comparatively low southern latitude, the South Orkneys are ice-bound for some six to eight months of the year. In mid-winter practically everything, even to the faces of precipitous cliffs, is covered with snow, and not before October or November does much of the snow disappear. In these months many patches of moss-covered ground came to light, and in some of them, by successive years' growth, six to ten inches of soil have been formed. Except this vegetable mould, there is little soil anywhere. The rocks—various kinds of graywacke—are mostly covered with lichens, particularly *Usnea*, and Weddell,[1] to whom we are indebted for the first account of the islands, mentions that at Cape Dundas where he landed "there was a patch of short 'grass.'" During the winter and spring that the Scottish Antarctic Expedition spent at the South Orkneys, I made a very careful search for this grass both at Cape Dundas and elsewhere, but failed to find any signs of it. It is possible that this grass may have been casually introduced, and succumbed after a few seasons to the severity of the climate, or been unable to grow on account of the numbers of penguins that frequent

[1] James Weddell, "A Voyage toward the South Pole in the years 1822–24," p. 24.

the place, yet I am inclined to think Weddell mistook a lichen (*Usnea*) growing luxuriantly at Cape Dundas for a grass. This was also the impression of Dumont d'Urville, who visited the island in 1838.[1] Cape Dundas, it must be remembered, is the eastermost point of the islands, and therefore the least likely spot for wind-carried seed to be deposited in that region of the westerly winds, and the coast there is unprotected and the anchorage bad, which make it improbable that whalers who could have been responsible for the introduction of the plant would have landed there unless, like Weddell, they had a scientific end in view. However, it is worth noting that the South Shetlands, which are very similar in physical conditions to the South Orkneys, support *Deschampsia antarctica*.

Owing to the fact that the South Orkneys lie within the region normally ice-bound in winter, the temperature is comparatively low, ranging from a mean of 9°·5 F. in mid-winter (June) to 31°·5 F. in mid-summer (December). The extreme range is from −40° F. to 47° F., but an approach to either of these extremes, particularly the latter, is rare.[2] The mean of the year is 22°·7 F.[3] Snowfall is excessive, sunshine very deficient, and strong gales frequent.

Through the kindness of the Director of Kew, Mr. C. H. Wright has determined my mosses. To him, and to Dr. O. V. Darbishire, who has undertaken the report on the lichens, I should like to record my indebtedness. Papers dealing with the algæ of the South Orkneys appeared in the "Journal of Botany" for April, May, and July 1905. A subsequent paper on the unicellular freshwater algæ will complete this account of the botany of these islands.

II. The Mosses of the South Orkneys. By C. H. Wright, F.L.S.

[The following list contains eight species of mosses, of which two are too incomplete to admit of precise identification. The other six are all known from Antarctic or

[1] Dumont d'Urville, "Voyage du Pole Sud," vol. ii. p. 131.
[2] R. C. Mossman, "Scot. Geog. Mag.," vol. xx. p. 116, and vol. xxi. p. 13, and August 1905.
[3] These figures are for 1903—a year which subsequent observations prove to have been milder than the average.

sub-Antarctic regions, with the single exception of *Campylopus vesticaulis*, which was previously known from Tristan da Cunha only.—R. N. R. B.]

Andrea sp.—Only a barren fragment, of which the species is indeterminable.

Campylopus introflexus, Mitt., in "Journ. Linn. Soc.," xii. p. 84, and "Chall. Bot.," ii. p. 172. *Dicranum introflexum*, Hedw., sp. Musc., i. p. 147, t. 29.

Scotia Bay.—Generally distributed throughout the southern hemisphere, including Marion Island and Tristan da Cunha, and extending northwards to Britain and Alabama.

Campylopus vesticaulis, Mitt., in "Mellis St. Helena," p. 359, and "Chall. Bot.," ii. p. 172.

Scotia Bay: growing among *Polytrichum subpiliferum*, otherwise only known from Tristan da Cunha.

Grimmia amblyophylla, C. Müll., "Syn Musc.," i. p. 779; Mitt., in "Journ. Linn. Soc.," xii. p. 98; Paris, in "Actes Soc. Linn. Bordeaux," lxix. p. 192.

Laurie Island, various localities. Also at Kerguelen and Hermite Islands.

Grimmia, cf. *apocarpa*, Hedw. A barren specimen which will not admit of more accurate determination. *G. apocarpa* is a Kerguelen species. Scotia Bay, Laurie Island.

Bryum, sp.—A barren species not determinable. Scotia Bay, Laurie Island.

Polytrichum subpiliferum. Cardot, in "Rev. Bry." (1900), p. 42, and "Résult Voy. Belgica Mousses," p. 39.

Scotia Bay, Laurie Island. Distributed in Europe and Asia to the Arctic regions, North and South America to the Straits of Magellan, Danco Land Antarctica, and also Australia.

Hypnum uncinatum, Hedw., "Musc. Frond.," iv. p. 65, t. 25; Bruch. and Schimp., "Bry. Eur.," t. 600; Cardot, "Résult Voy. Belgica Mousses," p. 43.

Amblystegium uncinatum. Mitt., in "Journ. Linn. Soc.," xii. p. 570.

Laurie Island.—Cosmopolitan in distribution, including Gerlache Strait, Antarctica.

III. THE LICHENS OF THE SOUTH ORKNEYS. By OTTO V. DARBISHIRE.

The lichens of the Arctic regions are fairly well known, and for this state of things there are three reasons. The limits of the Arctic regions are well defined. Furthermore, a very large amount of material has at various times been brought back to Europe; and, lastly, this material has been worked through critically and as a whole by various lichenologists.

With regard to the Antarctic lichens, on the other hand, we have three difficulties to contend with. The limits of the Antarctic regions do not admit of easy definition. We have, secondly, no very extensive and exhaustive collections from certain limited areas, but rather a sample taken here and a sample taken there, in localities to which often flying visits only have been paid by expeditions. This becomes the case more and more the further south we go. Of course the scattered nature of the land, which may be included in the term Antarctic, is largely responsible for this being the case. Lastly, we are still in want of a critical examination of all the herbarium material that has so far been collected, and all that there is to be found in the literature. There must be a sufficiently great quantity of material in European and American herbaria, and in the literature of the subject, to make such a critical examination a fairly hopeful undertaking. But a compilation of the printed records must be accompanied by a critical examination of the corresponding herbarium specimens.

Till this herculean task has been successfully accomplished we must confine our energies to getting hold of every possible morsel of lichen-material from the Antarctic regions and carefully recording name and locality. From this point of view the lichens brought back by the Scottish National Antarctic Expedition, and collected by Mr. R. N. Rudmose Brown, are very interesting and valuable. Eleven species were collected at the South Orkneys.

I will now enumerate the species, adding any observations that may appear necessary, and then make some more general remarks on the distribution of Antarctic lichens.

Lecidea fusco-atra (L.), Th. Fr.—Occurs in the Arctic regions. South Orkneys.

Rhizocarpon geographicum (L.), D.C.—Found on rocks in Scotia Bay, South Orkneys. It is a cosmopolitan species, being frequently met with in the Arctic regions, and it may also be described as being a typical Alpine plant.

Gyrophora vellea (L.), Ach. (or *vellerea* (L.), Ach., according to Arnold) was collected on rocks on the south-west shore of Scotia Bay rising to a height of 1000 feet. It was also collected on Saddle Island at a height of 300 feet. The specimens were all well developed, one measuring as much as 11 by 20 cm. The latter was found growing in close association with *Usnea melaxantha*, Ach., some plants of which were actually firmly attached to the surface of the *Gyrophora* plant. *Gyrophora vellea* is recorded from America and Europe, being an Arctic and Alpine plant.

Cladonia fimbriata (L.) Fr.—This species, though otherwise cosmopolitan in distribution, does not occur in the extreme Arctic regions, and its discovery in the South Orkneys, where it was found between moss in Scotia Bay, is of great interest.

Cladonia deformis (Ach.) Hffm.—A few specimens of a *Cladonia* brought from Scotia Bay, South Orkneys, seem to belong to this species. It is again cosmopolitan, being also a typical Arctic and Alpine plant.

Usnea melaxantha, Ach., is common both in the Arctic and Antarctic regions of America and Europe, and also in New Zealand and the Andes. A number of species appear to be nearly related to this plant, but they are not all quite clearly defined. I am referring to *U. Taylori* (Hook.); *U. Hieronymi*, Krphbr.; *U. trachycarpa*, Müll.-Arg.; and even *U. sulphurea*, König, which is probably only a synonym of *U. melaxantha*, Ach. Some of the specimens were found growing on and firmly attached to *Gyrophora vellea*.

Bryopogon jubatum, Link.—Cosmopolitan, Arctic, and typically Alpine. Small plants were found in between specimens of *Usnea melaxantha* from the South Orkneys.

Rinodina turfacea (Wahlenb.) Fr. — Europe, Asia and America, Alpine and Arctic. The material collected from a rock on the South Orkneys must, I think, be included in this species. It has a remarkably well developed, thick thallus, but this may be due to its unusual habitat on rocks.

Placodium elegans (Ach.) Nyl.—Cosmopolitan, Arctic, and typically Alpine. Good fertile specimens were found on rocks on the S.W. shore of Scotia Bay, South Orkneys.

Placodium fruticulosum (Darbish.) nov. sp.—This is a new species, and I will therefore preface my observations concerning it by its diagnosis. Thallus fruticulosus, basi substrato affixus. Protothallus gonidiis destitutus, chondroideus, margo effusus et hyphis instructus solitariis vel conglutinatis. Podetia fruticulosa, ad marginem thalli prostrata et leviter compressa, inferne albida, nondum substrato affixa nisi protothallo; ad centrum thalli erecta, 1–2 cm. alta, dichotome sed irregulariter divisa, 1–1·5 mm. crassa, ad apices bene divisa; apices juxtapositi thallum crustaceum simulantes; aurantiaca aut flavescentia KHO purpurascentia; stratum corticale hyphis instructum transversalibus, cuticulo valde distincto obtsectum 6–8 μ lato; stratum medullare dense stupteum. Gonidia protococcoidea. Apothecia lecanorina, 1–4 mm. lata, emergentia, sed adpressa, lateralia; amphithecium distinctum, gonidiis instructum; parathecium decoloratum; epithecium flavescens aut aurantiacum, KHO purpurascens; hypothecium decoloratum, strato gonidiali inferne instructum; thecium 90–100 μ crassum; paraphyses simplices, apice cellulis brevibus terminantes; axi cylindrici, elavati 10 μ lati; sporæ octonæ hyalinæ bicellulares orculiformes, $5–6 \times 11·5$ μ magnæ. Spermogonia et soralia non visa. Habitat ad saxa, S. Orkneys.

Placodium fruticulosum was found growing on rocks around Scotia Bay, South Orkneys. It is apparently very common from the shore right up to the summit, evidently representing an important constituent of the lichen vegetation. The podetia are fruticulose and erect, branching frequently and in an irregular way. The tips of the branches, however, are pretty much of the same height, and being very closely applied to one another, this lichen appears to be crustaceous. The exposed parts of the plant are light yellow or orange coloured, but those more hidden are paler, and in part even white. The lowest portions of the podetia can obtain a thickness of about 1·5 mm., the tips being as much as 1 mm. across. The podetia measure up to 2 cm. in height, and are generally cylindrical in section near the margin. Near the margin of the whole thallus, they generally assume a more typical

Placodium-structure. The marginal podetia show a dorsiventral arrangement, the short assimilators springing from the upper side only. But even here, near the margin the dorsiventral and free podetia can be distinguished perfectly from the protothallus, which is firmly attached to the rocky substratum.

The protothallus consists of fine strands of fungal hyphæ, which, white in colour, radiate out in an irregular manner from the base of the podetia. At this latter point the protothallus is often very thick.

The gonidia are fairly evenly distributed in the podetia, where these are exposed to light, but the gonidia are massed together at those points where a new branch or an assimilator is about to sprout.

The general structure of the apothecium is that typical of Placodium species. It is up to 4 mm. in diameter, with orange epithecium and distinct thalline margin, which, however, gradually sinks below the level of the epithecium. The light hyaline spores are polar-bilocular; parathecium and amphithecium are colourless, and green gonidia are found under the hypothecium.

This plant is very nearly related to *Placodium coralloides*, Tuck. (Synopsis of the North American Lichens, i. p. 169), and *P. cladodes*, Tuck. (*l.c.*). It differs from the latter by having colourless spores in each ascus instead of one brown one. It is also stouter and bigger than both species of Tuckerman. I have only seen specimens of *P. coralloides*. The big apothecia of *P. fruticulosum* also retain their amphithecium throughout life.

Placodium fruticulosum is an interesting plant which belongs to the subgenus *Thamnoma* of *Placodium*, created by Tuckerman for his species *coralloides* and *cladodes*. The thallus is throughout distinctly diploblastic, the protothallus being easily separated from the podetia, even when the latter are prostrate, near the margin of the plants.

Several species of *Placodium* have a tendency to become fruticulose. Thus in H. Lojka Lich. Regni Hung. exsic. i. (1882), n. 26, *Lecanora elegans* Lk v. *compacta* (Arn.) Nyl. (= *Placodium*) shows fruticulose podetia in the centre of the thallus.

Xanthoria lychnea (Ach.) Th. Fr., N. and S. America, N.

Asia and Europe. A number of small plants were found between some podetia of *Placodium fruticulosum* Rocks in Scotia Bay, South Orkneys.

Some fragments of crustaceous lichen are amongst the material brought from the South Orkneys, which, however, it is impossible to identify at present.

But disregarding these we have before us, brought back by the Scottish National Antarctic Expedition, eleven species from the South Orkneys. It is difficult with these few specimens to draw any conclusions, but it is interesting to note that all are found in the Arctic regions, and five are more or less Alpine. The new species is, of course, not included in these observations.

In a paper on the Greenland Lichens collected by Vanhöffen ("Bibl. Bot.," No. 42, 1897), the author of the present paper mentions that of the 286 known Greenland species, 213 were found also in Germany. Of these latter 105 (*i.e.* 49·4 per cent.) are purely Alpine species, 11 (5·1 per cent.) prefer Alpine conditions, and 97 (45·5 per cent.) are equally at home on the hills and in the plains. That is to say, 54·5 per cent. are typical hill-species, and none of the Greenland lichens found in Germany are confined to the lowlands. The lichen-vegetation of the former very closely corresponds, therefore, to the German Alpine flora.

We have not enough material to make such a complete comparison of the Antarctic lichens, but I would like to give some statistics attempted with the lichens brought back by H.M. Discovery ships "Erebus" and "Terror" in the years 1839–1843. These number about 124, and 44 are apparently extra-European. But of the remaining 80 species, which also occur in Europe, 2·5 per cent. are typical lowland plants, 23·75 per cent. typical Alpine plants, 66·25 per cent. are found on hillside and in lowland equally, 7·5 per cent. are exclusively Arctic, but of all the Antarctic and European species 73·75 per cent. occur also in the Arctic regions. Even the small material before us therefore admits of some interesting reflections on the great similarity between the Arctic, Alpine, and Antarctic regions in their lichen vegetation.

We can imagine the ancient polar floras having been continuous at one period, and then, with the decrease in the cold of the climate, the lichens followed the retreating ice and snow into the hills and the Arctic and Antarctic regions.

We find further evidence for this when we compare the most highly developed and therefore oldest lichens with the lower and therefore more recent forms, in regard to their distribution in the Arctic and Alpine zones. Of the Greenland fruticulose lichens 5·5 per cent. alone are unknown in Germany, of the foliose forms 14·3 per cent., and of the lower crustaceous forms as many as 35·6 per cent. But no special notice is taken of those species which occur in the regions lying between Greenland and the German Alps. A still more interesting comparison could be made by comparing the Antarctic lichens of America with the Alpine forms of the same continent and the Arctic lichens, but as yet the material at our immediate disposal makes this impossible.

These few remarks do favour the view that a very close relationship does exist between the Arctic and Antarctic lichens, which, however, must date back to the time when they were still constituents of one flora.

It will be seen from this that further collections of Antarctic lichens would be of very great interest.

EXPLANATION OF FIGURES.

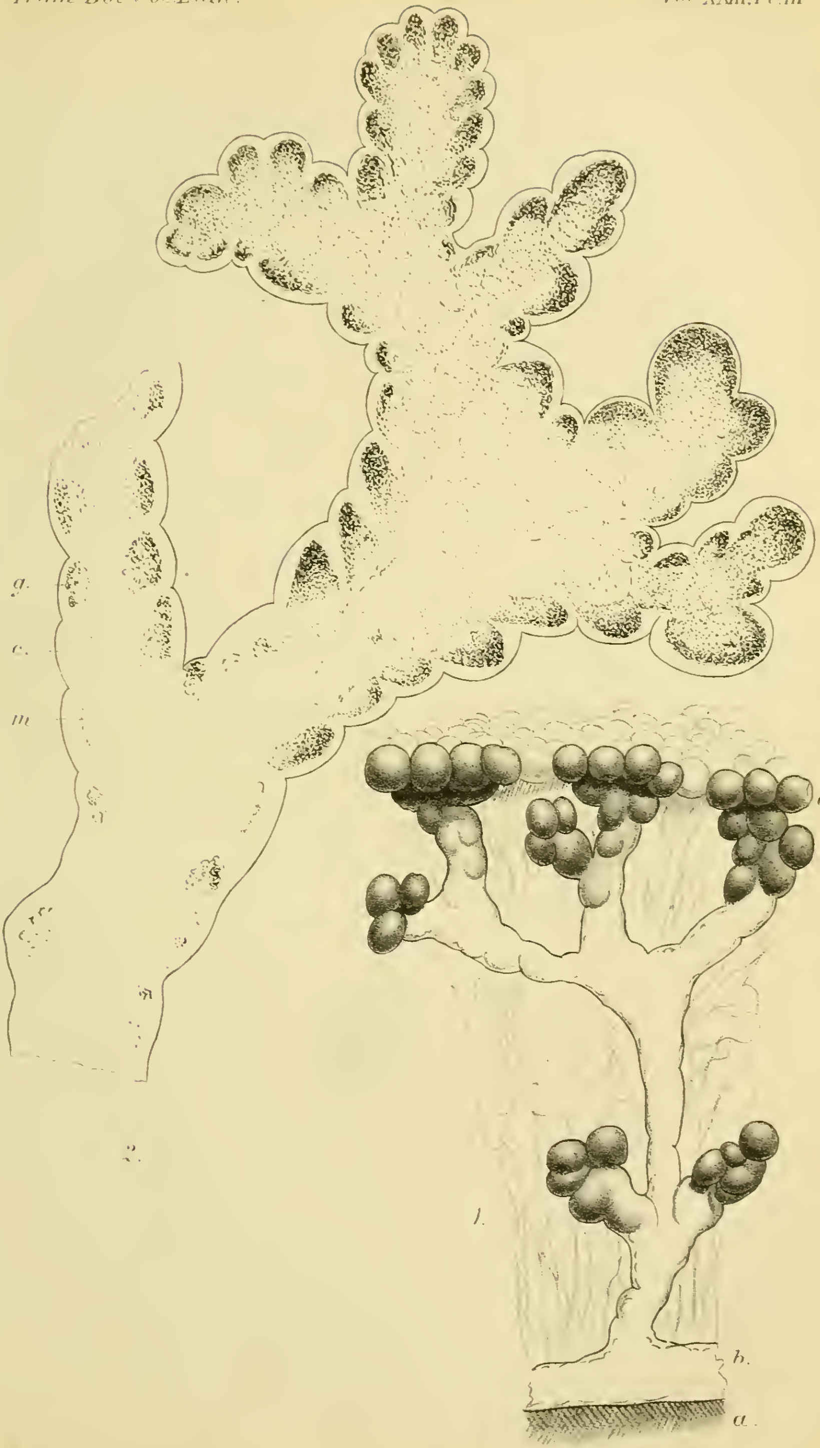
Placodium fruticulosum, Darbish.

Fig. 1. An upright podetium showing the small knob-like assimilators, which at the top, *c*, form the roof, which gives this lichen a crustaceous appearance. *a*, substratum ; *b*, protothallus ; *c*, top of podetium. × 8.

Fig. 2. Longitudinal section of a similar podetium, showing the distribution of the gonidia, *g*, in the rounded projecting assimilators. *m*, medullary, *c*, cortical portion, *g*, gonidia. × 12.

The President exhibited certain dried plants from Yunnan, recently received. They consisted of Gentians and Saxifrages, and included several new species. Photographs of the sheets of mounted specimens were also shown—a very useful addition to the description of new species.

Mr. Harrow exhibited a series of plants in flower from the Garden.



G V Darbishire, del. Huth, lith et imp

PLACODIUM FRUTICULOSUM. *Darbish.*

Dr. Borthwick showed *Peridermium pini acicola.*

Mr. Rutherford Hill exhibited some interesting forms of Daisy without ray florets, also others with runners and abnormal growth of stem and stem leaves. The President instanced similar conditions in Senecios, and pointed out that accounts of adaptations to environment were much needed in our flora.

Mr. M'Glashen showed peculiar forms of Mimulus—hose-in-hose—after the fashion of certain Primulas.

The above gentlemen were cordially thanked for their papers and exhibitions.

MEETING OF THE SOCIETY,

Thursday, July 13, 1905.

Professor I. BAYLEY BALFOUR, President, in the Chair.

It was recommended by the Council that the hours of meeting of the Society during next Session should be—

November, January, March—7·45 p.m.
December, February, April—4 p.m.
May, June, July—5 p.m.

This was put before the meeting, and carried unanimously.

Mr. HARROW exhibited a series of plants in flower from the Garden;

Mr. TAGG, fruits from Bombay, and Fasciation in *Carduus palustris*. The PRESIDENT remarked that this state seemed to be common this year.

Dr. BORTHWICK showed *Phytophthora parasitica* on Wallflower, and Woolly Aphis on Scots Pine.

Mr. RUTHERFORD HILL, referring to his exhibit last month, showed the same Daisy, which had reverted to its normal type, emphasising the difficulty of retaining malformation.

The following papers were read:—

NOTE ON ARENARIA TENUIFOLIA, LINN. AS A SCOTTISH PLANT. By W. W. SMITH, M.A.

This plant is recorded from various localities in the south-east of England, extending as far north as Yorkshire. Sowerby mentions that it has been reported from the coast of the Firth of Forth, but considers this record either a mistake or the plant a casual introduction with ballast. The record is due to George Don, 1806, and the locality given is Pettycur in Fife. A specimen from that locality is in the Herbarium of the Royal Botanic Garden, Edinburgh, with Don's name attached.

In June of this year the plant appeared in considerable quantity in the neighbourhood of Edinburgh, in a locality where there is no reason to suppose that it is truly native. The localities given for England—old walls, waste places, dry fields—would suggest that there also the plant is usually a casual.

Of the three forms of the species given in Sowerby, Don's specimen seems to be var. α, *genuina*; the recent specimens agree with var. β, *laxa*, with regard to the habit of the plants, length of capsule, and number of stamens. The glandular hairs usually present on the calyx are, however, absent.

ON DROSERA BANKSII, R.BR. By DR. MORRISON.

When examining the Australian species of *Drosera* in the Melbourne Herbarium a short time ago, I found a specimen of unusual interest labelled thus, in the handwriting of the late Baron von Mueller:—"*Drosera Banksii*, R.Br., Port Darwin, 1890. Maurice Holze." As the only specimen of this species hitherto recorded is that originally collected during Cook's voyage by Banks, at the mouth of the Endeavour River, Northern Queensland, and now preserved in the herbarium of the British Museum, an account of the Port Darwin specimen should be of interest to botanists, especially as the plants are evidently in more perfect condition than the type specimen. *Drosera Banksii* was first described in 1824 in De Candolle's "Prodromus,"[1] with R. Brown as the author of the name. In 1848 Planchon[2] published a full description of the plant from the type specimen, as also did Bentham[3] subsequently; and Bailey,[4] in his "Queensland Flora," has evidently had to rely on the published descriptions without having other specimens to

[1] De Candolle, "Prodromus," i. p. 319 (1824).
[2] "Ann. Sci. Nat.," ser. 3, ix. 291 (1848).
[3] "Fl. Austral.," ii. 469 (1864).
[4] "The Queensland Flora," part ii., p. 550 (1900).

examine or record. Lastly, Mr. James Britten[1] published, in 1900, a figure of the plant, copied from a sketch by Sydney Parkinson, taken during the voyage, and evidently from a living specimen. The Port Darwin specimen comprises three plants, each apparently complete, with root, stem, and flowers, measuring in total length—one 6·7 cm., with 24 or 25 leaves; another 6 cm., with 27 or more leaves; and the third 3·3 cm. A detailed description of these specimens is here given:—

Stem erect, slender, rather weak, continuing to grow out after production of raceme at its upper part. Root system well developed, and without a bulb; a number of strong fibres descending obliquely, some branching and showing smooth-walled hairs. Leaves numerous, scattered along stem from base to summit, none in the axile, largest at base of inflorescence and diminishing downwards; petioles slender, sparingly pubescent, up to 5 mm. in length, thick at base, and attenuated in upper half, attached close to truncate margin of lamina, which is suborbicular, thin in texture, and under 1 mm. diam., excluding the glandular hairs on its margin; stipules persisting during flowering on upper half of stem, slightly attached to base of petioles, but otherwise free, scarious, brownish, lanceolate, with a long filiform or flagellate point of nearly equal length, and a few shorter laciniate teeth on the sides, the whole 1 mm. long. A unilateral raceme, between 3 and 4 cm. in length, is produced at the upper part of the leafy stem, which continues to grow out and produce a terminal flower; it is leaf-opposed, pedunculate, bears three flowers without bracts, and is furnished with slender, fusiform, smooth, appressed peltate hairs, the lower end being produced considerably below the attachment. Pedicels 2·5 mm. to 4 mm. in length; sepals ovate-lanceolate, obscurely toothed, villous, not exceeding 1·5 mm.; petals twice as long, apparently white; anthers broader than long; styles three, about 1 mm. in length, forked near the base, and sometimes a branch again bifurcate, the long branches tapering, stigmatic to near the fork; ovary broadly ovoid; seeds ovoid, black, smooth, 1 mm. long.

The division of the genus *Drosera* into two main sections,

[1] "Journ. of Bot.," vol. xxxviii. p. 207, pl. 410 B. (1900).

as followed by Bentham, recommends itself by the separation of those species furnished with bulbs from all the others that have fibrous roots. The vegetative organs of large groups of species must be considered of prime importance for purposes of classification, when they show such marked differences, as observed in Droseras, seeing that they are specially adapted to the primary needs of the plants. In this case, however, in addition to the contrast between the bulbous and fibrous roots, there is a very apparent distinction between the styles of the bulbous forms as a whole and those of the section Rorella, these organs being multifid in the one series, and simple or only slightly divided in the other, with very few exceptions on either side. For the primary division of the genus the character of the root, and to a less extent of the styles, is taken; but the organs made use of for the further subdivision—stem, leaves, and flowers—are applied to an unequal degree in the two sections, the vegetative organs being of greater importance in Ergaleium, while in Rorella those of the reproductive system come more into force. In Ergaleium the styles are more uniform, and the stem and leaves show greater variability; but in Rorella the stem and leaves are varied to a less extent, while the styles and inflorescence generally are more heterogeneous and furnish the characters required for the formation of smaller groups.

The fibrous roots and bifurcated styles of *Drosera Banksii* seem, therefore, to forbid any doubt as to its position, namely, in section Rorella, near *D. indica*, a species with an elongated leafy stem, though without stipules, which are found in the majority of the species of the section, and possibly in all except those of annual duration. The transference of *D. Banksii*, with its elongated stem and stipules, to Rorella, would consolidate rather than confuse the arrangement, seeing that some caulescent species comprised in the Cape flora are already in that section, and have mostly, though not all, well-developed stipules. The division of the whole genus, according to the root-system, thus establishes two parallel series of similar extent, each comprising groups of forms, more or less comparable with those of the other series.

There is a marked resemblance, from various points of view, between *D. bulbigena* in the Ergaleium section and *D. Banksii*, the size and general aspect of the two species being similar; but while the root of one bears a bulb, that of the other is fibrous. The stem and leaves seem alike; but in the one stipules are absent, and the lowermost leaves are reduced to scales; while in the other stipules are present, and the leaves, though reduced in size towards the base, retain their leaf-like character. The slightly divided styles of *D. myriantha*, and in some degree also of *D. bulbigena*, detach these two species from the other cauline forms in section Ergaleium, and bring them into juxtaposition with *D. Banksii* in the opposite series. The somewhat abrupt diminution in size, and the withered condition of the leaves of the lower third of the stem, observed in the Port Darwin specimens of *D. Banksii*, may be due to submersion or dense shade, or some other unfavourable condition affecting the lower part of the stem. It is possible, however, that they may represent a previous season's growth of the plant, but no evidence of a dormant bud is apparent. The stipules in these specimens are not so caducous as they appear to have been in those originally collected at the Endeavour River by Banks, persisting as they do on all of the well-developed leaves of the upper half of the stem, even when the flowers in the raceme were well advanced. The peculiar position of the inflorescence is constant in all the plants so far observed. The raceme, which is usually terminal in caulescent forms, is in this species lateral or leaf-opposed, though larger than the continuation of the stem beyond its base, and appearing at first sight to be itself the main axis. This formation seems to be of the same type as that seen in the small group of bulbous species, including *D. stolonifera* and others.

It is interesting to note how the presence of a bulb in species of *Drosera* is associated with the absence of stipules and the reduction of the lower leaves to scales; the latter condition, it may be remarked, occurring in the rosette forms as well as in the caulescent. The function of the dormant bud among the leaves above ground in the Rorella section is transferred to the bulb in Ergaleium. The elongated distant petioles, with small stipules, of *D. Banksii*, however, do not seem well fitted for the protection of such a bud;

but the necessity for it does not exist in the perpetual summer of the Tropics, as it does in temperate climates, with their strongly contrasted seasons in which either a cold winter or a hot and arid summer necessitates special provision for the safety of the plant. In tropical countries, neither bulb nor dormant bulb may be required; and, as a matter of fact, no bulbous species are found in those regions, with the exception of *D. peltata*, which ranges from its home in Tasmania and Australia to Java, Ceylon, India, and southern China.

TRANSACTIONS AND PROCEEDINGS

OF THE

BOTANICAL SOCIETY OF EDINBURGH.

VOLUME XXIII.

PART II.

EDINBURGH:

PRINTED FOR THE BOTANICAL SOCIETY BY

NEILL & CO., LIMITED.

1906.

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TRANSACTIONS AND PROCEEDINGS

OF THE

BOTANICAL SOCIETY OF EDINBURGH.

SESSION LXX.

MEETING OF THE SOCIETY,

November 9, 1905.

Professor I. Bayley Balfour, President, in the Chair.

The following Office-Bearers of the Society were elected for the Session 1905–6:—

PRESIDENT.

Professor Isaac Bayley Balfour, M.A., M.D., D.Sc., F.R.S., F.L.S.

VICE-PRESIDENTS.

Alexander Cowan, Esq.
Symington Grieve, Esq.
J. Rutherford Hill, Esq.
James Whytock, Esq.

COUNCILLORS.

A. W. Borthwick, D.Sc.
Arthur E. Davies, Ph.D., F.L.S.
James Grieve, Esq.
William Young, Esq.
R. Stewart MacDougall, M.A., D.Sc., F.R.S.E.
J. A. Terras, B.Sc.
Professor J. W. H. Trail, M.A., M.D., F.R.S., F.L.S.
Percival C. Waite, Esq.
William Williamson, Esq.
Harry F. Tagg, F.L.S.

Honorary Secretary—William Craig, M.D., F.R.S.E., F.R.C.S.E.
Curator of Herbarium—W. Caldwell Crawford, M.A., F.R.S.E.

Foreign Secretary—Rev. D. PAUL, M.A., LL.D.
Treasurer—RICHARD BROWN, C.A.
Honorary Assistant-Secretary—W. W. SMITH, M.A.
Artist—FRANCIS M. CAIRD, M.B., C.M., F.R.C.S.E.
Auditor—ROBERT C. MILLAR, C.A.

LOCAL SECRETARIES.

Aberdeen—Professor J. W. H. TRAIL, M.A., M.D., F.L.S., F.R.S.
Bathgate—ROBERT KIRK, M.D., F.R.C.S.E.
Berwick-on-Tweed—FRANCIS M. NORMAN, R.N.
Birmingham—W. H. WILKINSON, F.L.S., F.R.M.S., Manor Hill, Sutton Coldfield.
Bournemouth—JOHN ARCHIBALD, M.D., F.R.S.E.
Calcutta—DAVID PRAIN, M.B., F.R.S.E., F.L.S., Royal Botanic Garden.
" Professor S. C. MAHALANOBIS, B.Sc., F.R.S.E., F.R.M.S., Presidency College.
Cambridge—ARTHUR EVANS, M.A.
Croydon—A. BENNETT, F.L.S.
Dumfries—Professor G. F. SCOTT-ELLIOT, M.A., B.Sc., F.L.S.
Dundee—Professor P. GEDDES, F.R.S.E.
East Liss, Hants—JAMES SYKES GAMBLE, M.A., C.I.E., F.R.S.
Glasgow—Professor F. O. BOWER, Sc.D., F.R.S., F.L.S.
" Professor J. CLELAND, M.D., LL.D., D.Sc., F.R.S.
" ALEX. SOMERVILLE, B.Sc., F.L.S.
Lincoln—GEORGE MAY LOWE, M.D., C.M.
London—WILLIAM CARRUTHERS, F.R.S., F.L.S.
" J. F. DUTHIE, B.A., F.L.S.
" E. M. HOLMES, F.L.S., F.R.H.S.
" Sir GEORGE KING, M.D., F.R.S.
Melrose—W. B. BOYD of Faldonside.
Otago, New Zealand—Professor JAMES GOW BLACK, D.Sc., University.
Perth—Sir ROBERT PULLAR, F.R.S.E.
Philadelphia, U.S.A.—Professor JOHN M. MACFARLANE, D.Sc., F.R.S.E.
St Andrews—Professor M'INTOSH, M.D., LL.D., F.R.S.E.
" ROBERT A. ROBERTSON, M.A., B.Sc.
" Dr. J. H. WILSON.
Toronto, Ontario—W. R. RIDDELL, B.Sc., B.A.
" Professor RAMSAY WRIGHT, M.A., B.Sc.
Wellington, New Zealand—Sir JAMES HECTOR, M.D., K.C.M.G., F.R.SS. L. & E.
Wolverhampton—JOHN FRASER, M.A., M.D.

The TREASURER submitted the following Statement of Accounts for the Session 1904–5 :—

INCOME.

Annual Subscriptions for 1904–1905	£48	15	0
Do. Arrears	9	15	0
Do. in Advance	1	10	0
Contributions of Life Members	17	17	0
Transactions sold	13	1	3
Subscriptions to Illustration Fund	1	10	0
Interest on Deposits in Bank	1	11	9
	£94	0	0

EXPENDITURE.

Printing (including Transactions for 1903–1904, £23, 7s. 9d.; and for 1904–1905, £36, 10s. 10d.) .	£76	9	1
Rooms for Meetings, Tea, etc.	8	7	0
Stationery, Postages, Carriages, etc.	3	7	5
Fire Insurance on Books, etc.	0	5	0
Excess of Income over Expenditure	5	11	6
	£94	0	0

STATE OF FUNDS.

Amount of Funds at close of Session 1903–1904 . .				£107	14	8
Add—Increase during Session 1904–1905, as above .				5	11	6
				£113	6	2
Being :—Sum in Current Account with Union Bank of Scotland, Ltd. .	£10	8	7			
Sum in Deposit Receipt with do.	100	0	0			
Due by Treasurer	2	17	7			
As above . .				£113	6	2

Note.—Subscription in arrear, 1904–1905, 15s.

The PRESIDENT remarked that the Society would receive the report of the year's finance with satisfaction, and on his motion a cordial vote of thanks was given to the TREASURER and to the AUDITOR.

The following gentlemen, recommended by the Council, were elected Honorary Foreign Fellows:—

Dr. Gottlieb Haberlandt, Professor of Botany in the University and Director of the Botanic Garden, Graz.

Dr. Eduard Janczewski, Professor of Plant Anatomy and Physiology in the University, Cracow.

Dr. Ernst Stahl, Professor of Botany in the University and Director of the Botanic Garden, Jena.

The following candidates were proposed as Resident Fellows of the Society:—

Robert Campbell, M.A., B.Sc., Geological Department, University of Edinburgh. Proposed by Professor Bayley Balfour, F.R.S., seconded by W. W. Smith, M.A.

W. Edgar Evans, B.Sc., 38 Morningside Park. Proposed by Professor Bayley Balfour, F.R.S., seconded by W. W. Smith, M.A.

James Waterston, B.D., 9 Woodburn Terrace. Proposed by Professor Bayley Balfour, F.R.S., seconded by W. W. Smith, M.A.

Mr. William Evans exhibited living examples of five species of *Riccia* found this autumn at the reservoirs in the Edinburgh district, and explained that the unusually low state of the water in the ponds had favoured the appearance of these plants. One species, *R. crystallina*, was an addition to the Scottish list; while another, *R. fluitans*, had not been recorded from Scotland since 1864.

Professor I. Bayley Balfour gave his Presidential Address.[1]

The following communication was read:—

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[1] During reconstruction of buildings at the Royal Botanic Garden, the manuscript of the President's address, containing the obituary notices and other matter read to the Society at its opening meeting, has been mislaid by him, and is not yet available for publication.

Acacias in Various Places: A Study in Associations.

By G. F. Scott Elliot, M.A., B.Sc., F.L.S.

In the study of Plant Associations, one is met at the outset by serious difficulties arising from the various classifications adopted by different authors.

Those employed in England and in France are, so far as the general idea is concerned, very much the same: but in Germany, in the United States, in Russia, and in Scandinavia respectively, the system of classification does not agree, even in essentials, either with that used in France or with each other, whilst as regards details almost every observer seems to make up his own descriptive terms.

Thus this, the youngest department in botany, runs a risk of being choked, whilst still growing up, in a thorny wilderness of terminology, which nevertheless shows how rich and fertile is the field of inquiry.

The reason of this confusion seems to be that botanists have at once rushed to the task of mapping out associations and giving them names. But no one would make a geological map without having both a definite idea of the succession of geological strata and of the numerous variations in the structure of ordinary sedimentary strata by the occurrence of volcanic dykes. I think there is just as definite and regular a succession of associations on any one spot as there is of geologic strata, whilst wherever rock, water, or desert conditions interrupt the ordinary climatic factors, whole series of transitional or fringing associations occur which connect the normal type of the district with rock, water, or desert associations. It is a mistake in policy, in my opinion, and produces confusion, if these transitional fringes are classed as associations in themselves. To attack the general question is much too dangerous an attempt for a short paper, and I shall only try to show how, if we recognise that many associations bordering desert countries are only transitional, the study of the subject is very much simplified.

The characteristic plant of all those associations which surround deserts in sub-tropical and tropical countries is the genus acacia. It is a very variable genus, and contains some

420 species. Why it should appear so regularly near but not quite over true deserts seems to depend on the following adaptations:—

1. The roots are usually very long, twenty to thirty feet in some cases, so as to reach deep-seated water. 2. The leaves are generally protected against strong sunlight by special devices, phyllodes, special powers of movement, etc. 3. Grazing animals are kept off usually by stipule spines, or, especially in the Australian species, by the development of tannin in the bark. Some species are extremely hardy: *A. Greggii* (the one used for the lac-insect) is able to do with only three inches of rainfall in the year; *A. longifolia* is a sand-dune plant.

Now in a general way, when one passes from an ordinary tropical "monsoon" wood into a desert, the vegetation changes as follows:—

First, the ordinary, close-ranked array of the tropical wood becomes altered into a light, more open wood. Second, the trees separate, forming clumps or patches, as one finds in an English park. Third, the trees become thorn-trees. Fourth, the thorn-clumps scatter and become scrub or thickets of thorny bushes. Finally, the thickets open out into isolated pioneer thorn-shrubs or small trees dotted over the ground like the plants in an orchard.

These isolated pioneers or scouts are almost invariably acacias, whilst the proportion of acacias and certain other Leguminosæ diminishes gradually in the vanguard of scrub and advanced guard of thorn woods until in the true "monsoon" wood there are exceedingly few or none at all.

This sort of succession can be seen in a great many places. Even in the Mediterranean region *A. Farnesiana* thrives and is even cultivated for its flowers (100,000 lbs. of essence has been made at Grasse).

In Egypt their importance is at once manifest. As one slowly steams up the Nile between sloping mudbanks a few feet high and covered with lupines and Lubia beans, the only vegetation above the bank consists of acacias or an occasional line of tall, graceful date-palms.

On landing, one finds a perfectly distinct line which shows the limit of the last inundation of the Nile. Beyond this line, acacias are almost the only shrubs or trees. They also often form rough hedges near the villages. They are very prominent in the rocky islets of the second cataract at Wady Halfa. The species of which I took special note were *Acacia Seyal*, L. "Seyal," the Shittah of the Bible; a shrub usually seven feet high, with a stem ten inches in diameter. It occurs in crevices of granitic rocks and also in sand or alluvium, sometimes at altitudes fully five feet above the level of high Nile. This is of great importance both as fuel and for use in the "sakkiehs" or waterwheels (Nos. 3364, 3333).[1] *A. albida*, Del., "Arras" or "Tolla'ih," a plant twenty feet high, was found in a wind-sheltered position some two miles south of Korosko. It also extends above the limits of high Nile and occurs in the Wady Halfa islets (3369, 3403). *A. tortilis*, Del., "Sallah" or "Seyal," also above the inundation limit and in the sandy granitic soil of the islets (3370). *A. arabica*, Willd., "Garrad" of Berbers, "Sunt" of Egyptians, Babool; fairly common at or a little above the level of high Nile (3381). *A. læta*, R. Br., fairly common in granitic rocks at the first cataract: a shrub or small tree just about the inundation limit (3436). These acacias are all liable to injury from the numerous camels, donkeys, and goats. In some places they seem to be disappearing altogether.

With the exception of *A. læta*, they all extend over a very wide range of country from Abyssinia and the Upper Nile to Senegambia: probably they are found all along the southern border of the Sahara. *A. arabica* extends eastward through Persia to Afghanistan. Some of them form woods of enormous extent, as, *e.g.*, the Seyal, from about 29° N. lat. to Konka. This species goes as far south as 9° N. lat. on the Nile. *A. tortilis* is the gum-acacia of the Tripoli desert. According to Ascherson in Rohlf's "Kufra," it is this species that makes the acacia woods in South Tunis between Gafsa and the coast on the southern flanks of the mountain Ben Hedma at 34½° Grad. It is also generally distributed on the stony desert on the road to Sokna from Beni Ulid and south of Misda. When upon the Anglo-French Sierra Leone Boundary Commission, I was able in the hinterland of that colony to reach an altitude of 3000 to 3500 feet at the Farana branch of the Niger. Here the ordinary monsoon forest had already been modified. The country was grass-

[1] The numbers refer to my herbarium book.

covered, with everywhere scattered trees: one could see perhaps a quarter of a mile in every direction. I selected seven plants as characteristic of this grassy, tree-covered plateau. All of them were Leguminosæ (*Albizzia fastigiata* and others). At this point the first step in the change from monsoon wood to acacia scrub had been taken, but to get the acacia pioneers, we should have been obliged to go much further to the north.

The district bordering the Sahara on the south is precisely that of which we know very little, but it is at least likely that similar acacia woods are or were common all along the border of the Sahara.

Somaliland is in some places a desert almost as devoid of vegetation as the Sahara itself. A transitional acacia and thorn-scrub region, with a long dry season, occupies a large area in British and German East Africa to the south of Somaliland.

From Mombassa to Kibwezi and Machakos I marched through this transitional zone. Acacias are exceedingly common and characteristic: they are, with succulent Euphorbias and Dioscoreas, perhaps also the most impressive features of the flora. There is a great deal of variation in the character of this scrub. Sometimes the acacias and other trees are scattered and distant, whilst the ground between is almost bare of vegetation. In other places the trees are in close order: flowering plants, creepers, and grasses cluster round their stems, and a considerable undergrowth springs up. Gnarled and twisted acacias of all sorts and sizes, with bright white bark and a very thin and naked appearance, are the most usual shrubs and trees. Grasses and sedges growing in small tufts are dotted over the ground between these trees, but only as an open flora, for the soil can be distinctly seen. These grasses form no sward or turf: except immediately after the rains, they are dead, dry, and withered up. Occasionally a tiny gazelle or "paa" with large ears springs out of the thorns and vanishes down the path. A closer search reveals (or at least used to do so) quantities of game such as ostriches, zebras, giraffes, Clarke's gazelle, etc. This district is in part the same as that described in Engler's "Pflanzenwelt Ost-Afrikas," which is connected especially with German East Africa. There is, in this book, the usual wealth of detail which is characteristic of German botanical work. Dr. Engler makes about ninety-five associations grouped under nine heads or formations, and in at least twenty of these associations acacias are found. The table which follows gives the titles of these acacia associations and the species which are recorded for each.

Now if one glances over this table, it must be confessed that it is exceedingly difficult to form any clear idea of the distinctions between and characters of these twenty associations. The first four belong to the coast, the next three are associations found below an altitude of 125 metres. Those marked v. *a*, *b*, and *c.a* are frankly acknowledged as transitional by Engler himself. My view, however, is that all these twenty associations are transitional: the majority of them are variations of an acacia-scrub region dependent on local differences in soil, in shelter, and in the amount of moisture. On the coast where the air is laden with moisture from the sea, one finds the usual thick evergreen wood with an occasional acacia on its outer edge (ii. C). This wood becomes more open in drier places where *A. pennata* is best able to take a prominent position (ii. D): further inland, where the influence of the sea moisture is less pronounced, the wood becomes a thick bush (iii. *c*); and in still drier places what Engler calls a thorn-bush thicket (ii. E and iii. *o*).

If a river cuts through this bush or thorn-scrub, its banks are covered by a strip of wood dependent on the river moisture, with a few acacias which are probably on the outside edge of the wood next the bush or thorns (ii. F). Much of the land is too dry even for thorn-bush thickets, and here comes in a pioneer acacia association, the so-called "orchard steppe," from a somewhat fanciful resemblance of the scattered acacias to an orchard (iv. *c*). In rocky places and little broken hills where the moisture is in crevices of the rock, the acacias are often partly replaced by Euphorbias and other succulents (iv. *f*).

At a height of about three thousand feet, this acacia region begins to shade off towards the monsoon wood, or, as Engler calls it, an "upper dry tropical wood," which is characteristic of African plateaux at about this altitude. The transitional stages are a close steppe bush thicket (iv. *a*) and a steppe wood (iv. *k*)

	ii. C. Thick evergreen coast bush	ii. D. Wood-like complex of coast	ii. E. Thorn-bush thicket of coast	ii. F. Alluvial woods of coast	iii. c. Thick bush of lower bushlands (below 125 m.)	iii. n. Tree-grass steppes of lower bush-lands (below 125 m.)	iii. o. Thorn-bush thickets of lower bush-lands (below 125m.)	iv. c. Orchard steppes of interior	iv. d. Steppe bush thickets of interior	iv. f. Euphorbia thorn-bush of interior	iv. h. Bush-grass steppes of interior	iv. i. Tree-grass steppes of interior	iv. k. Steppe woods of interior	iv m. Bush woods on South of V. Nyanza	iv. p. Savannah	iv. r. Thick alluvial wood (plains inland)	v. a. Transitional region, fertile bush steppe (red-gray soil)	v. b. Transitional region, fertile bush steppe (black soil)	v. c. a. Transitional mountain steppe wood	vi. b. Upper dry tropical wood to 1100 m.
A. Stuhlmanni.					×															
A. verugera.				×																
A. Holstii. / *A. etbaica.*																			×	
A. leucacantha. / *A. teilensis.*										×										
A. Catechu.																	×		×	
A. usambarensis.																	×	×	×	
A. subalata.										×		×								
A. tortilis.											×	×								
A. stenocarpa.	×3–7 m.				×				×		×						×			
A. pennata.		×			×4–12 m.				×	×				×			×		×	
A. spirocarpa.			×7–8 m.		×					×		×	×							
A. mellifera.					×															
A. Seyal.					×		×	×	×		×	×					×10 m.			
A. Senegal.					×5–15 m.				×			×						×		
Dichrostachys nutans.	×7 m.		×		×				×								×		×	
Cassia spp.	×								×								×	×		
Albizzia fastigiata, etc.					×					×							×		×	×

Where rivers cut their way through a monsoon wood their banks are covered with closely set riverside woods. In these riverside woods acacias may be present (iv. *r*).

But between Uganda and the coast and round Kilimanjaro and Kenia there is elevated land which has plenty of water and enjoys a distinctly temperate climate. The flora is also of a temperate character, and consists of grasslands on the plains and forests on the hill-flanks and sheltered valleys.

Where this rainfall makes itself felt, the grass, *e.g.* on flat or open ground, obtains some advantage and grows more luxuriantly. The scattered bushes or trees of acacia and other plants are then surrounded by distinct grass, and constitute the " bush-grass steppes " and " tree-grass steppes " (iv. *h*, iv. *i*, iii. *n*) of Engler.

On the other hand, at the meeting-place of temperate mountain forest and acacia scrub, one finds mountain steppe woods in which the acacias are abundant so long as the soil is reddish laterite (v. *a*), but become much less prominent when humus has accumulated and forms a rich black soil (v. *b*).

The bush-woods on the southern bank of the Victoria Nyanza seem, if I can judge from the notes of Dr. Stuhlmann, to be not one special association but a mixture of several. The so-called savannahs (iv. *p*) appear to be quite similar to what I have seen along the Kagera river, viz. alluvial plains, very dry and bare in the dry season, but overflowed in the rains. In other words, they are exactly the same as the Nile acacia region in Egypt.

Thus these twenty " associations " seem to me to fit fairly well into their places as transitional stages between wood and the orchard steppe, or between mountain forest and the latter.

Turning to South Africa, the desert of the Kalahari, Damaraland, Namaqualand, and the Karoo are not without the usual border of acacias. These occur in the high veldt of the Orange River Colony and Transvaal, where *A. robusta*, etc., grow either in a scattered, pioneer fashion over the grasslands, or sometimes in close order, forming light, open woods.

In Cape Colony, one of the views that I remember best is that from the top of the Boschberg in Somerset East. Looking over the plains, which are interrupted here and there by great flat-topped hills of recent sandstone, one sees how the dense thorn-woods and thickets which cluster round the base of the Boschberg open out into patches of wood which again scatter into isolated acacias and extend far out into the plain. Green river-woods accompany the windings of the Fish river, which also extends across the plains.

On the banks of dry riverbeds in the Karoo itself, *A. horrida* (Doornboom), *A. detinens* (Wait-a-bit), and *A. Giraffæ* are almost the only shrubs which can exist (Drude, "Handbuch der Pflanzengeographie"). Also in the deserts of Damaraland there are thick woods along some of the watercourses which are composed chiefly of acacias (*A. detinens*, var. *bijuga*, *A. hebeclada*) (Schimper, "Pflanzengeographie," p. 660).

I have no exact data as to the occurrence of acacias in India, but *A. planifrons* seems to be a pioneer in certain deserts (*cf.* Schimper, *l.c.*, p. 290), and thorn-woods are common. Kurz (see Schimper, *l.c.*, p. 407) describes in Pegu certain dry forests, Sha-woods, chiefly of *Acacia catechu*, which, from description, resemble very closely the East African thorn-bush.

In Australia there is the Mulga Scrub (*A. aneura*). Also, according to Tenison Woods (Drude, *l.c.*, p. 497) the Brigalow Scrub, on the western side of the coast mountains of Queensland, would seem from his description to be a similar association and similarly situated. The dominant plant is *Acacia harpophylla* (with *A. saligna* and *A. excelsa*); the bluish-gray colour of its sickle-shaped leaves gives to the whole scrub a peculiar silver-gray sheen. This scrub is a fairly close thicket, and covers a large amount of ground. It seems able to hold its own even on fairly good soil, for cattle do not eat the young shoots and devour the grasses (Proc. R.S. N.S. Wales, vol. vii. p. 565). The Kangaroo thorn, *A. armata*, is protected by thorns, but many of the Australian acacias rely upon the astringency of the bark, which has sometimes from 26 per cent. to 48 per cent. of tannin.[1] One species, *A. glaucescens*, is poisonous, and a narcotic is obtained from it which is used by the natives to stupefy fish. So far as one can gather from descriptions, these Australian acacias fringe the inland desert in quite a typical way.

[1] *A. binervata*, *A. decurrens*, *A. dealbata*, and other wattles.

In South America I found that an acacia, *A. caveniæ* (332, Chile), is or used to be the dominant plant over a considerable part of the Central Chilian valley, *i.e.* from Itata to Chillan.

This is the transitional zone between the temperate flora of South Chile and the horrible desert of Atacama and Tarapaca, where the only plant found by Darwin was a lichen growing on mule-bones.

In the locality where this acacia once existed in great numbers there is a very long dry season, and probably there is underground water. The Guanaco used to be common all over this part of Chile, so that the stout spines are not unexpected.

On the other side of the Andes, near Mendoza (Argentine)' there is an association of thorny shrubs, the Chanar (*Gourliea decorticans*), which, though not an acacia, seems to have a similar habitat.

In Brazil the "Carrascos," composed of *Acacia dumetorum*, are thickets of thorn-shrubs sufficiently open to allow a horseman to pass in any direction (Schimper, *l.c.*, p. 282).

In Nicaragua *A. sphærocephala* and *A. cornigera* are well known on account of the ant-police which they support, but I have not been able to satisfy myself as to their country.

In Northern Mexico, Arizona, and Texas, the extensive chaparal (*Prosopis glandulosa* and *P. pubescens*) is an acacioid thorn-scrub association, and acacias occur also in the sub-tropical steppes of Mexico, but here again I have not definite data (Schimper, *l.c.*, p. 509).

I must not omit the Island of Socotra, where the acacias *socotrana*, Balfour fil. (on plains near the sea on north side of island) and *A. pennivenia*, Schweinfurth (Tamha), as well as *Dichrostachys dehiscens*, Balf. fil. (Kadhab and Hadibu plains) occur, as well as an acacia undescribed [1] (plains near Galonsir). These plains have been described by our President as part of the Arabo-Saharan desert.

I think that this very imperfect sketch of the distribution of acacia shows that it is the commonest and most characteristic constituent of desert-bordering associations both in tropical and sub-tropical countries. They are often the dominant plant in thorn-scrubs, thorn-woods, and light woods

[1] Balfour, "Flora of Socotra."

near deserts, and, so far as my own experience goes, they are almost always the scouts or pioneers which extend farthest into the desert.

Any attempt to make separate associations of every transitional stage between desert and wood must result in confusion, because all sorts of changes take place. Climates do not, as is usually supposed, remain invariable. In such a transitional zone, if a climate becomes, ever so little, drier, then the pioneer acacias will be killed out, woods will break up into thickets, and pioneers are formed from the thickets. If, on the contrary, the climate becomes a degree more humid, then the acacias break new ground in the desert, and the whole army of plants behind them colonises a little more of it.

Moreover, changes in the vegetation may occur without any change in climate. The acacia fringe is, or used to be, the favourite pasture of hordes of grazing animals, antelope, zebra, guanaco, kangaroo, etc. Now these animals are not necessarily mere vegetable demons. If one watches a flock of merino kids devastating an acacia without paying the slightest attention to its horrible-looking spines, one is apt to think that this mild, innocent-looking little animal is a mere Apollyon of plants. The camel and the goat also are supposed, and probably with some reason, to have utterly devastated the flora of Egypt. But in all such cases the battle is unfair: grazing animals in big battalions are supplied with water and protected by man, so that enormous numbers act on one particular spot. Under natural conditions I think that grazing animals, although they may do harm, do an enormous amount of good.

Desert soil consists of sand, gravel, or rock; it is unworked soil, "urboden" in the German sense: it has no leaf-mould, no black earth full of valuable salts and decaying animal matter: there are no worms and probably no nitrogenous bacteria except those of the acacia and other leguminous roots. In such places the manure of grazing animals is scattered by birds and insects over a square foot or so of the neighbouring soil and improves it enormously. On this square foot young herbaceous seedlings will develop vigorously; they will form a close green carpet during the rainy season and will protect each other, remaining green long after their unprotected neighbours have withered away. So that the manure of grazing animals favours the change from pioneers to thicket or from thicket to woods.

I shall mention two cases in which such differences have been brought about.

The guanaco in South America has the curious habit of depositing its droppings in one locality for long periods. These spots are conspicuous on account of their rich green vegetation amidst the surrounding desolate and burnt-looking steppe.

Then also, in some parts of India, conspicuous green patches may be noticed on the burnt-up, brownish-yellow hillsides. These are where the natives have folded their flocks, and the more vigorous growth due to manure has prevented drought from having its usual effect.

I could mention similar cases in this country.

These considerations are sufficient, I think, to show that an association is not a stationary organism susceptible of exact definition, but that it is always trying to extend its borders. It is probably also, like a species or like an animal during its life, perpetually changing with varying conditions, or, if it refuses to adapt itself, being suppressed by something better able to stand the new conditions.

Since writing the above paper, a remarkable confirmation of my views has appeared ("Geographical Journal," Dec. 1905, p. 670).

"This year the whole distance between Algeria and the Niger has been traversed by one traveller, M. E. F. Gautier, whose excellent studies on the physical geography of the North Saharan borderlands have been frequently alluded to in the Journal. The explorers set out from Tuat on 12th May 1905. Gao, on the Niger, was reached on 3rd August. A short account of the journey, based on a communication to "Le Temps," appeared in the October number of "La Géographie." For the last 375 miles before reaching the Niger, the traveller crossed an unbroken steppe, covered with a widely spaced forest of mimosas, between which a fine grass grows. This M. Gautier considers as characteristic of the southern border of the desert from the Atlantic to Egypt."

MEETING OF THE SOCIETY,

December 14, 1905.

Rev. Dr. DAVID PAUL in the Chair.

The following gentlemen, recommended by the Council, were elected Corresponding Members:—

LUJO ADAMOVÍC, Professor of Botany and Director of the Botanic Garden, Belgrade.

FREDERICK MANSON BAILEY, F.L.S., Colonial Botanist of Queensland, Brisbane.

J. CASIMIRO BARBOZA, Director of the Botanic Garden, Oporto.

M. W. BEIJERINCK, Professor of Bacteriology, Delft.

HARRY BOLUS, F.L.S., Cape Town.

Dr. DOUGLAS CAMPBELL, Professor of Botany, Stanford University, California.

L. COCKAYNE, New Brighton, Canterbury, New Zealand.

JOHN MERLE COULTER, Professor of Botany, University of Chicago.

Dr. ANDRÉ FAMINTZIN, Emeritus Professor of Botany and Director of the Botanical Laboratory of the Imperial Academy of Sciences, St. Petersburg.

WILLIAM FAWCETT, B.Sc., F.L.S., Director of the Public Gardens, Hope Gardens, Jamaica.

Dr. CHARLES FLAHAULT, Professor and Director of the Botanical Institute, Montpelier.

M. FOSLIE, Curator of the Botanical Department of the Museum, Trondhjem.

Dr. THEODOR MAGNUS FRIES, Emeritus Professor at the University, Upsala.

AUGUSTE GRAVIS, Professor at the University and Director of the Botanic Garden, Liége.

Dr. EMIL HEINRICHER, Professor of Botany and Director of the Botanic Garden, Innsbruck.

Dr. FRANZ KJELLMAN, Professor of Botany in the University and Director of the Botanical Garden, Upsala.

JOHN MACOUN, M.A., F.R.S., Dominion Botanist on Geological Survey, Ottawa.

Dr. Oreste Mattirolo, Professor of Botany in the University and Director of the Botanic Garden, Torino, Piedmont.

Dr. Kingo Miyabe, Professor of Botany and Director of the Botanic Garden, Sapporo, Hokkaido, Japan.

Leonard Rodway, Government Botanist of Tasmania, Hobart.

Dr. Carl Schröter, Professor of Botany and Director of the Botanical Museum, Zürich.

Josef Velenovský, Professor of Systematic Botany in Imperial University of Bohemia, Prague.

Dr. Milail Vladescu, Professor of Botany in the University and Director of the Botanic Garden, Bukarest.

Robert Campbell, M.A., B.Sc., W. Edgar Evans, B.Sc., and James Waterston, B.D., were elected Resident Fellows.

The following candidate was proposed as a Resident Fellow :—

Mr. James Fraser, 18 Park Road, Leith. Proposed by W. W. Smith, M.A., seconded by A. W. Borthwick, D.Sc.

The following candidate was proposed as a Non-Resident Fellow :—

Mr. Harry Sanderson, Eastmount, Galashiels. Proposed by Mr. W. B. Boyd, seconded by the Rev. J. J. Marshall Lang Aiken.

The Rev. Dr. Paul exhibited three interesting Fungi: *Strobilomyces strobilaceus*, found only once previously in Scotland; *Trametes gibbosa* and *Onygena equina*.

Mr. R. L. Harrow exhibited a series of Plants in Flower from the Royal Botanic Garden.

Mr. L. Stewart showed an interesting series of Senecios, illustrating a wonderful amount of variation within the limit of a single genus. The series included *Senecio canus*, practically new to cultivation; *S. junceus*. *S. gonocladus*, *S. repens*, *S. scaposus*, var. *caulescens*, *S articulatus*, and *S. echinatus*.

H. F. TAGG, F.L.S., showed several preparations illustrating the development of *Marsilea*.

Dr. A. W. BORTHWICK exhibited several species of Fungi, including Larch-canker on the Japanese Larch. This disease, *Peziza Willkommii*, was found to be abundant in a wood of this tree previously supposed to be comparatively immune.

The following communication was read:—

THE EXTRA-TROPICAL TREES OF ARRAN.[1] By the Rev. DAVID LANDSBOROUGH, LL.D., Kilmarnock.

THE title extra-tropical is suggested by the use of this word in the celebrated work of Baron Müller, and the circumstance that foreign trees growing in the island of Arran are more frequently mentioned by him than those of any other place in Scotland (thirteen references). See "Select Extra-Tropical Plants," by Baron Ferd. von Müller (Australia), ninth edition, 1891.

While trees growing in Arran are my subject, these will be illustrated by reference to trees of the same species growing in other parts of Scotland.

My father, the Rev. Dr. Landsborough, Stevenston, an enthusiastic naturalist, made the island of Arran the special field of his investigations. From boyhood I was frequently there, and when I grew up I formed connections which made me intimate with most of the prominent persons residing there, and specially with James Paterson, Esq., Commissioner on the island to His Grace the Duke of Hamilton. I had three brothers in Australia, one of them a celebrated explorer (see a river, a town, and a county there named after him, as also a river in New Zealand). My brothers were in the habit of sending me seeds of various kinds, and, knowing that the plants I raised from them would not succeed in Ayrshire, I naturally thought of Arran, where, through my friends, nearly all the places on the east of the island were

[1] All unprotected.

open to me. Two difficulties, however, were before me. I had to learn the degree of hardiness of each plant, and I had to find out the places where the inclemencies of winter were least severe. It might be thought that the latter would be easily determined. It is not so. It is easily seen that some places are much exposed; but there are others which lie nicely to the sun and seem sheltered from high winds which most unexpectedly are found to be open to draughts and swirls which prove as hurtful as violent blasts. It is frequently only by the sad results of experiments that these places are determined; and even an experiment may fail to give the desired knowledge, as at times, from some unknown cause, a plant may fail, while a second of the same species would succeed.

My experiments began more than forty years ago. Since that date several winters have been severe That of 1894–5 was specially so. It was after it that my last paper was given to your Society (see "Transactions and Proceedings," February 1896, pp. 508–531). Since that winter no other has been so severe. In mentioning minimum temperature, I shall therefore give it of that winter.

This paper will be devoted to any facts worthy of notice overlooked in my previous paper, to the progress made by the plants previously mentioned, and to plants introduced since that date. Some are passed over because from some cause or other they are now gone. Since 1895, at several places on the west and south of Arran, and specially at a sheltered spot on the side of the highway at Whitefarland, on the north-west of the island, interesting experiments have been made by Hugh Fullarton, Esq., Glencairn, Greenock. In illustration of what the west coast of Scotland is capable of growing, there is added to my paper a valuable list of delicate or recently introduced plants which grow at Kinloch Hourn, Inverness-shire. For it I am indebted to the proprietor, Robert Birkbeck, Esq. The capability of the west is further illustrated by a list of the numerous plants of the bamboo and kindred families which grow wonderfully at Achnashie, Roseneath. I owe it to the proprietor, Robert Campbell, Esq.

Measurements.—Owing to an attack of internal trouble, I have been unable to take the measurements as formerly in

Arran myself. Those at Cromla were kindly made for me by the Rev. James Brown, Corrie; at Brodick and Whiting Bay by the forester, Mr William Inglis; and in Brodick Castle Garden by the gardener.

TEMPERATURES.

Minimum Temperatures in Winter of 1894–5.

Queen's Park, Glasgow (10th Feb., 7 a.m.) .	2° *below* zero.
Whittinghame, Haddingtonshire . .	zero.
Kinloch Hourn, Inverness-shire . . .	zero.
Achnashie, Roseneath, Dumbartonshire .	4° F.
Glendoune, Girvan, Ayrshire . . .	10° F.
Tighnabruaich, Kyles of Bute . . .	17° F.
Lamlash, Arran	22° F.

Sudden cold after a mild autumn, and late frost after a mild spring, do much more injury than the same intensity in the heart of winter. Some plants are more excitable than others, and in a mild spring start growth early. These suffer more from a late frost than some plants which would suffer more from severe frost in winter.

TREE FERNS.

The Great Bush Fern of Australia, Dicksonia Billardieri (*D. antarctica*).—The first tree-fern grown in the open air in Scotland. Height, 40 feet.

This fern does not grow, as the name *antarctica* would denote, in antarctic regions. The specific name has therefore been changed to *Billardieri*, the name of the naturalist by whom the former name was given. In greenhouses the stem of this fern is generally clothed with moss, to increase the vigour of the plant by the nourishment thus obtained by the stem-rootlets. This has not been done with the plants at Cromla, as it was wished to exhibit them in their natural state. These ferns at Cromla are specially interesting to the geologist, as in them we see again growing in our own country examples of those tree-ferns which in earlier eras of the world's history grew there abundantly. From spores of the original fern, sent in 1892 to the Botanic Garden, Edinburgh, young plants were raised, one of which was kindly presented to the writer. It was planted in a sheltered corner on the north side of Cromla House, the parent growing in a similar corner on the south. Being from home-grown spores, it ought to be more hardy than the other ; but, being on the north side, it will contend with more cold. The measurements of both are given.

1. Cromla, Corrie.—Sown 1864 (not 1854, as printed in my former paper). Planted 1867. 1895—height of stem, 2 feet; girth, 2 feet 10 inches at 1 foot; length of frond, 7 feet 3 inches. 1905—height of stem, 3 feet 10 inches; girth, 2 feet 4½ inches at 3 feet; length of fronds, from 6 feet 8½ inches to 7 feet 6 inches.

2. Cromla, Corrie.—Seedling. Sown 1892. 1905—height of stem, 5 inches; girth, 10½ inches at 3 inches; length of fronds, 3 feet 6½ inches; breadth of fronds, 1 foot 2 inches.

Cromla garden is on the coast, and separated from the sea at high tide by only the breadth of the highway. It is open to the south, sheltered on the west and north, seemingly exposed to the east wind ; but the high mountains behind it *lift up this wind before it reaches the coast.* The sea suddenly becomes deep near the land, and thus is the better frost defender.

Palms.

"The palm is the pride of tropical vegetation." It grows in Arran better than in any other place in Scotland.

A tree-fern growing in the open air in Scotland would have amazed our fathers. That a palm should thrive would have been considered an impossibility. Palms are of two kinds—the feather and the fan—names denoting the form of their fronds. Not one of the former has as yet succeeded in Scotland, but several of the latter. In the spring of this year (1905) I visited Egypt, and in a botanic garden at Cairo, among other species of palms, I found duly labelled three of *Chamærops excelsa*, a species which grows in Arran. To my great surprise, except in height, they were much inferior to those of Arran. While about 20 feet in height, their girth was only 1 foot 5½ inches at 5 feet from the ground, the crown being proportionally poor; and the bright green colour of frond, so attractive in Arran, was awanting.

Chamærops (*Trachycarpus*) (hair fan-palms).—"Hair" refers to the hair-like fibres which clothe the stem.

There are three species of fan-palm which succeed in Arran: 1st, the Chinese or Japanese; 2nd, the Chusan (island on the coast of China, lat. 30°); 3rd, the palm of Gibraltar. The second by many naturalists is regarded as a variety of the first. For practical purposes, however, it is distinct, being more elegant, the frond-stalks longer and more slender, and the fan finer in texture and darker in hue. I may add it is more delicate. In this paper I treat it as distinct.

I. *Chamærops* (*Trachycarpus*) *excelsa* (China and Japan fan-palm).—Height, 20 feet. Cordage made from the fibre of the leaves is water-proof, and almost rot-proof, and is extensively used by the Chinese for various purposes—coats, mats, etc. (Island of Formosa—J. W. Davidson, F.R.G.S., 1903, pp. 532–533.)

1. Ardchapel, Shandon, Gareloch.—The late Professor Swan, of the Natural Philosophy chair, St. Andrews, who after his retiral lived at Ardchapel, has the credit of having been the first in Scotland to plant a palm in the open air. Till 1898 it was left in its natural condition—that is, the dead fronds, which remain persistent, covered the stem to the ground. In some respects their removal is an improvement, in others it is the opposite. It is to be hoped that one of those in Arran, say the one at Cromla, near to the gate, will be allowed to retain its natural dress. Planted about 1866. 1895—girth of stem not easily determined, owing to the covering of dead fronds; height, 8 feet 3 inches; leaf-stalk, 2 feet 8 inches; breadth of lamina, 4 feet 2 inches. Bloomed in 1881. 1905—height, 11 feet 1 inch; girth, 3 feet 8 inches at 5 feet; leaf-stalk, 2 feet 8 inches; breadth of lamina, 3 feet.

2. Craigard, Lamlash.—Sown 1884; planted 1886. 1895—height of stem, 3 inches; girth, 1 foot; spread, 2 feet 6 inches; leaf-stalk, 8 inches; breadth of lamina, 2 feet 6 inches. 1905—height of stem, 2 feet 10 inches; full height, 6 feet 10½ inches; girth, 2 feet 6½ inches at 1 foot; spread, 8 feet 4 inches; length of leaf-stalk, 3 feet; breadth of lamina, 3 feet 2 inches.

3. Whitefarland, N.W. of Arran (south garden).—Planted

1895. 1905—Height, 4 feet; leaf-stalk, 1 foot 8 inches; breadth of lamina, 2 feet 7 inches.

4. Cromla, Corrie.—Sown 1890; planted 1892—situation exposed. Height of stem, 6½ inches; full height, 3 feet 6 inches; girth, 9 inches at 3 inches; leaf-stalk, 16 inches; breadth of lamina, 2 feet 4 inches.

5. Henderson Manse, Kilmarnock.—Planted 1897. 1905—height, 4 feet 11 inches; height of stem, 1 foot 1 inch; spread, 4 feet 11 inches; spread of lamina, 2 feet 8 inches; stalk, 1 foot 6 inches; girth, 1 foot 10 inches at base. During severe frost a sheet of strong brown paper has been thrown over it.

II. *Chamærops* (*Trachycarpus*) *Fortunei* (Chusan fan-palm).—Height, 30 feet.

Cromla, Corrie.—Planted 1897. This promises to become the grandest palm in Scotland. 1905—height, 5 feet 6 inches; girth, 1 foot 8 inches at 6 inches; height of stem, 1 foot 6 inches; leaf-stalk, 2 feet 6 inches; breadth of lamina, 3½ feet.

III. *Chamærops humilis* (Gibraltar palm).—Height, 10 feet. The only palm native to Europe.

Cromla, Corrie.—Planted 1899: of considerable size. 1905—height, 4 feet 2 inches; height of stem, 9 inches; girth, 10 inches at 4½ inches; leaf-stalk, 30 inches; breadth of lamina, 3 feet 4 inches.

PALM LILIES (CORDYLINES).

The Club or Cabbage Palm of New Zealand and Australia; has a deep tap-root and spreading rootlets near the surface.

No tree suggests the tropics as does the palm; none the extra-tropical as the palm-lily. In height and general appearance the two trees are so similar that in scientific and popular language the term palm is applied to both. It is of high interest that the two grow alongside at Cromla.

I. *Cordyline australis*, Hooker (*C. superbiens*, Koch).—"Specimens have been found in New Zealand 60 feet high and 16 feet in girth at base" (Koch). "This species of Cordyline is prone to vary, and is now recognised as including the old *indivisa*; and *lineata* is only a gardener's form of it, as are other named forms" (Professor I. Bayley Balfour).

Two of the family grow superbly on the west coast of Scotland. Few true palms equal the first in spread and luxuriance of bloom.

1. South Park, Campbeltown.—Planted about 1860. Lady Campbell, who resided at South Park, was the first person in Scotland to plant a Cordyline in the open air. It grew famously, and amazed everyone who saw it. Professor Balfour, on being shown a photograph of it, said it was the best example he had ever seen. Another gentleman, who had resided for years in New Zealand, occupying a high official position there, said that the Cordylines at South Park in style of growth surpassed any he had seen in their native country. This was specially true of the one first planted. Unfortunately, a few years ago it was so much broken by a violent storm that Alexander Gardiner, Esq., son of Lady Campbell, found it necessary to take it down. I have not its measurements, but I possess an excellent photograph of it given me by my friend, Hugh Fullarton, Esq., Glencairn, Greenock. It had bloomed and borne seed abundantly, and proof was given that it felt quite at home by the seed which fell on the ground germinating there freely. It is now represented by one of those seedlings, planted in 1877. It now measures (1905)—height of stem, 7 feet 8 inches; height of tree, 22 feet; spread, 16 feet 8 inches; girth, 3 feet 5 inches at 5 feet—at base, 5 feet 6 inches. This year (1905) it bloomed luxuriantly, twelve great heads of flowers issuing from the base of its many branches.

2. Lag, Arran.—Two seedlings of the South Park tree Planted by Mr. Fullarton, Greenock. Sown 1900.

II. *Cordyline australis*, var. *indivisa Veitchii*.—This tree grows to a greater height than the previous, but its girth, and specially the spread of its branches, are very much less, thus giving it an altogether different appearance. It has, however, that which renders it as conspicuous.

Cromla, Corrie.—Planted 1879. 1895—height, 20 feet; girth, 2 feet at 5 feet, 4 feet at base. 1905—height, about 26 feet; height of stem, 14 feet 10 inches; girth, 2 feet 5 inches at 5 feet—at base, 4 feet.

I may mention that this tree, when young, grew at Christchurch (lat. $43\frac{1}{2}°$), Canterbury, New Zealand. It was sent to Scotland in 1878, and planted at Cromla in 1879. Here, like the previous, it enjoys the best of health and thrives as if still growing in its native home in the Antipodes. In the early summer of 1901 it began to exhibit its speciality. I then saw what I took to be little blades of grass growing at the cleft where the stem bifurcates. To my great surprise, I afterwards discovered that these were tiny leaves of the Cordyline. Now, at the end of four years, they have developed into a central stem which may be expected rapidly to rise in height—a young tree growing erect from the top of an old tree! As it is well seen from the public road, walkers will not only see a New Zealand tree, but one that has grown in New Zealand, and also a style of growth which is to be seen at no other place in Scotland. There was formerly a good example at Erichtbank, Kirn, but the tree was almost destroyed by the frost of 1894–5. The whole stem is now clothed with young shoots. The Corrie example bloomed in 1902; but, unlike the South Park tree, its fallen seed never germinates in the ground beneath. This Cromla *Veitchii* was the only Cordyline in Arran uninjured by the frost of 1894–5.

III. *Cordyline australis*, var. *indivisa lineata.*—There are two of this variety at Cromla. The largest was sown in 1872 and planted in 1874, while the other was brought from Canterbury, New Zealand, along with the *Veitchii.* Both had their bark, on the side exposed to the early sun, split for several feet by the frost of 1894–5. This has never healed. The crown of the larger is as yet little affected, but, as if in preparation for it to fail, a young stem has sprung at the foot of the rent. The other is more injured.

1. Cromla (largest).—1895—height, 22 feet 8 inches; girth, 2 feet 1 inch at 5 feet. 1905—girth, 2 feet 7 inches at 5 feet, 4 feet at base; four magnificent bunches of flowers in 1905.

2. Whitefarland, west of Arran (north garden).—Planted 1895. 1905—height about 20 feet.

IV. *Cordyline australis indivisa.*—Alpine House, Corrie.—Planted 1897. Then 2 feet in height. 1905—height, 15 feet 4½ inches; girth, 1 foot 3½ inches at 5 feet—at base, 1 foot 8 inches.

EUCALYPTS.

(Arranged in the order of hardiness.)

There are 213 species of Eucalypts, and all, four excepted, are natives of Australia. All love abundance of light. The buds appear one year, the blossom on the next, the ripe seed on the third. Twelve species grow in Arran—examples of all at Corrie. It is of the Myrtle family (Myrtaceæ).

I. *Eucalyptus Gunnii.*—South Australia. Height, 150 feet. This tree, when young, is very attractive because of the rich bloom upon its foliage. "The leaves then are opposite, oval, and blue-green. As the tree advances they become longish, alternate, and dark green" (Birkbeck). The flower resembles that of the myrtle. The tree of this species at Whittinghame, Haddingtonshire, is the first Eucalypt grown in the open in Scotland, and was given by the late Marquis of Salisbury to Mr Balfour. It was also the first to bloom and ripen seed, and from these plants were raised at the Royal Botanic Garden, Edinburgh. By the severe frost of 1860–61 the Whittinghame tree was cut to within 3 feet of the ground, but shoots sprang from what remained of the trunk. "It is notable that plants raised from the Whittinghame tree are more hardy than their parent. In the year 1894–5, when on two nights the mercury sank at Whittinghame to zero, the young plants did not lose a leaf, while all those of the parent tree were destroyed" (Garrett).

1. Whittinghame.—1895—height, about 55 feet; girth, 12 feet 5 inches at 2 feet from the ground. 1905—height, 70 feet; girth, 13 feet 6 inches at 2 feet.

2. Stonefield, Tarbert, Loch Fyne.—Sown 1881. 1895—height, 38 feet; girth, 2 feet 3 inches at 5 feet. 1905—height, 71 feet; girth, 4 feet 4 inches at 5 feet; spread, 30 feet.

3. Kinloch Hourn, Inverness-shire.—Planted 1890. 1895—height, 15 feet; covered with buds. September 1905—height, 33 feet; girth, 1 foot 4½ inches at 5 feet.

4. Craigard, Lamlash.—Planted 1897; was eaten by a cow. 1905—height, 9 feet 6 inches; girth, 3¾ inches at 1 foot.

5. Whitefarland, N.W. of Arran.—1905—height, 19 feet.

6. Bellfield, Kilmarnock, and Piersland, Troon. Both sown 1904, and planted 1905. Both from the seed of a tree at Brightlingsea, Essex.

II. *Eucalyptus acervula* (crowded).—South Australia and Tasmania. "Leaves equal-sided, shining, and often undulated; many times the size of those of *E. Gunnii.* Flowers six or eight together" ("Tasmanian Timbers," Vail).

My plants were given me by Mr Birkbeck, Kinloch Hourn, and were raised by him from seed received from the Botanic Gardens, Hobart Town, Tasmania (lat. 42½°). In Arran they are growing behind the Free Church at Corrie, alongside of a plant of *Eucalyptus Gunnii.* The situation is exposed to a concentrated sea-blast. They have grown well, while the *Gunnii* has remained almost stationary. This tree is regarded by some botanists as simply a variety of *Eucalyptus Gunnii.* If so, it is strange that in style of growth and appearance it has almost no resemblance to it. I therefore insert it.

1. Kinloch Hourn, Inverness-shire.—A little forest of this tree extending several hundred feet above sea-level.

2. Free Church, Corrie.—Sown 1894; planted 1897. 1905 (largest)—height, 21 feet; spread, 9 feet; girth, 1 foot 4 inches at 3 feet.

III. *Eucalyptus vernicosa* (Eucalypt with varnished bark). —The most dwarfish of all Eucalypts.

1. Whittinghame, Haddingtonshire.—1895—height, 7 feet. In the winter of 1894–5 killed to within 3 feet of the ground. 1905—height, 20 feet; girth, 1 foot 2 inches at 5 feet; seeds abundantly.

2. Kinloch Hourn, Inverness-shire.—Planted 1891. 1905 —height, 13 feet; girth, 5 inches at 5 feet, 13½ at base.

3. Cromla, Corrie.—Sown 1905; planted 1906. Received from Kinloch Hourn.

IV. *Eucalyptus coccifera.* — Named from the coccus-like bloom on its bark; height, 40 feet.

1. Kinloch Hourn, Inverness-shire. — Planted 1887. 1895—"Several of the younger plants cut last winter to the ground; the older trees a good deal browned. One had bloomed when five years old" (Birkbeck). 1905—height, 28 feet; girth, 2 feet 7½ inches at 5 feet; spread, 23 feet.

2. Stonefield, west shore of Loch Fyne. — Sown 1881. 1895—height, 21 feet; girth, 15½ inches at 5 feet; bloomed 1895. 1905—height, 26 feet 8 inches; girth, 2 feet 4 inches at 5 feet; spread, 18 feet.

3. Roseneath U.F.C. Manse. — Planted 1886. 1895—

height, 15 feet. Bloomed June 1891, when only 6 feet 7 inches high. 1905—height, 19 feet 6 inches: girth, 4 feet 4 inches at 2 feet $3\frac{1}{4}$ inches; spread from east to west, 25 feet 4 inches—greatest spread of any.

4. Free Church, Corrie.—Planted 1897. 1905—height, 7 feet. Only a wall $5\frac{1}{2}$ feet in height and the breadth of the highway separates it from the sea at high water. Planted to see if it could stand the sea-blast:—Successful.

V. *Eucalyptus urnigera.*—Tasmania. Height, 150 feet.

1. Kinloch Hourn, Invergarry, Inverness-shire.—1905—height, 24 feet. The tallest in Scotland.

2. Cromla, Corrie.—Sown 1894; planted 1897. 1905—height, 10 feet; girth, 3 inches at 5 feet.

3. Roseneath Established Church.—Planted 1883. Height, 12 feet in 1895. "Died afterwards in a mild winter without apparent cause" (Rev. A. Warr, M.A.).

VI. *Eucalyptus pauciflora* (drooping gum; white gum; swamp gum).—South Australia and Tasmania. Height, 60 to 70 feet; leaves 4 to 6 inches long; droop, as do also the twigs; leaves turn their edges to the light.

This is the most elegant of the Eucalypts which grow in Arran. The tree at Craigard, Lamlash, is also the oldest Eucalypt growing in the west of Scotland. The name *pauciflora* is in Arran altogether misleading, as there it blooms and seeds abundantly.

The drooping habit of this species renders it specially suitable for an avenue. As far as I could judge, without careful examination, it is this species that lines the avenue from Cairo to the Pyramids. This it was which suggested to me to plant several of it at the foot of the garden at Cromla, that, Cairo-like, they might there overhang the highway. The seed from which the Lamlash tree grew was gathered on the Blue Mountains (4100 feet), New South Wales, by Mr. Bailey, Government Botanist, Queensland, and by him most kindly sent to the writer. It is fortunate that this elegant species stands a considerable degree of frost. At Kilmarnock last winter (1904–5), seedlings in a pot were accidentally left in the ground on a night when the mercury in the garden behind the house sank to 9 degrees (23 degrees of frost); and beyond losing most of their leaves and a few twigs the plants were uninjured. The border on which they grew is in front of the house, and looks to the south. This would by several degrees lessen the cold.

1. Craigard, Lamlash.—Sown 1879; planted 1880. 1895—height, 25 feet; bole, 12 feet; girth, 2 feet $3\frac{1}{4}$ inches at 5 feet; 1905—has made little progress, as, to prevent it being blown down, as had befallen a blue gum near to it, severe lopping twice took place, the second leaving nothing save the trunk. It is now recovering.

2. Cromla, Corrie.—Sown 1904; four planted 1905. Raised from the seed of the tree at Lamlash.

3. Balnacoole (Mr Allan's), west side of Arran.—Sown 1904; planted 1905.

VII. *Eucalyptus cordata* (leaves heart-shaped).—Height, 50 feet. Leaves have the hue, bloom, and the perfume of the blue gum (*E. globulus*). No Eucalypt which grows in Arran so early manifests the influence of spring. The writer this year visited Egypt. He was at Cairo and the Pyramids on the third week of March. There he saw several Eucalypts, yet not so many species as grow in Arran. Not one of them was in bloom. On his return, he was in Arran on the first week of April. Great was his surprise to find at Cromla *Eucalyptus cordata* not merely in bloom, but giving proof that it had been for a couple of weeks, as the flowers on one axil were not only fully expanded, but those on the next axil—nearer to the point of the twig—were beginning to unfold. Arran earlier than Cairo, in Egypt!

1. Kinloch Hourn, Inverness-shire.—Planted 1894. Twice lost 6 feet of top by a storm. 1905—height, 34 feet; spread, 20 feet; girth, 1 foot 10 inches at 5 feet.

2. Cromla, Corrie.—Planted 1895. Height, 3 feet 7 inches. 1905—height, 26 feet; girth, $13\frac{1}{4}$ inches at 5 feet; spread. 19 feet. The flower-buds appear in the month of August.

3. Silverbank, Whiting Bay.—Place exposed. Planted 1892. Leaves and small twigs destroyed by the frost of 1894–5, but the tree recovered. It was afterwards stolen.

VIII. *Eucalyptus amygdalina* (almond-leaved gum—name inappropriate).—" Leaves small, narrow, dark green, shining; bark rough, colour brownish" (Müller).

This is a most striking and imposing tree, and in appearance totally different from any other Eucalypt growing in Arran. It was given me by Mr. Birkbeck. The Cromla tree is, I believe, the only example of this species in Scotland in the open air. It is the most beautiful tree in Arran.

1. Cromla, Corrie.—Planted autumn of 1895; transplanted, in 1897. 1905—height, 20 feet; girth, 9 inches at 5 feet. It grew very rapidly, and, lest it should be blown down, it was twice topped. Flower-buds this year in August.

IX. *Eucalyptus globulus* (blue gum).—Victoria and Tasmania. Height, 350 feet. The best Eucalypt oil is made from this species. Cattle may taste it—will not do more. This is the favourite Eucalypt. It is one of the most notable trees in the world, being famed for its rapid growth; great size; the excellence of its timber; the large amount of ozone generated by its leaves; the antiseptic nature of its volatile oil, valuable as a medicine; the great amount of moisture absorbed by its roots fitting it for the drying of swamps; the attractiveness when the tree is young of its leaf—blue, softened by bloom and diffusing a sweet, pungent odour. There is a variety not uncommon. In it the branches part from the stem at shorter intervals and are more spreading, while the leaves are smaller, lighter in colour, and beautified by a more abundant bloom. It is more characteristically a "blue gum."

The writer this spring (1905) visited Damascus (lat. 33°; 2300 feet above sea-level), the capital of Syria, and bordering on Arabia. Outside of the south-west gate he found a wood composed principally of Eucalypts of various kinds. To his surprise he noticed that about two-thirds of the trees had lost all their leaves—probably many so injured that they would not recover. On inquiry he learned that the frost of the previous winter had been of extraordinary severity, the mercury one night having registered 17° F.—15° of frost. He afterwards learned that the temperature had at the same time been as low at some parts of the Riviera. How strange that in Italy and the south of France and at Damascus the cold last winter should have been much more severe than in the island of Arran, in Scotland!

1. Craigandarraich, Tighnabruaich, Kyles of Bute.—Planted 1890. The only blue gum in Scotland that survived the winter of 1894–5, and even it was cut down to within 3 feet of the ground. The Lamlash tree had previously been blown down. The minimum temperature that

winter at Tighnabruaich was 19° F. 1905 (August)—height, 54 feet; spread, 22 feet; girth, 3 feet 9 inches at 5 feet.

2. Craigandarroch, Blairmore, Argyllshire.—Planted about 1896. 1905—height, 30 feet; girth, 2 feet 4 inches at 5 feet.

3. Cromla, Corrie.—Sown 1902; south of England seed. Planted April 1905. 1905 (July)—height, 7 feet 6 inches; girth, 2 inches at 1 foot 6 inches from ground.

4. The Lodge, Whiting Bay.—Several trees. Height of the tallest, 30 feet. Yearly polled. The branches are sent to the eminent physician, Sir Alfred Cooper, London, the owner of The Lodge.

X. *Eucalyptus botryoides* (white mahogany).—New South Wales and Queensland. "One of the most stately of Eucalypts" (Müller). "Stands more frost in winter than *E. globulus*—less in spring. More excitable" (Birkbeck).

Cromla, Corrie.—Planted 1896. Grew well for several years. Killed, as also a plant of *E. coccifera*, by the sap of a large dungstead formed on the opposite side of a wall and on a higher level.

XI. *Eucalyptus rudis* (slender). — Western Australia. Height, 80 feet. "River-banks and around swamps" (Müller). The foliage of this species is very beautiful—pinky blue softened by a pleasing bloom. The tree the gift of Mr. Birkbeck.

Cromla, Corrie.—The only example in the open air in Scotland. Planted 1887. 1895—height, 14 feet; girth, 5 inches at 5 feet. Cut to the ground by the frost of 1894–5, but sprouted from the root. 1905—height, 22 feet; girth, 8 inches at 5 feet.

XII. *Eucalyptus regnans* (the giant Eucalypt).—S.E. Australia. "Sheltered and well-watered forest glens. The tallest tree in the world. A tree of this species cut in the Otway Range, Victoria, had a height of 415 feet, and another tree had a girth of 56 feet at 5 feet" (Müller). This tree is by many naturalists regarded as a variety of *E. amygdalina*; but in foliage and style of growth they altogether differ. *E. regnans* is also more delicate than *E. globulus*.

Cromla, Corrie.—Planted 1892. The only example in Scotland in the open air. The gift of Mr. Birkbeck. 1894 (autumn)—height, 10 feet 5 inches. Cut to the ground by the frost of the following winter, but sprouted from the base. 1905—height, 13 feet; girth, 3½ inches at 5 feet.

VARIOUS EXTRA-TROPICAL TREES AND SHRUBS GROWING IN ARRAN.

I. *Acacia decurrens* (Sydney feather-leaf or fan-wattle).—New South Wales and Southern Queensland. Height, 30 feet. The Arran plant was the first of the species to be planted in Scotland in the open air. Arran is still its only Scottish habitat.

The leaf of this acacia is specially tender, airy, and elegant, and has larger leaflets and at longer intervals than any other acacia. It is the most beautiful leaf in Arran. A notice of the Arran plant which Baron Müller happened to see led him to send a letter to the writer about it. The original plant died, but there are now two at Corrie. Perfect shelter and a moist atmosphere develop the leaf in fullest beauty. "It is hardier than *Eucalyptus globulus*" (Müller).

1. Craigard, Lamlash.—Planted 1882. Height in 1892, 12 feet; girth, 1 foot $3\frac{3}{4}$ inches at 5 feet; circumference of branches, 37 feet. Died in 1892 without apparent cause. Never bloomed.

2. Cromla, Corrie.—Sown 1900; planted 1902. 1905—height, 8 feet; girth, 2 inches at $2\frac{1}{2}$ feet.

3. Corrie Hotel.—Sown 1900; planted 1903. Situation not so sheltered as at Cromla.

II. *Agalma tomentosum* (Araliaceæ).—Planted 1883. This is a very singular plant. The leaves resemble those of the horse-chestnut. It was sent me from the Royal Botanic Garden, Edinburgh. 1895—height, 9 feet 7 inches; girth, $5\frac{3}{4}$ inches at 5 feet: length of leaf-stalk, 2 feet 3 inches; breadth of leaf, 2 feet $1\frac{1}{2}$ inches. 1905—height, 23 feet $3\frac{1}{4}$ inches; girth, 13 inches at 5 feet. Never bloomed. I have not seen this tree elsewhere in the open air.

III. *Araucaria imbricata* (monkey puzzle).—Chili and Patagonia. Height, 150 feet. "Agrees with the moist atmosphere of the sea-coast." "It is the only tree from the southern hemisphere which, save in exceptional circumstances, attains in Britain the size of timber."

1. Brodick Castle.—Planted 1854 or 1855. 1895—girth, 4 feet $11\frac{1}{4}$ inches at 5 feet. 1905—height, 55 feet; spread, 28 feet; girth, 6 feet at 5 feet.

2. Blairbeg (Dr Fullarton's), Lamlash (fronting the pier).

—Planted 1853. 1905—height, 50 feet; spread, 23 feet; girth, 5 feet 4 inches at 5 feet.

3. Cromla, Corrie.—Planted 1861. 1895—height, 33 feet; girth, 2½ feet at 3 feet. 1905—height, 42 feet; girth, 3 feet 7 inches at 5 feet; spread, 23 feet.

4. Free Church, Whiting Bay.—Planted about 1878, with the other at the church gate. Transplanted. 1905—height, 29 feet; spread, 15 feet; girth, 1 foot 11 inches at 5 feet. Now growing very rapidly; yet the soil is very wet, but not sour. At the side of a stream.

IV. *Camellia Sasanqua plena-alba.*—China. The south wall of an outside stair at Cromla is adorned by the large dark-green leaves of this handsome Camellia. It is specially attractive in winter and spring, as it begins to bloom in January and continues to unfold its flowers till May. A few drop should the frost be severe. I may add that for the last ten years a change has come over the flowers. Originally, as the name denotes, they were white; but crimson blooms began to appear, and now all are of this colour.

Cromla, Corrie.—Planted 1886. 1905—height, 5 feet; girth, 4 inches at 9 inches.

V. *Camellia reticulata*, var. *Donckellaari.*—Planted 1890. A standard. 1905—height, 5 feet. Blooms abundantly, but none open till the end of spring. None fall in consequence of severe frost.

VI. *Ceanothus Veitchianus.*—The Lodge, Whiting Bay.

VII. *Clianthus puniceus* (glory pea of New Zealand).—The Lodge, Whiting Bay. Blooms abundantly.

IX. *Corynocarpus lævigata* (karaka of New Zealand).—60 feet.

Cromla, Corrie.—Sown 1899; planted 1906. Presented by Hugh Fullarton, Esq.

X. *Cunninghamia sinensis* (broad-leaved Chinese fir).

Brodick Castle Garden.—Planted 1854. 1905—height, 8 feet 6 inches; spread, 7½ feet. Was nearly killed by the winter of 1894–5. I have not seen this plant elsewhere in the open air.

XI. *Cupressus macrocarpa* (the Monterey cypress).—"One of the quickest in growth of all Conifers" (Müller). 150 feet.

Free Church, Corrie.—Planted 1896. The only example in Arran. 1905—height, 8 feet. Has been frequently cut back, as the spot where it grows is much exposed to high winds.

XII. *Desfontainea spinosa.*—Chili and New Granada. Introduced 1853. Flowers tubular, an inch long, crimson outside, yellow within. At Cromla, magnificently in bloom in July, and a few flowers in mild winters till February.

1. Cromla, Corrie.—Planted 1865. Now the oldest and largest in Scotland in the open air. 1895—height, 9 feet 10 inches; girth 1 foot 5 inches at 2 inches from the ground; circumference, 21 feet. 1905—height, 11 feet 6 inches; girth, 1 foot 10½ inches at 6 inches; circumference, 30 feet.

2. Alpine House, Corrie.—A hedge of *Desfontainea.*

XIII. *Eurya latifolia variegata.*—Japan. This variety introduced in 1871.

Strathwhillan, Brodick.—Planted 1887. I have not seen it elsewhere in the open air. 1895—height, 2½ feet; spread, 3½ feet. 1905—height, 2 feet 11 inches; circumference, 6 feet 2 inches.

XIV. *Fuchsia magellanica* (the common fuchsia of Arran).

Cromla, Corrie.—Planted 1833. The first in Arran. Now being supplanted by the *Veronica.*

XV. *Fuchsia microphylla* (the Mexican small-leaved fuchsia).—Introduced 1828.

Cromla, Corrie.—Planted 1878. Flowers late and continues in bloom till January.

XVI. *Griselinia macrophylla.*—New Zealand. More handsome than *G. littoralis.*

Craigard, Lamlash.—Planted 1889. The only place in Scotland where this plant grows in the open air. Here never suffers.

XVII. *Lomatia ferruginea.*—Akin to *Grevillea robusta.*

Cromla, Corrie.—Planted 1895. A standard. 1905—height, 12½ feet; girth, 4¼ inches at 5 feet. Has not bloomed.

XVIII. *Metrosideros lucida* (New Zealand rata or bottle-brush tree). Cromla, Corrie.—Planted 1899. 1905—height, 3 feet 9 inches; girth, 3 inches at 2 inches. Has not bloomed.

XIX. *Myrtus communis* (common myrtle.)—Planted 1862.

Cromla.—In favourable seasons blooms abundantly in September and October. Never berries.

XX. *Nymphæa.*—The Lodge, Whiting Bay.—Flowers white, with yellow centres, 4½ inches in diameter. Occasionally nearly fifty flowers open at the same time.

XXI. *Passiflora cœrulea.*—Cromla.—On wall of outside stair.

XXII. *Picea Morinda* (Himalayan weeping pine).—Brodick Castle grounds. Planted 1854 or 1855. 1895—girth, 4 feet 2 inches at 5 feet. 1905—height, 65 feet; girth, 5 feet 9 inches at 5 feet; spread, 30 feet; never suffers.

XXIII. *Pinus insignis.*—The most beautiful in hue of all pines. Free Church, Corrie.—Planted 1896. In good health.

XXIV. *Photinia eriobotrya* (the loquat tree of China and Japan).—Cromla, Corrie.—Planted 1897. 1905—height, 8 feet; girth, 5 inches at 5 feet; has not bloomed.

XXV. *Photinia serrulata.*—Planted 1879. 1895—height, 12 feet. Leaves of beautiful crimson when young, and also when old. 1905—height, 16 feet; girth, 1 foot 2½ inches at 2½ feet; has not bloomed.

XXVI. *Pittosporum Ralphii.*—Craigard.—Planted 1886. Blooms.

XXVII. *Pittosporum tenuifolium.*—Beautiful delicate leaf. Cromla and Free Church, Corrie.—Neither has bloomed.

XXVIII. *Pittosporum.*—Craigandarroch, Blairmore, Argyllshire.—Though not growing in Arran, I give this plant, as it is said to be the tallest Pittosporum growing in the open air in Scotland.

XXIX. *Platanus orientalis* (Oriental plane).—Bank above Brodick Castle low garden.—1895—girth, 4 feet 2 inches at 4½ feet. Much broken by storm of winter 1894. 1905—height, 43 feet; girth, 4 feet 7 inches at 5 feet; spread, 36 feet.

XXX. *Quercus suber* (cork oak).—Evergreen, Spain; 40 feet. Brodick Castle grounds. — Planted 1854 or 1855. 1895—girth, 3 feet 2 inches at 4 feet 2 inches; lost its leaves and small twigs in frost of 1895. 1905—height, 27 feet; girth, 5 feet 4 inches at 5 feet; spread, 30 feet.

XXXI. *Fagus obliqua.*—Received from Kew Gardens in spring of 1905. Brodick Castle grounds.—Height, 3 feet 4 inches.

XXXII. *Rhododendrons.*—Cromla, Corrie.—The following Rhododendrons grow at Cromla:—*Rhododendron arboreum*, *R. Falconeri*, *R. Gibsoni*. *R. Thomsoni*, *R. virginalis*. *Rhododendron arboreum*, planted 1853, did not begin to bloom for fully thirty years. The twigs which bear the blossoms are within the bush, and so hid by leaves and longer twigs that the flowers, which are not very numerous, are not seen unless one is looking for them. *Rhododendron Falconeri*, which grows in India to the height of 50 feet, promises at Cromla to become magnificent. Planted in 1897, it already attracts much attention, for its leaves, apart from foot-stalk, measure 15½ inches in length by 6½ in breadth. Has not yet bloomed.

XXXIII. *Rosa Banksiæ.*—Cromla.—Planted 1875 on the wall of the house looking eastward. Height, 20 feet. Buds occasionally, but very seldom any bloom.

XXXIV. *Senecio rotundifolius.*—New Zealand. Height, 30 feet. A present from the Royal Botanic Garden, Edinburgh. Drimla Lodge, Kildonan, Arran.—Planted 1897. Though near to the sea and fully exposed to the sea-blast, its foliage was uninjured. A great success and a most desirable acquisition for a stormy coast. At the end of five years was most unfortunately blown down when the family were from home, and did not recover.

1905.

SOME OF THE MORE TENDER SHRUBS THAT HAVE DONE BEST AT KINLOCH HOURN, INVERNESS-SHIRE. Only those are mentioned which have been out for several years.

		Introduced.
Abelia rupestris	China	1844
serrata	”	”
Abutilon vexillarium	Chili	1837
Aciphylla Colensoi	New Zealand	1875
squarrosa	”	”
Akebia quinata (20 ft. on house)	Chusan	1845
Andromeda arborea	U.S.A.	1752
Azara Gilliesi (10 ft.)	Chili	1859
microphylla (20 ft.)	”	1873
Azaleas	India, China, Japan	
Benthamia fragifera	Nepaul	1825
Berberidopsis corallina	Chili	1862
Calceolaria violacea	”	1853
Camellias—in var.		
Carpenteria californica (8 ft.)	California	1880

Caryopteris mastacanthus	China	1844
Chamærops excelsa	Japan	1844
humilis	S. Europe, N. Africa	1731
Choisya ternata (11 ft.–12 ft. through)	Mexico	1825
Cistus ladaniferus	Spain	1629
maculatus		
Citrus trifoliata	Japan	
Clerodendron trichotomum	,,	1800
Colletia cruciata	Rio la Plata	1824
spinosa	Chili	1823
Cordyline australis	New Zealand	1823
Cornus Kousa	Japan	1847
macrophylla	Kumaon	1827
Crinodendron Hookerianum (5 ft.) (Tricuspidaria dependens)	Chili	
Coprosma lucida	New Zealand	
Daphniphyllum glaucescens	China	
Desfontainea spinosa	Chili	1853
Diplopappus chrysophyllus	New Zealand	
Erica arborea	S. Europe	1658
australis	Spain	1769
lusitanica	Portugal	
Escallonia, eleven species, of which the best are:—		
floribunda	New Grenada	1827
Langleyensis (hybrid, E. macrantha and E. Philippiana)		
Philippiana	Valdivia	1873
pterocladon	Patagonia	1854
Eucalyptus coccifera	Australia	
cordata	,,	
Gunnii	,,	
Whittinghamei	,,	
Qy. Tasmanian var.	Tasmania	
urnigera	Australia	
vernicosa	Tasmania	
Eucryphia pinnatifolia (7 ft.)	Chili	1880
Eugenia Ugni	Valdivia	1845
Fabiana imbricata	Chili	1838
Genista æthnensis (10 ft.)	Sicily	1816
Grevillea sulphurea	Australia	
Griselina littoralis (7 ft.)	New Zealand	1872
Hydrangea aspera	Himalayas	1889
hortensis (blue)	China	1790
Mariesii		
Otaksa	Japan	
paniculata grandiflora	,,	1874
quercifolia	Florida	1803
Thos. Hogg	Garden var.	
Illicium religiosa	Japan	
Indigofera floribunda	India	1842
Koelreuteria paniculata	China	1763
Leptospermum scoparium	New Zealand	1876
Lomatia ferruginea (8 ft.)	Chili	1851
Mitraria coccinea	Chiloe	1848
Muehlenbeckia complexa	New Zealand	1870
Notospartium Carmichaeli (8 ft.)	,,	1883

Olearia Gunnii	Tasmania	
Haastii (6 ft.)	New Zealand	
nitida	"	1886
macrodonta (9 ft.–14 ft. through)	"	"
Ozothamnus rosmarinifolius	Australia	1827
Phillyrea Vilmoriniana	Asia Minor	1885
Phormium Colensoi	New Zealand	1868
tenax	"	
variegata	"	
atropurpurea	"	
Phygelius capensis	Cape of Good Hope	1855
Piptanthus nepalensis	Himalayas	1821
Pittosporum undulatum (6 ft.)	Australia	1789
Prumnopitys elegans	Chili	1860
Raphiolepis ovata	Japan	1865
Rhododendrons	India	
Rhynchospermum jasminoides	China	1846
Schizophragma hydrangoides (30 ft. on house	Japan	1879
Solanum crispum	Chili	1824
jasminoides (20 ft. on house)	S. America	1838
Stephanandra flexuosa	Japan	1870
Stuartia pentagyna	N. America	1785
Pseudo-Camellia	Japan	1878
Styrax japonica	"	"
Xanthoceras sorbifolia	China	1870

PLANTS OF THE BAMBOO FAMILY GROWING AT ACHNASHIE, ROSENEATH, N.B., 29th August 1905.

1. *Thamnocalamus Falconeri* or *Arundinaria Falconeri*.—Measured, 31st October 1904, 20 ft. 3½ ins. August 1905—Circumference of a cane 5 ft. from ground, 2 ins.; circumference of clump, 5 ft. from ground, 20 feet.

There are many plants of this bamboo in Achnashie grounds. The measurements are from the oldest and largest clumps. Some of the more recent clumps are nearly as fine as the oldest. This species of bamboo flourishes splendidly at Achnashie.

This bamboo was brought to Parkhill, Forfarshire, by Sir Henry Ramsay from Khamaun, North-Western Himalayas. It came to Achnashie from Forfarshire in 1871, very small plants in pots. The plants were kept in pots for some years, and were taken indoors in winter. In 1880 the experiment was made of planting out part of the plants from the pots. The plants did well, and the present large clumps were planted where they are now in spring 1885. The stalk attains full height in its first year. In the second and following years it puts forth side leaves and short twigs.

2. *Thamnocalamus spathiflorus* or *Arundinaria spathiflora*.—From North-Western Himalayas. Bought and planted in 1900. Growing well this year. Height, August 1905, 9 ft.; circumference 5 ft. from ground, 6 ft.

3. *Arundinaria nitida*.—Bought and planted 1900. Growing well. Height, 8 ft.

4. *Arundinaria japonica Metake*.—Got from Dr. Watson, Largs, in 1896. Grows freely. Height, August 1905, 10 ft. 8 ins.; cane circumference 5 ft. from ground, 1½ ins; clump circumference 5 ft. from ground, 11 ft.

5. *Arundinaria Simoni.*—Bought and planted in 1898. Height, 5 ft.; grows very well. Seeded 1904 and 1905. Young plants raised from its seed in autumn of 1905.

6. *Arundinaria Simoni*, var. *striata.*—Bought and planted 1900. Height, August 1905, 11 ft.; circumference 5 ft. from ground, 12 ft.; Does well.

7. *Arundinaria Hindsii.*—Bought and planted, 1901. Height, August 1905, 6 ft.

8. *Bambusa disticha.*—Bought and planted, 1900. Height, August 1905, 2 ft.

9. *Bambusa fastuosa.*—Bought and planted, 1900. Height, August 1905, 6 ft.

10. *Bambusa pygmæa.*—Bought and planted, 1900. Height, August 1905, 9 ins.; clump 15 ft. in circumference.

11. *Bambusa nana.*—Bought and planted, 1901. Height, August 1905, 3 ft. 6 ins.

12. *Bambusa palmata.*—Bought and planted, 1898. Height, August 1905, 5 ft.; circumference, 12 ft.

13. *Bambusa Quilioi.*—Bought and planted, 1900. Height, August 1905, 3 ft. 6 ins.; not flourishing.

14. *Bambusa tessellata.*—Bought and planted, 1900. Height, 1 ft. 6 ins.

15. *Phyllostachys castillonis.*—Bought and planted, 1900. Height, August 1905, 2 ft. 9 ins.; not flourishing.

16. *Phyllostachys aurea.*—Bought and planted, 1898. Height, August 1905, 7 ft.; flourishing. Circumference 5 ft. from ground, 9 ft.

17. *Phyllostachys henonis.*—Bought and planted, 1898. Height, 10 ft., August 1905; circumference, 12 ft. 5 ft. from ground; flourishes excellently; flowered 1905.

18. *Phyllostachys nigra.*—Bought and planted, 1900. Height, August 1905, 5 ft. 6 ins.; flowered 1904 and 1905.

19. *Phyllostachys violascens.*—Bought and planted, 1898. Height, August 1905, 9 ft.

20. *Phyllostachys mitis.*—Bought and planted, 1900. Height, 8 ft., August 1905; circumference, 9 ft., 5 ft. from ground; flourishing.

21. *Phyllostachys nigra punctata.*—Bought and planted, 1900. Height, August 1905, 4 ft. 6 ins.

22. *Phyllostachys viridi-glaucescens.* — Bought and planted, 1900. Height, 8 ft.; circumference, 15 ft., clump 5 ft. from ground; flourishing.

23. *Phyllostachys viminalis.*—Bought and planted, 1900. Height, 2 ft. 6 ins., August 1905.

Summary.

Thamnocalamus or Arundinaria	2
Arundinaria	5
Bambusa	7
Phyllostachys	9
	23

MEETING OF THE SOCIETY.

January 11, 1906.

J. Rutherford Hill, Esq., Vice-President, in the Chair.

Mr. James Fraser was elected Resident Fellow.

Mr. Harry Sanderson was elected Non-Resident Fellow.

The following gentlemen, recommended by the Council, were elected Associates:—

Mr. R. L. Harrow, Royal Botanic Garden, and Mr. L. Stewart, 28 Rodney Street.

The gift of a collection of Ceylon Ferns from Pericles Joannides, B.Sc., was intimated.

Dr. R. Stewart MacDougall exhibited a series of specimens illustrating the life-history of *Pinus sylvestris*.

Mr. J. F. Jeffrey gave a short note on Don's original specimen of *Silene alpestris*.

Captain Norman, R.N., showed branches of *Pinus* attacked by the Pine-Aphis.

Mr. R. L. Harrow showed a series of Plants in Flower from the Royal Botanic Garden.

Mr. L. Stewart showed *Octoblepharum albidum*—a tropical moss of wide distribution. This was growing in the Royal Botanic Garden with plants sent from the West Indies and also from Liberia.

A series of slides illustrating the growth and appearance of the chief British Forest Trees was shown on behalf of Dr. A. W. Borthwick.

H. F. Tagg, F.L.S., gave a communication with photos on the Pioneer Plants of the Volcanic Mud of Tarawera. Grasses and ferns seemed to be the first forms to settle on the denuded area.

Mr. TAGG also exhibited a Mangrove Seedling.

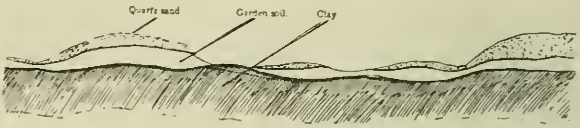
The following communication was also read:—

THE SAVANNAHS OF GUYANA. By EDUARD ESSED.

If we travel in Guyana from north to south along the rivers, we shall be highly impressed by the luxuriant plant-growth, forming high walls of dense, nearly impenetrable forests, in which the Mangrove—in the lowlands, the Avicennias—in the upperlands, are the predominant trees, whilst thorny *Drepanocarpus lunatus* (a papilionaceous plant), *Desmoncus horridus* (a palm), *Paritium elatum* (Malvaceæ), *Pancratium caribæum* (Amaryllidaceæ), as fringes of the forest, are hanging and swaying in the water several metres from the actual river bank.

The same vegetation continues along the numerous fresh-water branches or creeks, but here we find the *Pachira aquatica*, the never-failing *Calladium arborescens* (one of the largest Aroids), the *Euterpe oleracea*, *Manicaria saccifera*, changing the character of the vegetation; whilst arboreal Rubiaceæ, Papilionaceæ, Apocynaceæ, Bignoniaceæ, etc., as so many pillars support the garlands of the tropical forests; the lianes which, very often, tie together the crowns of the trees on both sides of the not more than 30 to 50 feet broad streamlet, form above the water an arch, in which thousands of birds and insects are lulling each other to sleep with their diverse nocturnal tunes, the expressions of their delight in the well-deserved rest after a busy, trying day. If we look on the map of Dutch Guyana by W. L. Loth, we see the geological formation roughly indicated by three different colours. The northern part is a strip of land 50 to 60 km. broad, running from east to west parallel to the sea-shore. This part is purely alluvial, and consists mainly of blue clay, here and there traversed by vertical layers of sea-shells, the deathbed of millions of Molluscs in remote antiquity. Here the vegetation is fairly continuous. The southern part is the hilly and mountainous "hinterland," with its Urwälder, for the most part unknown; the middle part, a strip widening from 30 km. in the east to 100 km. in the west, is the flattest part of the diluvium, with only few scattered hillocks—in some regions a merely undulating plain. It is in this part that we find the savannah through the whole breadth of the country,—with the exception of the forest-tracts along the rivers, as said before.

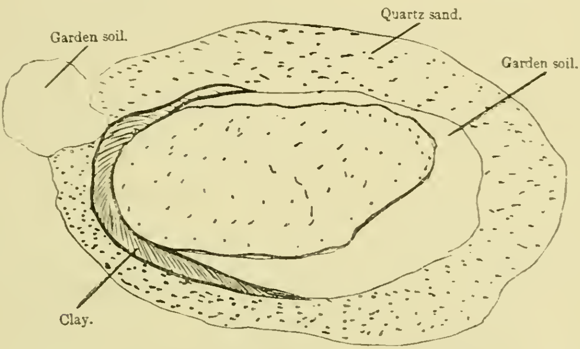
What is the savannah in Guyana? According to the native conception, the savannah is an open tract covered with low plants, a few trees scattered here and there, and surrounded by forest. This conception corresponds very well with the description given by Schomburgk, as seen in Professor Schimper's book on Plant-geography, Part II., page 327: "Forests—I have termed them oases—sometimes miles across, sometimes of less extent, most frequently with a



Vertical section through the soil of the Savannah.

circular outline, rise out of the savannah like islands from the sea," which gives Professor Schimper himself reason to say: "Not a uniform formation, spread over a wide area, but a richly differentiated, undulating, park-like country, in which different forms of woodland and grassland partake, although the latter predominates." This description, however, as well as the native conception, is vague, too vague to give a real impression of the savannah. But there is more about it in Professor Schimper's book; on page 360, Part II., we find again: "It (thorn-woodland) alternates frequently with the savannah, and in this case, as in all dry districts, edaphic influences are in the first place responsible for the change in the character of the vegetation, since savannah prevails on a stiffer soil that is superficially wetted by the rain, whereas woodland occupies a sandy soil that is very permeable to water." Nothing is more beside the truth than this, so far as Guyana is concerned. On the contrary, the soil of the savannah in Guyana consists, as shown in annexed figure, of three different layers, of which the upper one, 1 to

3 feet thick, is totally or mainly coarse quartz sand; the second layer, a mixture of sand and decomposed vegetable matter, called by the natives *blakka doti* or black soil; and the third layer, a more or less loose, reddish clay, a detritus of old laterite rocks: more about this later on. Further on, pages 363 and 364, we read again: "The appearance of a tropical savannah remains always essentially the same, at least in plains. Tall grasses, in many districts exceeding the height of a man, spring up in dense tufts, separated by bare intervals of soil, which is very variable physically as well as chemically, and is frequently coloured red by iron oxide. On high plateaux the grass is shorter, frequently not



Surface View.

taller than in our meadows, and more intermingled with herbaceous perennials and undershrubs. At greater or less distances apart trees appear, usually as stunted, gnarled dwarf-trees, resembling our apple-trees, but occasionally as lofty individuals, which as a rule belong to characteristic species not present in the forest. Besides dicotyledonous trees, palms also occur in savannahs." According to this description the savannah of Guyana, situated but little above sea level, and even for four to six months of the year, sometimes longer, flooded by the creeks and rivers, which have not sufficient capacity to drain the enormous amount of water falling from March to July at least, should present to us tall grasses exceeding the height of a man, in dense tufts, etc. Well, the grasses are there, but never reaching and of course never exceeding the height of a man: the grasses are there, but seldom in dense tufts; or the grasses are not there, because the savannah is *not always* grassland. Very often, as on the savannahs to the east of the Surinam river, we find only here and there small patches of grass and large parts of the savannah are without a sprig of grass. The description of the savannahs on high plateaux corresponds a little more to the savannahs of Guyana, which, however, are not on high plateaux. For although, according to my opinion, not very much of a European meadow is to be found in the savannahs of Guyana, nothing is more characteristic of them than the scattered trees, stunted, gnarled, dwarf, with occasionally lofty individuals, which belong to species not present in the forest. True is it always that palms occur in the savannah, especially the *Mauritia flexuosa*, perhaps one of the most grandiose palm-trees in the world. It is worth noting here that these scattered dwarf-trees differ again in species from east to west. In the savannahs of the Commewyne river, the stunted *Psidium gujave*, the poisonous *Euphorbia cotinifolia*, and the gregarious *Clibadium surinamense* prevail. In the savannahs of the Surinam river the *Euphorbia cotinifolia* disappears, the *Psidium* and *Clibadium* diminish, whereas the *Melicocca bijuga*, a Sapindaceous plant, and the *Anacardium occidentale* predominate. In the Lara district, however, the *Melicocca* disappears nearly entirely, while the other above-named plants are equally distributed amongst Apocynaceæ, Clusiaceæ, Rubiaceæ, Myrtaceæ, and are there in considerable numbers. On these savannahs we find, but not very often, a curious plant with a delicious fruit, the *Bati-bati*, of which, up till now, the scientific name is not known, and no description could be found in the notes of any one of the few botanists who have visited the Guyanas or studied their flora. Of the western districts I have few recollections; but, so far as I remember, grasses and grass-like Liliaceous plants prevail, Melastomaceæ frequently occur, Cactuses here and there appear on elevations of the undulating soil. If we consider now the descriptions given for savannahs in America, that given by Schomburgk, especially for Guyana, is vague, more metaphorical than satisfactory; the descriptions of the savannahs of Minas Geraes and other parts of Brazil can hardly be said to apply entirely to Guyana. What can be the reason that we, in the above-mentioned book of Professor Schimper, who undoubtedly collected the most reliable data for his book, do not find what we might expect for Guyana? It is possible that no other reliable data are available than those of Schomburgk, which we saw before are vague and unsatisfactory; and surely it is extremely difficult to give a correct description of this characteristic, tropical association after a short, rather hasty, exploration, perhaps only in one direction. How can one have a true impression of a vegetation which, in every corner, in all directions, keeps both a secret and surprise for us? Nowhere else is the vegetation so varied as in the savannahs: more than half the number of the plant orders in the Guyanas—and there are many—are represented here; every moment we may find a new or scarcely known species, convincing us that, only after a patient and exact exploration, it will be possible to give a satisfactory description of the savannah. For it is difficult to say what the typical character of this association is. Decidedly xerophilous plants are growing alongside pronounced hygrophilous plants, and amongst these, plants of a dubious or tropophilous character. But how to explain that? Well, we have to go back to the formation of the soil and the climatic influences. As seen above, the soil was mainly coarse quartz sand in the upper layer, with loose garden soil and clay underneath. This soil is manifestly permeable, but the layers are not everywhere of the same thickness, and here and there the upper layer alone or both the upper and middle layer disappear, leaving the under layer at the surface. It is evident that we have three distinct conditions before us, which will affect the vegetation. Then again, if we compare the data of the rainfall on Placer de Jong, situated in the savannah region, with the data of the rainfall in Paramaribo, we find for Placer de Jong an average of 2156·4 mm., and for Paramaribo an average of 2226·9 mm.; the highest and lowest in one year for Paramaribo respectively 2754·5 and 1240·1 mm.; for Placer de Jong 2719·5 and 1372·5 mm. It is notorious also that the temperature over the whole country is fairly equal and constant, and the relative humidity on the savannah a little less than in the forests; but the open savannah soil has the full benefit of the immense amount of dew that settles down during the cold nights in the dry season, where this dew is intercepted by the leaves of the trees in the forests, and but little reaches the soil. There are more factors worth considering: as I said before, the savannahs are inundated during a great part of the year, so that one can travel with great ease in a canoe from one place to another; again, there is practically no month in the year without rain; the driest months, September and October, show a rainfall of 50 mm.

Before finishing this brief account, it is perhaps desirable to say a few words about another peculiar association, known in Dutch Guyana as Bieri-bieri. These Bieri-bieris are only found along the coast. They are of a pronounced xerophilous character, which is brought about by the large amount of salts contained in the soil; for all the land on which we find the Bieri-bieri is at or under sea level, and is therefore flooded by the sea or the rivers at high tide. They correspond nearest to the description of the savannah in lowlands, given by Schimper on pages 363 and 364, to which I referred before. But it is perhaps necessary to add to this description that the grasses are all covered with dense, stiff hairs and provided with sharp, cutting edges—the native indicates them by the general term of Baboonneffie, *i.e.* Baboon knife—and further, that most of them are Gramineæ. Few other plants are scattered through these monotonous grass-plains. But now and then a small group of *Avicennias* or *Rhizophoras*, or *Calladium arborescens* and *Drepanocarpus lunatus*, show the places where shallow pools are formed in which now and then we may meet with one of the Lemnaceæ or Salviniaceæ and stiff, leafless Juncaceæ. Putting all these data together, one might arrive at a conclusion in regard to the character and origin of the savannahs of Guyana. I wish only to show that the last word has still to be said; however, this communication may be a forerunner of what I hope to be able to say about the savannahs, and other points, after my views are enlarged by the guidance which I shall feel so happy to receive from the University of Edinburgh.

MEETING OF THE SOCIETY,

February 8, 1906.

Professor BAYLEY BALFOUR, President, in the Chair.

Dr. R. STEWART MACDOUGALL gave an account of the attack by *Megastigma spermatrophus* on the seeds of *Pseudotsuga Douglasii*. This is the first time this insect has been recorded for Britain. It was pointed out that the genus was usually parasitic on other insects, but here almost certainly injurious to the seeds.

Dr. MACDOUGALL also showed two West Australian plants, *Lachnostachys verbascifolia* and *Trichinium Manglesii*—both marked xerophytes.

The PRESIDENT exhibited *Rhododendron parvifolium*, Adams, —rare in cultivation—which lends itself to layering and flowers early.

On behalf of W. ELDER, M.A., Dr. MACDOUGALL communicated a note on the Variation of the Leaf in the genus *Rubus*, with exhibition of specimens.

H. F. TAGG, F.L.S., gave an account of the water pores in *Lafoensia*.

The following communications were read :—

MEETING OF THE SCOTTISH ALPINE BOTANICAL CLUB, 1905, AT KILLIN. By ALEXANDER COWAN.

The members of the Club travelled to Killin by the afternoon train on Monday, 31st July, and, as usual, made the Bridge of Lochay Hotel their headquarters during their stay. There is a new landlord there since the last visit of the Club took place, who, like his predecessor, did all in his power to make the members and visitors comfortable.

On Tuesday, 1st August, the party drove to Loch na Lairige, in order to explore Meall nan Tarmachan. The day was fine to start with, but before long it became very wet, and continued so all the day—so much so, that most of the party left the hill and proceeded to walk home. The principal find of the day was *Cystopteris montana*, which had never been previously recorded on this hill; at all events, by any of the members of the Club.

The following rare Alpines were found:—*Carex atrata*, *Carex pulla*, *Draba incana*, *Juncus castaneus*, *Poa alpina*, *Salix reticulata*, *Saxifraga nivalis*, *Tofieldia palustris*, *Trollius europæus*. A plant of *Polystichum lonchitis* was found with twisted, crispy fronds; also plants of *Blechnum Spicant*, one very dwarfed and congested, the other caudate.

After the long and tiring day spent on Meall nan Tarmachan, it was decided to spend Wednesday, the 2nd August, in the neighbourhood of Killin, and to take things easily, in view of the proposal to climb Ben Lawers on the following day. Some of the younger members, however, decided to climb and botanize on Creag na Caillach and Fionn Lairige. The day proved an excellent one, as the air was cool; but late in the afternoon some showers fell.

The following plants were found:—*Athyrium alpestre*, *Dryas octopetala*, *Juncus castaneus*, *Juncus biglumis*, *Polystichum aculeatum* (at over 2000 feet), *Salix reticulata*, *Saxifraga nivalis*, *Vaccinium uliginosum*, *Viola amœna*. In addition to these, the President, who spent the day in visiting the Kinnel vine at Auchmore and fern-hunting in the neighbourhood of Killin, found a very tall and narrow form of *Lastrea montana*.

An early start was made from the hotel on the morning of Thursday, the 3rd August, by conveyance, in order to climb Ben Lawers, but unfortunately for the prospects of the party it was soon seen that heavy mist enveloped by far the larger half of the mountain. When the burn was reached, where the ascent by way of the corrie is usually commenced, the party divided into two, one half proposing to climb the mountain from this point, the other half continuing the drive as far as Lawers Inn, with the intention of making the ascent by the pathway and burn leading to Lochan à Chait.

Unfortunately, the first party had no compass with them, and by the time they reached and entered the mist they found it quite impossible to strike the proper direction.

The wind was blowing half a gale, and the mist was exceedingly thick, and something like two hours were spent in a fruitless attempt to gain the corrie; and it was well past mid-day when a sudden break in the mist showed the party that they were about two miles out of their proper course. As it was felt useless to make further attempts to reach the corrie, far less ascend to the summit of the mountain, there was nothing left for the party to do but reluctantly retrace their steps and make for Lawers Inn. Heavy rain had by this time come on, so that the shelter of the inn and its excellent scones and tea were most welcome. The second party ascending by means of the path did not attempt to go beyond the rocks near Lochan à Chait, and returned to the inn somewhat later than the first party, thoroughly drenched. As far as pleasure went, the day was quite spoilt by the wretched weather, and the list of plants found—viz., *Athyrium alpestre*, *Drosera anglica*, *Myosotis alpestris*, *Tofieldia palustris*, *Viola amœna*—is a very short one, though the members may be considered lucky to have found *Myosotis alpestris*. On the road to the hotel one of the members was lucky enough to find two or three distinct forms of *Lastrea montana*.

Friday, the 4th August, was spent in the neighbourhood of Killin, where again some varietal forms of *Lastrea montana* were found by two of the members. This day was also very wet, and altogether the week was one of the most unpleasant, as far as the weather is concerned, that has ever been spent by the Club, three days out of the four being very wet indeed; luckily, however, none of the members of the party are reported to have been any the worse of their experience.

The meeting broke up and the members returned home on the morning of Saturday, the 5th August.

Notes on the Flora of the Coast and Islands of Portuguese East Africa, with Photographs of Interesting Trees, Plants, and Forest Scenery. By J. A. Alexander, Director of Agriculture and Arboriculture, Beira.

I feel as if I were due my old Society a few notes upon this little-known territory, wherein my duties rest at present. Much that I have written is in the form of pamphlets and articles to the public press and scientific societies. I trust the members of this distinguished Society will accept my general botanical notes in that fraternal spirit that has always characterised the proceedings of the old Society. I am afraid many of the old members of my ken have passed away; still, our distinguished President I can remember in 1870, when I was a student under his learned father.

The recent visit of the British Association to Beira has renewed old memories and created fresh vigour in my old bones, also adding new friends to my already voluminous list. It is much to my regret that so few botanical members came this way from the Victoria Falls, and in the short visit here the only Edinburgh University members I conversed with were Professor Simpson and Mr. Marshall. I was curious to once again meet Dr. Noël Paton, an old and very active member of the Society.

Excepting Cape Colony, very few plants were to be found in flower, it being near the end of our dry season. I intend early in the year, if I can find a friend to join me, to visit the Victoria Falls and district on a collecting tour. Much can then be found of interest. I trust the British Association's visit will stimulate and enlarge scientific knowledge in South Africa. Any member coming this way will receive a real Scotch welcome. I am one of the few British subjects holding office under a Portuguese Government, known as the "Companhia de Mocambique." I find the Portuguese exceedingly kind people to work with.

In giving my description of the flora of this territory, I will classify and describe them under their due orders. I trust the photographs will give to the members an idea of the actual subjects they represent. For convenience I have demarcated this territory into three divisions:—

First. Coast-line and islands of a two-mile-wide belt.

Second. General low country, forty-mile-wide belt.

Third. Rising ground and mountains to Rhodesian boundary.

I find those divisions of the country describe the physical features, also the flora and fauna, in a very satisfactory distribution.

The coast-line from Beira to Lorenzo Marques is about five hundred miles, very irregular, with numerous inland bays extending from four to eight miles. The rivers flow from the watershed of the Rhodesian border, east and south-east, into the Indian Ocean.

Beira is situated in a land-locked basin at the mouth of the Pungue and Busi rivers, and the influence of the tidal wave extends for forty miles inland. Proceeding southwards, the first large bay is Sofala—a place long noted in history as a station frequented by the Phœnicians, passing into the auriferous regions of Africa. Sofala is one of the first forts erected by the Portuguese on this coast, early in the sixteenth century; now fallen into decay. It is worth mentioning that they conveyed the stones from Portugal. Timber they found in abundance, good hard red woods, of acacia and bruguiera, which resist the termites (white ants). Stones are not to be found on this coast suitable for building purposes. Numerous islands abound by the river mouths and inland creeks, almost of sand formation; and the vegetation denotes them of a not far removed period. Chiloane is one of the largest islands, about fifty miles from Beira; it was the first Portuguese settlement, possessing a fort and governor's residence, but all that power has long passed away. The island is about one mile wide and six miles long, and consists of cocoanut gardens and native habitations, and is also the residence of the Portuguese official known as Commandant.

The whole territory is divided into districts, and presided over by commandants, who administer civil and judicial control over the inhabitants. The natives on the seaboard are a strange mixture of races: Portuguese, Mahomedan Indians, and Cafirs; law-abiding and childlike in their habits, but very vain, and fond of wearing European clothing of gaudy colours. The natives of the interior are a much finer race, and have not yet acquired the vices of the Western races. From ages of a pastoral and hunting life, they do not take kindly to mining and agricultural labour when their white brother calls them to handle the pick and hoe. Nature has provided them abundantly with roots, fruits, seeds, cereals, and spirituous drink, each following in due season; so that it is only in the failure of any one of these products through a dry season that they are compelled to seek further aid. The next large inland bay is at Mambone, at the mouth of the Savi river, which flows through a rich pastoral country; that excellent fodder grass, *Panicum maximum*, has become naturalised. The largest bay on the coast is some twenty miles further south—Govuro, at the mouth of the river of that name. Its area is over thirty thousand acres, and almost enclosed by land, leaving a good entrance that small vessels can easily enter. The vegetation surrounding this bay is peculiar, being almost a cover of that Queensland tree, the *Casuarina equisetifolia*, which has become naturalised. No doubt the seed has been carried by wind or tide from the Zanzibar coast. The promontory at the point of this bay is known as Bartholomew Dias.

The next point of interest on the coast is the Bazaruto Islands, under the Lorenzo Marques government. Inhambane is the district north of Lorenzo Marques, and is one of considerable agricultural importance. Coffee, sugar, tobacco, and cocoanut-palm cover large areas. Minor products are largely grown. Petroleum oil springs have lately been discovered.

Since I have been going on giving you geographical notes. I will now turn to a few remarks on geological points. The present tide-line of the coast is very clearly marked by a coral reef running from south to north, and in examining the country I find that the high tidal mark reaches another reef of degenerated coral.

All over the low country for twenty miles inland, reefs of coral can be traced, generally running from five hundred to seven hundred yards distance apart.

The proper term, I believe, is dead coral stone, for it is of little value; wherever it appears on the surface it has become solidified from atmospheric action.

I trust members will forgive me for my introductory notes, and not consider that my paper should have been sent to our friends in Queen Street, the Royal Scottish Geographical Society. Geographical and geological sciences are so connected with botanical knowledge, that I find it difficult to leave them distinct from each other.

In consulting "Harvey's Flora Capensis," "The Flora of Natal," and the more recent work, not yet completed, "The

Flora of Tropical Africa," I find many plants appearing, no doubt the same species, under different descriptive names. The generic name remains the same. I may be correct in saying that the "Natal Flora" is identical with the flora of this territory, but owing to our wider geographical range our flora consists of many more species of plants.

Our silvan area cannot be touched by the whole of Natal, Cape Colony, and the Transvaal, and I may include a large portion of Rhodesia.

RANUNCULACEÆ.—*Clematis Kirkii*, *C. Stanleyi*, *C. grata*. These three species are common enough by the edges of forest and partly cultivated lands. In the higher ranges I have observed another species. *Thalictrum rhynchocarpum* is found in a few places within the coast-line. *Ranunculus pinnatus* is the only one I have noticed, and very common.

ANONACEÆ.—An order containing many forms of excellent tropical fruits—the custard apple, sour sop, sweet sop, and cherimoya. Not one of them yet grown in the territory, but a supply of seeds will soon be at hand. *Uvaria caffra* is a common shrub; the fruit is eaten by the natives. *Artobotrys monteiroiæ* is a climbing shrub, with edible fruit.

MENISPERMACEÆ.—*Cocculus villosus*: this is a very common creeper, extending its vines all over the ground, generally about as thick as a pea-straw. I have turned them to most valuable account in the making of baskets for agricultural purposes. They resemble string of a fibrous nature. *Cissampelos Pariera*, *C. torulosa*, both common climbers in the dry zone. *Stephania hernandifolia*, another twining shrub with edible fruit.

NYMPHÆACEÆ.—*Nymphæa stellata*, very abundant, covering all the ponds and wells on the coast.

PAPAVERACEÆ.—*Papaver gariepense*, plentiful in waste and cultivated ground. *Argemone mexicana*, common herb. *Fumaria officinalis*, found about native habitations very often.

CRUCIFERÆ.—*Cardamine africana*, common in cultivated ground. *Sisymbrium capense*, common annual. *Brassica strigosa*, found in cultivated and waste ground. *Lepidium sativum*, found only in the shaded pools and small streams. *Senebiera integrifolia*, *S. didyma*, both very common weeds.

CAPPARIDACEÆ.—*Cleome monophylla*, found in abundance. *Marua angolensis*, a small tree, fruit not eaten by natives or birds. *Cadaba* sp.: I cannot fix this shrub with any of the species enumerated in African flora. *Capparis citrifolia*, *C. corymbifera*, *C. Zeyheri*, all are found rambling over the bush cover in the low country.

MORINGACEÆ.—*Moringa pterygosperma*, known as the horse-radish tree, from the form of the pods; when half-grown are cooked as a curry and excellent to eat. This tree is one of the many introductions from India, so general on this coast.

BIXINEÆ.—*Oncoba spinosa*, a glabrous shrub with fragrant white flowers; the fruit has an ornamental appearance, and in a dry state is turned to various uses. *Aberia longispina*, a small tree with an edible berry, not very common.

POLYGALEÆ.—*Polygala capillaris*, *P. confusa*, *P. myrtifolia*, *P. rarifolia*. all common weeds of the cultivated and waste lands.

FRANKENIACEÆ.—*Frankenia pulverulenta*, a very common herb on the low shore lands.

CARYOPHYLLACEÆ.—*Dianthus prostratus*, generally to be found in the grass lands. *Silene Burchellii*, *S. gallica*, both found in the open grass plains. *Stellaria media*, very abundant everywhere on the low ground. *Spergula arvensis*, found in some localities. *Drymaria cordata*, common weed. *Polycarpæa corymbosa*, a profuse-flowering herb, rather common.

PORTULACEÆ.—*Portulaca oleracea*, common on sandy wastes. *P. pilosa* is also to be found. *Talinum caffrum*, another common weed. *Tamarix articulata*, common bush by the coast-line in sandy situations.

HYPERICINEÆ.—*Hypericum Lalandii*, *H. lanceolatum*, both common in the open lands.

MALVACEÆ.—*Malvastrum spicatum*, *M. capense*, both very common in waste and scrub lands. *Sida triloba*, *S. carpinifolia*, *S. cordifolia*, and *S. spinosa*, all common weeds. *Abutilon indicum*, *A. glaucum*, also common. *Urena lobata*, not uncommon. *Pavonia odorata* and *P. microphylla* are both common plants. *Hibiscus Trionum*, *H. vitifolius*, *H. physaloides*, *H. furcatus*, and *H. tiliaceus* are all to be found. *Hibiscus calycinus* is abundant in swampy ground; the bark of the stems produces strong rough fibre which I have utilised for ropes. *Gossypium anomalum* and *G. herbaceum* are both found about the borders of the forest and abandoned lands. The cotton is collected by the natives, but is of short staple and not much commercial value. Last year and since, the small growers that have taken up cotton cultivation in the territory have employed the natives to collect the staple, and have mixed it with the Egyptian species they have been growing, thus destroying their good sample. Many parcels I have seen brought in to the dealers this season. *Adansonia digitata*, the most remarkable tree on the coast, generally found singly growing on the highest points of land, and clearly observed by steamboat travellers. It is an ugly, flat-topped, blunt-branched tree, and eight months of the year leafless. Known as the Baobab, or "Cream of Tartar" tree, as the pulp surrounding the seeds is a pleasant acid, and is used in a cooling drink. I have measured many trees having a girth of eighty feet; wood soft and worthless. A photograph is given of the tree in one of our cotton plantations.

STERCULIACEÆ.—*Dombeya multiflora*: I think this is the only species of this small tree I have observed; some of the forms are very handsome. *Hermannia filipes*, an annual, not uncommon. *Maherna* sp.: there are, as far as I can observe, several species not yet enumerated. *Waltheria americana*, a common weed.

TILIACEÆ.—*Grewia columnaris* and *G. caffra* are both common shrubs. *Grewia occidentalis* and *G. pilosa* are two common small trees found in the open scrub and waste lands. *Triumfetta pilosa* and *T. rhomboidea*, both common shrubby plants. *Triumfetta tomentosa*, introduced from India, is found growing near habitations. *Corchorus olitorius* and *C. acutangulus*, found in open and semi-cultivated land.

LINEÆ.—*Erythroxylon emarginatum* appears general in the coast country.

MALPIGHIACEÆ.—*Acridocarpus natalitius*, a climbing shrub, not uncommon in the low country.

ZYGOPHYLLEÆ.—*Tribulus terrestris*, a spreading annual, very common.

GERANIACEÆ.—*Monsonia biflora*, an annual herb, common in certain localities. *Geranium ornithopodium* is the only species I have observed in the coast country. *Pelargonium capitatum* and *P. grossularioides* are generally to be found. *Oxalis corniculata* and *O. convexula* are both abundant weeds.

Rutaceæ.—*Toddalia lanceolata* and *T. natalensis*, small trees to be found in many places. *Clausena inæqualis*, rather a profuse-flowering small tree, flowers white.

Ochnaceæ.—*Ochna atropurpurea*, glabrous shrub, found in open forests.

Burseraceæ.—*Balsamodendron africanum*, not common, and found in desert situations.

Meliaceæ.—*Melia Azedarach*, known as the Indian lilac, been introduced to this country and grown in gardens and about habitations. *Trichilia emetica*, small tree; oil and tallow produced from the seeds. *Ximenia caffra*, small tree, common in all the low coast country. *Apodytes dimidiata*: this is another tree of the lower elevations.

Ilicineæ.—*Ilex capensis*, generally found by edges of swamps and lagoons.

Celastraceæ.—*Celastrus*: there appear to be several species of this shrub, none of any value—*Celastrus angularis*, *C. buxifolia*, *C. procumbens*, and *C. peduncularis*. *Elæodendron capense*, *E. laurifolium*, *E. velutinum*, and *E. æthiopicum* are all to be found as ordinary shrub cover. *Salacia Kraussii*, another to our list of shrubs.

Rhamneæ.—*Zizyphus jujuba* and *Z. mucronata*, both common thorny scrubby trees, found everywhere in the territory; fruit edible. *Berchemia discolor*, shrubby tree, with yellow fruit, rather abundant. *Colubrina asiatica*, occasionally to be found in the open waste lands. *Helinus ovatus*, a climbing shrub, found in thickets of the open grass country.

Ampelideæ.—*Vitus capensis*, *V. cuneifolia*, *V. lanigera*, *V. Thunbergii*, *V. integrifolia*, *V. quadrangularis*, are a few of the numerous species of vines I have observed. Nearly a hundred species are described.

Sapindaceæ.—*Cardiospermum Halicacabum*, herbaceous annual, rather common, classed as a climber. *Schmidelia monophylla*, common tree of the coast islands. *Schmidelia rubifolia* and *S. alnifolia* are also to be found. *Sapindus capensis*, a tree twenty to thirty feet high; the timber is not of any value. *Dodonæa viscosa*, a small tree, flowers rather abundantly.

ANACARDIACEÆ.—*Rhus:* about thirty species are described from Cape Colony to Natal. I can only locate the following species in the coast flora: *Rhus insignis*, *R. glaucescens*, *R. villosa*, and *R. longifolia*—small trees, rather resinous. *Mangifera indica:* this is the only species I have seen in S. Africa, introduced from India, but the mango (fruit) is poor, the trees are not cultivated and not of a good variety. We are now introducing good varieties from India and elsewhere. *Anacardium occidentale* (Cashew nut), introduced, but has now become naturalised. The largest trees I have ever seen are on the island of Chiloane. They are a great source of food for the Cafirs—the fruit, nuts; and a spirit from the fermented fruit is made, very intoxicating, which both Cafir men and women relish until they are dead drunk. *Sclerocarya caffra*, a glabrous tree; the oily cotyledons are edible. The drupe is peculiar in its formation.

LEGUMINOSÆ.—This is an Order of considerable interest and magnitude. As in Asia, so in Africa it includes many valuable food-products and highly commercial timber trees. Some portions of our African silva must give way to this Order entirely. Nearly a hundred genera attached under this name, and many handsome plants. *Crotalaria*, over a hundred species in Africa. Open land, cultivated and abandoned fields they are to be found. On the coast I have observed *C. capensis*, *C. globifera*, *C. macrocarpa*, *C. natalitia*, *C. striata*, and *C. lanceolata*. *Argyrolobium uniflorum*, *A. ascendens*, and *A. racemosum*, all frequently found. *Medicago lupulina*, *M. denticulata*, and *M. laciniata* are not uncommon. *Melilotus parviflora*, a common weed. *Trifolium africanum*, abundant. *Lotus arabicus*, not uncommon. *Psoralea pinnata* and *P. obtusifolia*, both to be found in open ground. *Indigofera:* being so many, it is confusing keeping them all in recollection. Many of them are very attractive plants, more or less found in open ground. *Indigofera Dregeana*, *I. endecaphylla*, *I. hirsuta*, *I vestita*, *I. micrantha*, *I. velutina*, and *I. polycarpa*, all to be collected within the coast-line and islands. *Tephrosia canescens*, *T. discolor*, *T. macropoda*, and *T. longipes* are all found. *Mundulea suberosa*, an old favourite, very showy plant, and found at certain places on the coast. This plant has a remarkably wide range. The last place I collected it at was in the north of Ceylon, in the dry zone, among rocks at the Dambulla Temple. *Millettia caffra*, small tree, handsome flowers, rather common. This is one of the trees used by the Cafirs for knobkerries and walking-sticks; the wood is very hard, heart-wood black. *Millettia Sutherlandi* I have also found. *Sesbania aculeata*, a common annual. *Sesbania punctata*, rather a showy flowering shrub. *Æschynomene uniflora*, a shrubby plant, not uncommon. *Smithia sensitiva*, a herbaceous annual. *Arachis hypogæa*, ground nut. One of the common native food-products of all tropical countries. Commonly eaten after roasting the nuts. Good food for cattle and pigs, also poultry. *Desmodium hirtum*, an annual with red corolla, common. *Desmodium incanum*, grows more in the form of a shrub; flowers reddish. *Desmodium Dregeanum* also to be found. *Pseudarthria Hookeri*, small shrub, showy and free-flowering. *Abrus precatorius* and *A. pulchellus*, both common climbers overrunning the bushes and small trees, and showing up when the pods burst and display clusters of pretty scarlet seeds, with one black spot. The natives in India convert them into ornaments. *Clitoria Ternatea*, an exceedingly attractive climber, and very difficult to say where it is not to be found in the tropics. I have cultivated it as a trellis plant. Its name is appropriate. *Glycine javanica*, abundant. *Teramnus labialis*, common on the coast. *Erythrina caffra*, a characteristic tree of the dry country, and the scarlet seeds are used as ornaments by the Cafirs. *Erythrina Humei* and *E. tomentosa* are both common on the coast. Owing to the thorny nature of the branches, they all form excellent fence plants. *Canavalia obtusifolia* and *C. ensiformis*, both abundant, flowers fragrant. *Phaseolus trinervius*, climbing annual, common. *Vigna Burchellii*, *V. luteola*, *V. marginata*, and *V. vexillata* are all to be found. *Dolichos Lablab*, very often cultivated in the fields with *Sorghum vulgare*. *D. biflorus* and *D. axillaris* are to be found in the open ground. *Rhynchosia minima*, *R. caribæa*, *R. hirsuta* can be identified in many places. *Eriosema parviflorum* and *E. cordatum* are only recognised. *Dalbergia armata* is the only species I have seen on the coast. *Baphia racemosa*, a small shrub, not uncommon. *Calpurnia lasiogyne*, rather a showy shrub, with bright yellow racemes. *Sophora tomentosa*, found at certain places on the coast and islands. *Cordyla africana*, a large tree with grey corky bark and large yellow fruit, two-seeded, and resembling a plum, which is eatable. Wood of no value. *Caesalpinia Bonducella*, a common thorny rambling shrub with recurved prickles. *Cassia delagoensis*, *C. mimosoides*, *C. obovata* are all abundant. *Cassia tomentosa*, found at a few places. *Bauhinia articulata*, common tree with rough bark; inner bark strong, and can be made into ropes. *Afzelia cuanzensis*, rather a remarkable tree in appearance; not common. *Tamarindus indica:* this valuable Indian tree is found in a few localities, and the first tree to fruit is producing this season. *Entada scandens*, often found spreading over the trees and bushes. *Acacia pennata*, *A. arabica*, *A. Kraussiana*, and *A. spinosa* are all to be found. *Albizzia Lebbek*, *A. fastigiata:* I think these are the only two species to be found near the coast. In the interior there are several. A most excellent tree to plant for shade for commercial products, owing to the light foliage.

Rosaceæ.—*Rubus rigidus*, small shrub, not very common.

Crassulaceæ. — *Crassula:* there appear to be many species, but I have not fixed them all so far. *Crassula rubicunda*, *C. expansa*, *C. quadrifolia*, and *C. Dregeana* are to be noted in the dry country. *Bryophyllum calycinum:* this plant has a wide range in dry tropical countries. *Kalanchoe crenata* and *K. rotundifolia* are not uncommon.

Droseraceæ.—*Drosera Burkeana* and *D. ramentacea* are found in swampy and grass lands.

Halorageæ.—*Serpicula repens*, a common weed. *Gunnera perpensa*, also a common herb.

Rhizophoraceæ.—*Rhizophora mucronata* and *R. racemosa* form the chief cover on the coast and islands, all within the high-tide lines. Not much else than mangrove bushes are to be found, associated with *Ceriops Candolliana*. *Bruguiera gymnorrhiza*, often found a fair-sized tree and extending farther inland. It is most excellent red hard wood, and the only tree suitable for building purposes. *Weihea africana* and *Cassipourea verticillata* are also small trees, all classed among the mangroves. Mangrove bark, a rich tannin bark, is collected and exported from this Portuguese coast; but the work is carried out very roughly, and much improvement is desirable in the method of collecting and exporting.

Combretaceæ.—*Lumnitzera racemosa:* this shrub is common on the coast, and I recognise it as similar in growth to that found in Ceylon. *Combretum erythrophyllum* and *C. Sonderi* are the only two species on the coast. *Quisqualis parviflora*, a climbing shrub common within the coast-line.

MYRTACEÆ.—*Eugenia cordatum* and *E. owariensis* I have both seen in different localities. They are fair-sized trees, but wood not of any commercial value.

MELASTOMACEÆ.—*Dissotis phæotricha*. *D. incana*, *D. eximia*. Under their old name, "Osbeckia," I knew them better. They are a very showy species of plants. I only find the three above named in the moist grass-lands. I must not leave out a well-known tree, *Barringtonia racemosa*.

LYTHRACEÆ.—*Nesæa floribunda* and *N. erecta*, both found on the sandy banks of streams. *Sonneratia acida*, not uncommon, but by the seashore and islands; bushy tree.

ONAGRARICÆ.—*Jussieua diffusa*, a creeping plant found in wet places. *Jussieua pilosa*, found in similar localities. *Trapa bispinosa*, common about the riversides; floating herb.

PASSIFLOREÆ.—*Tryphostemma Sandersoni*, a not very common climbing plant. *Ophiocaulon gummifer*, a woody climbing plant; produces a red gum.

CUCURBITACEÆ.—*Peponia Mackenii*, a climbing annual found in certain localities. *Lagenaria vulgaris*, generally found in cultivation; bottle gourd. *Luffa ægyptiaca*, cultivated for the fruit. *Sphærosicyos Meyeri*, cultivated. *Momordica Charantia*, cultivated. *Benincasa cerifera*, cultivated; ash pumpkin. *Cucumis Figarei* and *C. hirsutus*, both found about Cafir gardens. *Citrullus vulgaris*, found in cultivated ground. *Cephalandria indica*, generally to be found in open ground; very showy fruit. *Cucurbita maxima* and *C. Pepo*, both found in cultivation. *Zehneria scabra*, found in open ground.

FICOIDEÆ.—*Mesembryanthemum edule*, very common. *Aizoon canariense*, common weed. *Sesuvium Portulacastrum*, common herb, leaves gathered as a vegetable. *Orygia decumbens*, another common plant. *Mollugo Glinus* and *M. Cerviana* are both ordinary weeds. *Limeum viscosum* I have noticed in certain places.

UMBELLIFERÆ.—*Hydrocotyle asiatica* and *H. umbellata* are both to be found. *Alepidea amatymbica*, seen in a few places. *Apium graveolens*, generally found near habitations. *Ammi* *majus*, found in cultivated land. *Carum Carvi*, cultivated. *Sium Thunbergii*, found about open ground.

Araliaceæ.—*Cussonia spicata* and *C. umbellifera*: I have found both these small trees within the coast-line.

Rubiaceæ.—*Oldenlandia decumbens*, *O. caffra*, and *O. macrophylla* are all found in the open bush country. *Mussænda arcuata*, a climbing shrub overgrowing the low trees and bushes. *Randia dumetorum*: this spinous shrub has a wide range. I last collected it in India and Ceylon. *Gardenia Thunbergii*, shrubby tree; the elephants eat the fruit. *Gardenia citriodora*, small shrub; the berries are used extensively by the natives as coffee. *Gardenia Gerrardiana* is not uncommon. *Oxyanthus latifolius*, not common. *Tricalysis Sanderiana*, a small glossy shrub, not very common. *Pentanisia variabilis*, only found in a few places. *Vangueria infausta*, small tree; fruit eaten by the natives. *Vangueria edulis* appears to be the other species found on the island; fruit edible. *Fadogia lasiantha*, a glabrous shrub, with edible fruit. *Pavetta Gerrardi* and *P. lanceolata* are the only two I find within this coast-line and islands. *Spermacoce stricta*, a common weed. *Richardia scabra*, rather abundant in some places. *Mitracarpum scabrum*, not very common. *Rubia cordifolia*, a creeping herb, abundant.

Compositæ.—As in other parts of the world, this is the largest natural order of plants in Africa. *Ethulia conyzoides*, a branched shrub, general within the coast-line. *Vernonia*, a very large genus, and many of the species show a good effect when rambling over the trees and bushes. There are about eighty species enumerated, and it is quite a study to describe all those that can be seen on a day's march. *Vernonia Kraussii*, *V. natalensis*, *V. corymbosa*, *V. Dregeana*, and *V. angulifolia* have all been found near the coast. *Adenostemma viscosum*, common weed. *Ageratum conyzoides*: I suppose this is one of the most common weeds of the tropics, appearing in cultivated lands. The plantations in Southern India, Ceylon, etc., are overrun with this plant. *Mikania scandens*, a rambling shrub. *Erigeron canadense*, not uncommon. *Nidorella auriculata*, one of the common plants covering the sandy waste ground by the seashore. *Nidorella linifolia*, also abundant. *Conyza incisa* and *C. ivæfolia* appear to be the species on the coast. *Blumea* *lacera* and *B. natalensis*, both very abundant on waste lands. *Laggera alata*, common with the two above-named species. *Gnaphalium luteo-album* and *G. purpureum*, both common. *Helichrysum:* to describe this genus is bewildering. In Natal alone some fifty species have been collected. The following species are generally to be found at low elevations:—*Helichrysum adenocarpum*, *H. fœtidum*, *H. cymosum*, *H. decorum*, *H. Gerrardi*, *H. Kraussii*, *H. latifolium*, and *H. rugulosum*. *Athrixia Gerrardi*, another common annual. *Xanthium spinosum* and *X. Strumarium*, both common weeds. *Siegesbeckia orientalis*, rather abundant. *Eclipta erecta*, common weed. *Wedelia biflora*, not uncommon. *Melanthera Brownei*, common weed. *Spilanthes africana*, a widely distributed plant. *Bidens pilosa*, very common, the setæ adhering to one's clothing. *Bidens bipinnata*, also common. *Matricaria nigellæfolia*, common. *Cotula bipinnata*, common weed. *Gynura cernua*, very common. *Senecio*, another puzzling genus to arrange. In South Africa alone about 100 species. *Senecio vulgaris*, *S. picridifolius*, *S. speciosus*, *S. laneeus*, *S. angulatus*, and *S. ruderalis* are common on the lowlands. *Osteospermum moniliferum*, not uncommon. *Haplocarpha scaposa*, common weed. *Gazania uniflora*, occasionally to be found. *Berkheya Zeyheri*, common on open ground. *Dicoma anomala*, a widely spread form. *Gerbera piloselloides* and *G. Kraussii*, both very showy annuals—S.A. daisies. *Lactuca capensis*, abundant in open land. *Sonchus oleraceus*, sow-thistle, very common. *Lannæa bellidifolia*, not uncommon.

Campanulaceæ.—*Lobelia Erinus* and *L. decipiens* are the only two species I have observed.

Primulaceæ.—*Samolus porosus*, found in damp places.

Myrsineæ.—*Myrsine melanophleos*, found in shady places. *Embelia Krassii*, shrub, found near rivers.

Sapotaceæ. — *Chrysophyllum natalense*, fair-sized tree with edible fruit. *Sideroxylon inerme*, small tree, fruit about the size of a marble. *Mimusops caffra* and *M. obovata*, both small trees with very hard wood.

Ebenaceæ.—*Royena pallens* and *R. villosa*, found in the bush cover, among other evergreen shrubs. *Euclea lanceolata*, glabrous-leaved shrub. *Euclea divinorum*, found in the same bush cover as the other named species. *Maba* *buxifolia*, a variable species, has a wide range in the dry zone.

OLEACEÆ. — *Jasminum multipartitum* and *J. streptopus* appear both to be found climbing over the bush thickets. Another species may be *J. Walleri*. *Schrebera alata*, small tree, hard wood, not very common. *Olea verrucosa*, a small tree found in a few localities.

SALVADORACEÆ. — *Salvadora persica*, a much-branched shrub very abundant by the coast and islands. The natives use the long lateral roots, soaked in water; makes a cooling drink; known as the "mustard tree" of Scripture.

APOCYNACEÆ.—An interesting Order of plants and trees, extending over a wide range of the tropics. *Landolphia*: some forty species in Africa. These are the great rubber-yielding vines that so much has been written about. Nearly all the species are confined to higher elevations. Only two species in the dry zone, and the vines are not over 3 inches in diameter, whereas the others run 6 and 9 inches in diameter. They grow in the thick forest shade, rambling from tree to tree, and often found over 400 feet in length. The latex from the vines coagulates quickly by the atmospheric action, so no artificial aid is required to harden the substance. I have just written an article on all commercial rubbers, which will soon be published. Of the forty species known, only ten produce rubber of value. *Landolphia florida* and *petersiana* are the dry-country species. *Carissa Arduina* and *C. acuminata* are both common rambling shrubs. *Acokanthera spectabilis*, shrubby tree, flowers fragrant. *Acokanthera venenata*, small tree; the roots are very poisonous. *Rauwolfia natalensis*, common tree in the open grass lands on the coast. *Plumeria rubra*, found about habitations; been introduced. *Voacanga Thouarsii* and *V. lutescens*, shrubs not uncommon by the edges of open forest and grass lands. *Strophanthus petersianus*, branched shrub, found in certain localities. *Adenium multiflorum*, small shrub, leafless when in flower, not uncommon.

ASCLEPIADEÆ.—*Raphionacme splendens* and *R. densiflora* both are to be found, with milky juice. *Secamone frutescens*, a twining shrub, often to be found. *Microstephanus cernuus*, same habit as the previously named plant. *Xysmalobium involucratum*, rambling plant with milky juice, not uncommon.

Asclepias densiflora and *A. physocarpa*, perennial herbs, abundant within the dry zone. *Asclepias sphacelata*, common weed on the coast. *Margaretta Whytei*, not uncommon. *Pachycarpus concolor*, to be found generally within the coast-line. *Sarcostemma viminale*, common trailing plant. *Dæmia extensa* and *D. barbata*, both twining plants common in the open, sandy ground. *Cynanchum crassifolium*, coast plant, twining on the scrub bushes. *Tylophora syringæfolia*, twining plant. *Pergularia africana*, slender climbing plant. *Ceropegia mozambicensis*, twining on the general vegetation near Beira. *Ceropegia Sandersoni* is also found. *Riocreuxia torulosa*, not uncommon. *Brachystelma natalense*, large tuberous root, sometimes eaten by the natives. *Stapelia gigantea*, dwarf plant, not uncommon.

LOGANIACEÆ. — *Nuxia oppositifolia*, small tree, glabrous. *Buddleia salviæfolia*, a shrub, resembles a lantana in appearance. *Strychnos spinosa*, a small tree, fruit the size of an orange and edible. *Strychnos Atherstonei* I have also observed, a small tree with small fruit.

GENTIANEÆ.—*Exacum quinquenervium*, slender annual pink flowers, common in grass lands. *Sebæa aurea*, found in open scrub land. *Belmontia grandis*, not uncommon in damp ground. *Chironia baccifera*, found in marshy ground. *Neurotheca Schlechteri*, glabrous annual, not very common. *Faroa involucrata*, dwarf annual herb.

BORAGINEÆ.—*Cordia caffra*, small tree, common on the coast.

CONVOLVULACEÆ.—*Ipomœa angustifolia*, *I. digitata*, *I. obscura*, *I. palmata*, and *I. purpurea* are all abundant on the coast and islands. *Hewittea bicolor*, common climber. *Jacquemontia capitata*, not uncommon. *Convolvulus farinosus*, abundant some places. *Evolvulus alsinoides*, this perennial is found in certain localities.

SOLANACEÆ. — *Solanum auriculatum*, *S. sanctum*, and *S. nigrum* are all to be found in the waste and open lands. *Physalis peruviana*, Cape gooseberry, found in many places. *Withania somnifera*, *Nicandra physaloides*, *Lycium acutifolium*, all to be found. *Datura Stramonium*, very abundant everywhere.

SCROPHULARINEÆ.—*Nemesia cynanchifolia*, not uncommon. *Halleria lucida*, found in a few places. *Anastrabe integer-*

rima, abundant. *Manulea parviflora*, not uncommon. *Striga coccinea* and *S. Forbesii* are both to be found. *Buttonia natalensis* and *Sopubia Dregeana*, both lowland plants.

LENTIBULARINEÆ.—*Utricularia prehensilis* and *U. stellaris*, to be found about the marshes.

BIGNONIACEÆ.—*Tecoma capensis*, found climbing over the low trees and shrubs. *Kigelia pinnata*, one of the characteristic trees of the low country, found in open plains and grass lands. The long cylindrical fruits, hanging from a long footstalk, give it a remarkable appearance; they are of no value. See photograph.

PEDALINEÆ.—*Sesamum indicum*, Gingelly, has become naturalised in many places. *Ceratotheca triloba*, not uncommon.

ACANTHACEÆ.—*Thunbergia alata*, an old friend found in many parts of the tropics, twining over vegetation. *Thunbergia Kirkiana* is common on the islands. *Thunbergia Dregeana*, not uncommon. *Hygrophila spinosa*, a plant with a wide range. *Brillantaisia pubescens*, low aromatic herb, not uncommon. *Ruellia prostrata*, small shrub, found in open forest cover. *Dyschoriste verticillaris*, small shrub, found near the coast-line. *Phaylopsis longifolia*, found near the coast. *Crossandra nilotica*, found in certain places. *Crabbea hirsuta*, small shrub, not common. *Asystasia coromandeliana*, perennial herb, pretty little plant. *Barleria spinulosa*, common in damp ground. *Barleria Meyeriana* and *B. repens* are both to be found. *Justicia Betonica*, a plant with a wide range. *Justicia natalensis* and *J. protracta* are found near the coast. *Rhinacanthus communis*, found in many localities. *Hypoestes aristata*, small shrub, found in many places. *Hypoestes verticillaris*, not very common.

SELAGINEÆ.—*Hebenstreitia dentata* and *H. comosa*, small, heathlike shrubs, are both found. *Selago hyssopifolia* and *S. racemosa*, found in the coast country.

VERBENACEÆ.—*Lippia nodiflora*, a creeping herb, common. *Priva dentata*, found in certain places. *Premna viburnoides* and *P. senensis* both are to be found; the wood is light and burns freely. *Clerodendron glabrum*, a small shrub, found on the coast and islands. *Avicennia officinalis*, a shrubby tree found near the coast-line.

Labiatæ.—*Ocimum basilicum*, common weed on the open waste lands. *Ocimum suave*, common on the coast. *Moschosma riparium*, shrubby perennial, found in the dry zone. *Pycnostachys reticulata*, perennial herb. *Plectranthus petiolaris* and *P. tomentosus* are the only two forms I have seen near the coast, both dwarf shrubs. *Syncolostemon ramulosum*, a perennial herb, the only species I have observed. *Hyptis pectinata*, common annual. *Mentha aquatica*, not very common. *Stachys æthiopica*, herbaceous perennial found in certain localities. *Leonotis Leonurus*, rather a striking perennial herb found in open land; rough, strong fibre is got from the stems. *Leonotis nepetæfolia*, much of the habit of the preceding species.

Amaranthaceæ.—*Celosia trigyna*, common weed. *Amaranthus spinosus*, very abundant. *Sericocoma chrysurus*, common. *Cyathula globulifera*, *Pupalia atropurpurea*, *Ærva lanata*, *Achryanthes aspera*, *Alternanthera sessilis*, *Gomphrena globosa*, all common weeds.

Chenopodiaceæ.—*Chenopodium murale*, abundant. *Salicornia herbacea*, common.

Polygonaceæ. — *Oxygonum Dregeanum*, very common. *Polygonum lanigerum* and *P. tomentosum*, both very common.

Laurineæ. — *Cryptocarya acuminata*, a not uncommon evergreen tree.

Loranthaceæ.—*Loranthus Dregei* and *L. Kraussianus* are both very abundant parasitical plants. *Viscum continuum* and *V. obovatum*, very common. The colours of the flowers of these parasitical plants, I have always observed, are much brighter near the sea than in the interior.

Euphorbiaceæ.—This is a genus of exceedingly interesting plants. Many species found in the dry zone. *Euphorbia pilulifera*, *E. indica*, *E. grandidens*, *E. Tirucalli*, and *E. cervicornis*, all to be found. *Synadenium arborescens*, abundant. *Bridelia micrantha*, very common. *Phyllanthus glaucophyllus*, common shrub. *Antidesma venosum*, common. *Jatropa hirsuta* and *J. gossypifolia* are both to be found. *Jatropa Curcas*, physic nut, has been introduced from India. It is a valuable fence plant, and about one of the best to grow vanilla upon. *Croton sylvaticus*, abundant shrub. *Acalypha petiolaris*, found in a few places. *Ricinus communis*, naturalised, but not cultivated by the natives; in fact, castor oil is little used by the Cafirs. *Manihot Glaziovii*, Ceara rubber tree, has been introduced in general to this province, but not a success. The same fault to be found here as in our colonies. It is planted in the open ground instead of in forest shelter. It is a forest tree, so must have treatment according to its requirements. *Manihot utilissima*, Cassava Manioca, root valuable as food product, largely grown in the light, sandy soil, and suits the natives, as they give it no attention during the season.

Urticaceæ.—*Celtis Kraussiana*, common tree. *Trema bracteolata*, common tree; woöd produces good charcoal. *Chætachme aristata*, common tree. *Cannabis sativa*, found in open ground. *Ficus cordata*, very abundant. *Urtica urens*, common.

I have now reached a stage on my list that causes me to halt, before I enter upon the Monocotyledons. Taking the Orchideæ, and those that follow—I have to see a wet season before I can describe those that are to be found within this limit. The grasses alone will require a paper to describe them, being so numerous, and I have many yet to work out. There are a good many plants I have not given, as I am uncertain about them, and therefore must have them classified before I can place them on record.

MEETING OF THE SOCIETY,

March 8, 1906.

Professor Bayley Balfour, F.R.S., President, in the Chair.

Before proceeding to the business of the evening, the President called attention to the occurrence amongst the books presented to the Society of the "Report of the Agricultural Research Association," which contained a paper by Mr. Jamieson. Attached to the paper was an intimation that its author would be glad to have comments upon it, and, with their permission, the President took the opportunity to refer to the paper, for its subject was of the greatest moment to agriculturists. He said :—

The point of the paper is, that the nitrogen of the air is directly absorbed and fixed as albumen by green plants. Now, atmospheric free nitrogen is an evident possible source, and was formerly supposed to be the source, but careful experiments during the last century have given negative results, and these hold up to the present. In the later years of last century, however, the power of certain bacteria in the soil to bring free nitrogen of the air into combination was recognised, and thus indirectly the nitrogen of the atmosphere is made available for green plants. Although there is much to be learned about these soil bacteria, that they fix free nitrogen is an established fact. At the same time, all recent assertions which extend this power of fixation of free nitrogen to algæ, and then to all green plants, have failed to stand the test of scientific criticism and experiment.

Mr. Jamieson now comes forward and maintains the view that, after all, green plants do absorb and fix free nitrogen. Accepting as proved the discredited statement that algæ fixed free nitrogen, he assumes that the green colouring matter (chlorophyll) has something to do with the fixation, and disposing of the known fact of the nitrogen-fixing power of certain bacteria by saying that it is reasonable to suppose that bacteria cannot fix free nitrogen, as they are colourless and parasitic, he then assumes that fixation by ordinary green plants takes place.

The question then arises—At what part of the plant does this proceed?

How Mr. Jamieson arrives at his discovery of the organs of fixation in green plants is illustrative of the faulty data underlying his hypotheses.

The root cannot be an agent, he says, because the root in the soil is practically excluded from air. This, it will be recognised, is far from the fact.

Mr. Jamieson says further that the stem cannot be the organ, because it has often an impervious bark. But we know that the young stem has a superficial structure not unlike that of the leaf.

Mr. Jamieson then fixes upon the leaves as the organs by which the plant absorbs and fixes nitrogen, and he is strengthened in this view by the fact that the leaf absorbs carbonic acid gas and is also the absorber of what the plant chiefly requires, namely, water. But there is one fact in plant physiology that has been definitely established, it is that the leaf does not absorb the water which the plant requires.

Having made up his mind that the leaves are nitrogen-fixers, Mr. Jamieson then seeks for direct evidence of special arrangements for the work. These he finds in the hairs which, as everyone knows, cover frequently young leaves and stems, disappearing sometimes as the shoot matures. The contents of these hairs showed, by their reaction to certain chemical tests applied by Mr. Jamieson, and which more or less consistently indicated the presence of nitrogen, that a nitrogenous substance which he called albumen was present. To Mr. Jamieson the whole matter was clear; it was the solution of the question of the fixation of nitrogen from the air; whence could the nitrogen of the albumen reach the hair but from the air? There was free nitrogen in the air; these hairs were more or less exposed to the air; these hairs contained a nitrogenous substance; therefore the nitrogenous substance was formed by fixation of the air-nitrogen. Having assumed that green plants fix air-nitrogen; having assumed that green chlorophyll has to do with it; having assumed that fixation takes place in the leaf, and having seen nitrogenous substance in certain hairs on the leaf, Mr. Jamieson names the hairs albumen generators, and announces the discovery of the fixation as albumen of the free nitrogen of the air. That, briefly stated, is Mr. Jamieson's discovery! Not a semblance of proof of fixation of nitrogen is advanced by Mr. Jamieson.

Those who are acquainted with the facts of plant life know that every cell contains protoplasm so long as it is alive. The hair cells which Mr. Jamieson stained are living cells, and naturally showed a nitrogenous reaction, but it is awkward for Mr. Jamieson's hypotheses that such epidermal cells usually have no chlorophyll. Similar living cells are found all through the plant, and it would be as natural to assume, on the evidence advanced by Mr. Jamieson, that the cells of the pith and every living cell absorb and fix free nitrogen. It is unfortunate that statements which, if correct, would have so important a bearing upon a vast industry, should be put forward in this rash way without proof. Please note, however, that I am not to be understood to say that green plants do not absorb nitrogen from the air. The scientific attitude at the present time is simply this, that there is no proof of it. It would be a real discovery if it could be shown that green plants absorbed free nitrogen, but a good deal more than is put forward by Mr. Jamieson is wanted before we can admit that the fact is as Mr. Jamieson states it.

Mr. Jamieson's discovery is not a discovery, then, and his observations as recorded in his paper do not advance our knowledge of the subject, and cannot be the basis of any modification of agricultural practice.

Unfortunately this is not the first statement regarding plant life which Mr. Jamieson has put forward that requires qualification. Members of the Society will recollect that some years ago he read a paper at one of our meetings in which he announced the discovery of apertures in the root hairs by which plants took in solid particles. This was really a restatement of an exploded view a century old. He exhibited microscopic specimens at the meeting which were anything but satisfactory, and, in response to my invitation, Mr. Jamieson was so good as to come to the laboratory at the Royal Botanic Garden on the following day to show me those apertures. They were merely appearances, the result of faulty microscopical manipulation.

Later Mr. Jamieson announced as a newly discovered fact that the styles of grasses are not essential parts of the pistil. This statement any tyro can readily show to be incorrect, and one has only to look at the figures published with Mr. Jamieson's paper on this subject to see how inadequately he has understood the matter with which he is dealing.

Both of these so-called discoveries are quoted as leading results of the work of the Agricultural Research Association, of which Mr. Jamieson is director, and I mention them now as indications of the difficulty there is about attaching importance to the discoveries which Mr. Jamieson announces.

W. EDGAR EVANS, B.Sc., exhibited a series of casuals found in the Edinburgh district, chiefly *Ranunculaceæ* and *Cruciferæ*.

Mr. F. C. CRAWFORD showed *Pyrethrum cinerariæfolium* —a composite grown in the south of Europe and used when crushed as an insect powder; also three interesting Carices, *Carex helvola*, Blytt., *C. trinervis*, Degland., and *C. involuta*. Bab.

Mr. J. RUTHERFORD HILL also showed some preparations of the above *Pyrethrum*.

Mr. G. WEST exhibited some forms of the Scottish Limnetic Phytoplankton, illustrated by slides and specimens.

Mr. R. L. HARROW exhibited a series of plants in flower from the Royal Botanic Garden.

On behalf of Dr. A. W. BORTHWICK, a series of lantern slides was shown illustrating the transport of forest produce, chiefly in America and on the Continent.

JAMES WATERSTON, B.D., gave some interesting notes on the Flora of St Kilda, with lantern illustrations.

MEETING OF THE SOCIETY,

April 12, 1906.

Mr. J. Rutherford Hill, Vice-President, in the Chair.

Mr. James Whytock showed an exceptionally fine collection of flowers, etc., from Dalkeith Palace Garden.

Mr. James Fraser exhibited a series of casuals (*Graminea*) recently found in the neighbourhood of Edinburgh, including some not previously recorded from Britain.

Dr. A. W. Borthwick showed branches of various trees with fasciations.

Mr. R. L. Harrow showed a series of plants in flower from the Royal Botanic Garden.

The following communications were also read:—

Note on Rhacomitrium ramulosum. By William Young.

The specimen of the moss *Rhacomitrium ramulosum* which I now put before you was gathered on Craig Mohr, in the vice-county of Mid-Perth, in July 1898. It has taken a few years to come to its own. It has been variously named as the species *sudeticum* and the variety *gracilescens* of *heterostichum*. Under the latter cognomen two pieces were sent this year to the Moss Exchange Club. It has been examined by Professor Barker and Mr. H. N. Dixon, who agree in pronouncing it to be *ramulosum* of Lindberg.

Dr. Braithwaite says: "This moss still (1888) remains a doubtful native, its claims as such resting solely on the unlocalised specimens in the Hookerian herbarium, where the habitat is simply described as 'dry mountain rocks in the Highlands.'" Since then, as recorded by Mr. Dixon in his "Handbook," it has been found in two localities widely apart: by Dr. Stirton in Lewis in 1901, and by Mr. Lillie in Caithness.

According to the authors it is very closely allied to *heterostichum*, which is a very variable moss. Slender, and more slender, elongated stems with a gradually vanishing hair-point bring the varieties *alopecurum* and *gracilescens* of *heterostichum*, and the sub-species *sudeticum* and *ramulosum*, very close together. Extreme forms can be distinguished, but when they approach each other, as they frequently do, it is difficult to separate them The chief characteristic of the present plant lies, as its name indicates, in the branching, for the stems are slender with very numerous, short, obtuse lateral branchlets; the short hair-point; and the long and very narrow leaf-cells.

Mr. Dixon says: "Some authors unite it with *heterostichum* as a variety, but this seems scarcely justified, so long especially as *sudeticum* is maintained as a separate species: I cannot but think that the elongated upper areolation in *ramulosum* is a character of greater importance than any which separates the former from *heterostichum*. It must, however, be admitted that this character is less constant and uniform than one could wish, and it is perhaps better to treat both *sudeticum* and *ramulosum* as sub-species of *heterostichum*. In habit *ramulosum* resembles *fasciculare* to some extent, and in the densely nodose branching it even approaches *canescens*, while the hair-point is occasionally so developed as to render the plant quite hoary: the areolation and the presence of a hyaline point combined make it easy of recognition: in the fruiting characters it is near *sudeticum*, but the capsule is longer and darker, while the habit is quite different. So much doubt exists as to the plant intended by Bridel to be described by his name *microcarpon*, that it seems safer, and is far less confusing, to use Lindberg's name for the present species and *sudeticum* for the second of the two plants to which Bridel's name has equally been applied."

A sheet with all the British species and varieties of the genus *Rhacomitrium* was exhibited.

NOTE ON A RARE BRITISH FERN, CYSTOPTERIS FRAGILIS, var. SEMPERVIRENS. By WILLIAM YOUNG.

I wish to bring before the Society a fern which hitherto seems to have been considered a doubtful native. This plant was found by me in Corrie Ceann-mor, South Aberdeenshire, in July 1904. At the time I was not aware of what I was gathering except that it looked a strong plant of the type *Cystopteris fragilis*, of which indeed I gathered several that same day. They were all planted together in a cold frame. In a short time all sent up new fronds, the old ones having been all broken off in my vasculum. While all the fronds of the others died down with the first frosts in the late autumn, the fronds on this plant remained green throughout the winter. Last summer all the plants grew most luxuriantly, this plant markedly so. Again, it showed its evergreen character by withstanding the frosts of early winter. No doubt there is shelter from wind, rain, and hoar-frost in the frame; but frost does penetrate, for the surface of the soil has been repeatedly frozen. It stood alone among a thicket of withered fronds of the ordinary plants. I am sorry, the season being now so far advanced, there is only one very dilapidated frond remaining to show you. However, this dried and mounted frond, cut on 8th December last, and sent to Mr. Somerville, Glasgow, for his opinion, will show you what a fine, strong-growing plant it is. It is considerably larger than it was when growing in its native habitat. Mr. Somerville sent the frond to Mr. Druery, to whom at his request I, in January last, sent all the best fronds remaining.

In a letter to Mr. Somerville, Mr. Druery said: "I cannot say whether this is *C. sempervirens*, but I doubt it. It is, however, a very large form apparently. I have never met with *C. fragilis* anything like the size. If it be really not deciduous, I should name it *C. f. sempervirens*, and perhaps *gigas*, unless the size is due to specially favourable local conditions. I have a plant of presumed *sempervirens* given me years ago by Colonel Innes, but that is a crested form."

In a note in the "Gardeners' Chronicle" of 10th February, Mr. Druery says: "The fronds appear to answer to the description of the *sempervirens* form of the species described by Mr. Britten, in page 23 of his 'European Ferns,' as being a native of Madeira, except perhaps as regards the greater size of the anterior basal pinnules, and the glandular hairy vestiture of the indusium which is conspicuous in the fresh plant. The sempervirent character, however, is abundantly shown by the fact that I have just received (Jan. 31) perfectly green fronds taken by Mr. Young from his plant under glass, while the ordinary *C. fragilis* is deciduous, dying down entirely in the autumn. Mr. Young's plant is furthermore distinguished by its very robust growth, the fronds attaining eighteen inches in length, as is shown by the accompanying specimen, while as a rule I have never seen the fronds more than half that size. Under the above circumstances I consider that Mr. Young is perfectly justified in considering his find to be really *C. fragilis*, var. *sempervirens*, of which previous finds in this country appear to have been doubtfully recorded."

Moore, in his "Handbook of British Ferns" and in the "Nature-printed Ferns of Great Britain and Ireland," says: "The form we have named *sempervirens*, though reputedly found in Devonshire and Kent, is not positively known to be an English plant, though certainly a native of Madeira. It has several distinctive features. There are some doubts as to the English origin of this plant, but of its distinctness as a variety, and probably a species, none. Bolton's figure under the name *Polypodium rhæticum* is a facsimile of moderate-sized specimens, and he besides mentions two of its most prominent characteristics. If, therefore, his statement is conclusive, which may be open to doubt, it is a native of Scotland. It is certainly a native of Madeira. It has also certainly been found at Tunbridge Wells, but there are rumours of its having been planted there. A similar but not identical plant is loosely stated to have been found in Devonshire, but this is also open to suspicion, the garden from which it has been distributed having been enriched by importations from Madeira. The differences are:—

"(1) Their evergreen character under shelter.

"(2) The toughness, not brittleness, of their pallid, stoutish stipes.

"(3) The greater size of the anterior basal pinnules.

"(4) The glandular hairy investiture of the indusium which is conspicuous in the fresh plant.

"This evergreen species has in addition a short creeping rhizome, vigorous fronds of narrowish lanceolate outline, and rather distant pinnules, of which the larger are often nearly or quite again pinnate and the lobes separate. The spores are irregularly roundish oblong and muricate."

This plant differs in one or two particulars:—Its stipes is brittle like the type: its fronds are not narrowish lanceolate in outline, neither are the lobes separate nor the pinnules distant.

You will see this plant has already made some progress with its new season's fronds. The plants of the type in my possession have not yet begun to move.

Mr. Druery has expressed a wish to have the variety tried in the open through the winter. For this purpose I have divided the plant, and next winter we shall see the result.

This shows the Baobab Tree. *Adansonia digitata*.

A tree of *Kigelia pinnata*, with its hanging fruits.

J. A. Alexander.

Grass, *Phragmites communis*. Our common dwarf palm, *Hyphæna crinita*.

General view in the open grass country. *Phragmites communis* is the grass, burned down. Trees, Acacia, Desmodium, Dalbergia, and the palm, *Phœnix reclinata*.

J. A. Alexander.

Experimental Garden, Janga, Mambone. Mango trees, *Mangifera indica*, and textile plants, *Sanseviera guineensis* and *Furcræa gigantea*.

Experimental Garden, Janga, Mambone. *Agave americana*, *A. aloe*, and *Bœhmeria nivea*, Ramie.

J. A. Alexander.

MEETING OF THE SOCIETY,

May 10, 1906.

Professor BAYLEY BALFOUR, F.R.S., President, in the Chair.

The following gentleman, recommended by the Council, was elected Associate:—

Mr. D. S. FISH, Royal Botanic Garden.

W. EDGAR EVANS, B.Sc., showed a series of British Plants occurring as aliens in the Edinburgh district (*Caryophyllaceæ* to *Rosaceæ*).

Forms of *Gentiana nivalis* from two new stations in Perthshire and Forfarshire were shown on behalf of Mr. M'TAGGART COWAN, Jun.

The following communication was read:—

A Voyage on the Salwen River. By GEORGE FORREST.

MEETING OF THE SOCIETY,

June 14, 1906.

Professor Bayley Balfour, F.R.S., President, in the Chair.

Dr. A. W. Borthwick exhibited pear leaves attacked by *Eriophes pyri*.

Mr. R. L. Harrow showed a series of plants in flower from the Royal Botanic Garden.

W. W. Smith, M.A., showed a very pale, ash-coloured variety of *Ajuga reptans*, found near Bridge of Allan.

The following communication was read:—

Note on Adiantum Capillus-Veneris (Linn.). By D. S. Fish.

According to Mr. Chichester Hart, *Adiantum Capillus-Veneris* was first recorded for Ireland by Edward Lhwyd, the antiquarian, who, writing from Cornwall on 25th August 1700, mentions the occurrence of this plant on the islands of Aran, Galway Bay. The flora of these islands is similar to that of the Burren district of Co. Clare. The land is very barren, and scattered stones everywhere abound, giving the country a peculiar appearance.

Another remarkable feature in the landscape of this portion of Co. Clare are the flat beds of limestone, deeply fissured. At the bottom of these fissures *Adiantum* is found in profusion. These sheets of limestone are so level that they resemble enormous pavements, carefully laid down in concrete, the surface being interrupted at more or less regular intervals by deep seams. The seams or fissures running parallel add to the artificial appearance of this curious formation. Plants do not generally occur on the surface of these natural pavements, for there is nothing in which they could root. In the fissures, however, plants grow readily, *Adiantum* sending up fronds 18 or more inches in height, while *Asplenium marinum* has been recorded from such positions with fronds 3 feet long. *Rubia peregrina* scrambles in many places. A specimen of *Samolus Valerandi* was noticed with stems 18 inches high.

A more favourable position for ferns could hardly be had in the British Isles. Shelter is secured from winds, and the moisture, heat, and shade present form an ideal environment for these plants. The fissures vary in depth, and the stature of the plants therein likewise varies. Flowering plants become very drawn when they occur in the deeper gaps.

So much for an Irish station where the fern luxuriates. *Adiantum* also occurs in Ireland, on dry limestone rocks such as on the one depicted in the second photograph, and by far the most interesting station of this description is found near Roundstone, Connemara. At the back of Roundstone lies Urrisbeg, and crossing this mountain a large fresh-water lake is seen—Lough Bollard. At the east end of this lough there is a small limestone rock on which *Adiantum* grows. This spot has been thrice visited by the Botanical Society, and mention of these visits may not be uninteresting.

1. Dr. Graham and party in August 1838 ("Annual Report," 1838–39, p. 56). Roundstone is mentioned, but no full particulars are given as to the actual site of the *Adiantum*. Most probably, however, this particular spot was the one visited by Dr. Graham. He notes: "On one rock very sparingly, small specimens of *Adiantum Capillus-Veneris*."

2. When the late Professor Balfour's party visited Ireland in September 1874, the *Adiantum* was again noted. Professor Balfour says in his notes of that excursion: "There was a great deal growing on the rock, but fortunately for the habitat it is impossible to get at the roots" (vol. xii. p. 375).

In August 1890 Connemara was visited by the Alpine Club, and *Adiantum* was again found near Lough Bollard. In the report of the excursion (xix. p. 21) a doubt is expressed as to whether the rock noticed on this occasion was the same as that seen on the previous excursion, as the one seen in 1890 was only a few feet in height and not by any means difficult to get at. When growing on limestone the roots penetrate deeply into the crevices, and the plant, with the exception of its fronds, may be quite inaccessible even though close to hand.

Adiantum in Italy.

Adiantum Capillus-Veneris clothing masonry over which water continually flows is typical of many Italian scenes. In damp places this fern may spread so freely as to become a weed, but it cannot live on dry ground nor endure drought, as can such ferns as *Ceterach* and *Asplenium Adiantum-nigrum*, *Ruta-muraria*, etc.

Adiantum Capillus-Veneris in Cultivation.

There is little that need be said. For general use the Brazilian species—*A. cuneatum*—is the popular Maidenhair fern, and in many gardens a *Capillus-Veneris* is not cultivated at all, only occurring as a sort of naturalised plant on the walls and floors of plant houses. Although a native, it is not truly hardy. Established plants planted at the Rock Garden last summer perished during the winter. In this respect it is akin to *Asplenium marinum*, with which it is often associated in Ireland. Both like warmth.

MEETING OF THE SOCIETY,

July 12, 1906.

Professor Bayley Balfour, F.R.S., President, in the Chair.

Mr. Bennet Clark exhibited some Insect and Fungus Pests.

Mr. R. L. Harrow exhibited a series of plants in flower from the Royal Botanic Garden.

The following communication was read :—

Contributions towards the Botany of Ascension. By R. N. Rudmose Brown, B.Sc., Botanist of the Scottish National Antarctic Expedition. Communicated by W. W Smith, M.A.

On the return of the Scottish National Antarctic Expedition from Cape Town to Scotland, the "Scotia" spent a few days at the Island of Ascension (7° 55′ S., 14° 25′ W.), and I was enabled to make some observations and collections of botanical interest. While the earliest record of the flora of this island dates from some two centuries ago, and although it has been visited by botanists at intervals since, including Joseph D. Hooker in 1843, the first really comprehensive collections brought back were those made by H. N. Moseley, during the visit of the "Challenger" in 1876: in 1876 the German Transit of Venus Expedition in the "Gazelle" made a call at the island, and Dr. Naumann collected a number of cryptogams. The results of all these expeditions are fully summarised in Mr. W. Botting Hemsley's exhaustive work on insular floras,[1] which, despite the fact of its having been published in 1885, practically includes all our knowledge of the flora of Ascension until the visit of the "Scotia" in 1904.[2]

[1] W. B. Hemsley, Report on the Voyage of H.M.S. "Challenger," 1873–76, "Botany," I. ii. p. 31 *et seq.*

[2] The German Antarctic ship "Gauss" called at Ascension in 1903, but no account of her botanical collections there has as yet been published.

The island comprises an area of some forty square miles of undulating plains lying around the base of Green Mountain, a tertiary volcano which rises to a height of 2840 feet.

The geological constitution of the island is hard volcanic slag and some beds of volcanic ashes.[1] With the extreme dryness of the atmosphere, the want of rain, and the equability of temperature at sea-level, the low-lying ground remains almost as fresh and unweathered to-day as if its formation was a matter of only a few years ago instead of ages. The vegetation of these dry and soil-less plains is naturally very scanty; in fact, save in some exceptionally favoured spots, they are practically a desert: but that want of water is the one vital hindrance to vegetation is more clearly seen as one ascends Green Mountain. The geological structure and soil of this old volcano is of course essentially the same as that of the plains, but the vegetation steadily increases from the foot upwards, until before 2000 feet one is pleasantly surprised to find oneself amidst a veritable oasis of rich sub-tropical vegetation. Still higher the vegetation assumes a more temperate aspect, and the top, exposed to the continually blowing south-east trade wind, is covered with grassland. This position of the island, in the direct track of the dry south-east trade winds, is responsible for the extremely small rainfall, which at Georgetown (sea-level) averages under three inches a year; but on Green Mountain, at a height of 2000 feet, where clouds often envelop the hill, it is over 17 inches. With this very scanty rainfall the extreme desert nature of the plains is little to be wondered at, and it was only at "Wideawake Camp," the nesting-place of myriads of terns (*Sterna fuliginosa*), that much vegetation was found, and it was almost entirely composed of *Portulaca oleracea*, considered to be indigenous, and the widely spread tropical grass *Setaria verticillata*, a species doubtless introduced by the action of the terns.

"Wideawake" is a hollow apparently slightly less arid than its surroundings, while, in addition, the guano of so many birds must materially assist the vegetation. *Portulaca oleracea* in places forms an almost continuous carpet, and is apparently well adapted to the prevailing conditions, for

[1] For a fuller account of the geology of Ascension, see Darwin's "Naturalist's Voyage."

without doubt it is spreading on the island. Of the four phanerogams recorded from the island, considered by Mr. Hemsley as indigenous, I found, besides *Portulaca oleracea*, only *Euphorbia origanoides*. This endemic species is comparatively rare: near Georgetown on the "golf links" are a few stunted specimens, though on the "road" across the plains to Green Mountain I found not a few vigorous plants of it, all growing in an almost desiccated soil. Neither of the two above essentially xerophilous species finds a place in the vegetation of the higher slopes of Green Mountain. Several introduced weeds show signs of prospering, despite the adverse conditions; but the planted palms are all in an extremely miserable condition. Among the species which seem to find themselves most at home are *Vinca rosea*, *Clematis*, several species of *Physalis*, and *Ricinus communis*; while several plants of *Opuntia*, planted, I believe, to give some shade near the "God be thanked" water tank on the road to Green Mountain, show every sign of spreading. In view of the essentially desert character of these plains, it is surprising to find the statement of Schimper[1] that "the island is almost completely overgrown with ferns," but this is a deduction evidently drawn from the floral statistics, which show among indigenous species a great preponderance of ferns.

Encircling Green Mountain at a height of 2000 feet runs Elliott's Pass—a pathway some two to three miles in length and generally cut on the slope of the hill, but often running through short tunnels where a precipice would otherwise interrupt its course. On this path, and principally in the damper localities in or about the shaded entrances to the tunnels, I collected all the cryptogams enumerated in the following list. The list contains a few new records for Ascension; and while, in the extremely altered state of the vegetation to-day, it is impossible to absolutely assert that any of these are indigenous, there is, on the other hand, no very plausible reason for considering any of them as introduced.

My collections suggest no new affinities for the flora of Ascension, which shows all evidence of long isolation, and has an indigenous flora too scanty to allow any generalisation to be safely made as to its relationships.

[1] A. F. W. Schimper, "Pflanzengeographie" (1898), p. 90.

Finally, I must record my indebtedness to the late Director of the Royal Botanic Gardens, Kew, through whose kindness the mosses, hepatics, and lichens were there determined.

Phanerogamæ.

Euphorbia origanoides, Linn. Amœn. Acad., iii. p. 114; Sp. Pl., i. 453; Hemsl. Chall. Bot., p. 36.—On the dry plains between Georgetown and "Two Boats." An endemic species, but far from common.

Portulaca oleracea, Linn. Sp. Pl., i. 82; Hemsl. Chall. Bot., p. 34.—This species is very common on the plains, especially at Wideawake and vicinity, and is undoubtedly spreading on the island. It is widely spread in tropical and subtropical countries, and Mr. Hemsley doubts whether it is indigenous at Ascension.

Cryptogamæ—Filices.

Polypodium reptans, Sw. Syn. Fil., p. 36; Hook. and Bak. Syn. Fil., p. 316.—Elliott's Pass. Found from West Indies to Brazil, but not previously collected at Ascension.

Polypodium trichomanoides, var. jungermannoides, Hook. Syn. Fil., p. 33; Hook. and Bak. Syn. Fil., p. 326; Hemsl. Chall. Bot., p. 41.—Elliott's Pass: an endemic variety.

Pteris incisa, Thunb. Prod. Fl. Cap., p. 733; Hook. Sp. Fil., ii. p. 230; Hemsl. Chall. Bot., p. 39.—Elliott's Pass: indigenous (Hemsley). Widely distributed in the southern hemisphere, including Tristan da Cunha and Gough Island.

Asplenium lunulatum, Sw. Syn. Fil., p. 80; Hook. and Bak. Syn. Fil., p. 202; Hemsl. Chall. Bot., p. 40; *A. alatum*, A. Rich. Sert. Astrolab., p. 52.—Elliott's Pass. Widely spread, including Tristan da Cunha.

Blechnum australe, Linn. Mantissa, i. p. 130; Hook. Sp. Fil., p. 56; Hemsl. Chall. Bot., p. 39.—Elliott's Pass. Distributed from St Paul and Madagascar through South Africa to Tristan da Cunha.

Nephrodium molle, Desv. in Mém. Soc. Linn. Paris, vi. p. 258; Hook. Sp. Fil., iv. p. 67; Hook. and Bak. Syn. Fil.,

p. 293; Hemsl. Chall. Bot., p. 40.—Elliott's Pass. Widely spread, including St Helena.

Pellæa hastata, Link. Sp. Fil., p. 60; Hook. and Bak. Syn. Fil., p. 152.—Elliott's Pass: new record for Ascension. Extends from South Africa to the Mascarene Islands eastward and the Cape Verdes northward.

Lycopodiaceæ.

Lycopodium cernuum, Linn. Sp. Pl., i. 1103; Hemsl. Chall. Bot., p. 38; *L. Boryanum*, A. Rich. Sert. Astrolab., p. 52.—Elliott's Pass and summit of Green Mountain. Very widely spread.

Musci.

Campylopus introflexus, Mitt. in Journ. Linn. Soc., xii. p. 84; Hemsl. Chall. Bot., p. 42; *Dicranum introflexus*, Hedw. Sp. Musc., p. 147.—Elliott's Pass. Very widely spread, including Tristan da Cunha.

Sphagnum cuspidatum, Ehrh. Crypt., No. 251.—Wetter places on Elliott's Pass, and near summit of Green Mountain. A widely distributed species.

Dicranella ascensionica, Mitt. in Melliss' St Helena, p. 357; Hemsl. Chall. Bot., p. 42.—Elliott's Pass: endemic to Ascension.

Bartramia, cf. subolescens, C. Müll. in Eng. Bot. Jahr. (1884), p. 84.—Elliott's Pass.

Barbula, cf. leucochlora, C. Müll. in Eng. Bot. Jahr. (1884), p. 84.—Elliott's Pass.

Hepaticæ.

Targionia hypophylla, Linn. ex Rich. Voy. Astrolabe Bot., p. 51; Hemsl. Chall. Bot., p. 45.—Elliott's Pass: an endemic species, but one very nearly related to *T. michelii*, Corda., which is widely diffused.

Plagiochasma limbatum, Nees. in Hemsl. Chall. Bot., p. 44; *Fegatella limbatum*, Tayl. in Hook. Lond. Journ. Bot. (1845), p. 95.—Elliott's Pass: a new record for Ascension; previously known from St Helena.

Lophocolea, aff. lenta, Gottsche, Lind. and Nees.

Mastigophora (Sendtnera) leioclada, Mitt. in Melliss'

St Helena, p. 370; *Jungermannia leioclada*, Tayl. in Hook. Lond. Journ. Bot. (1845), p. 85; Gottsche, Lind. and Nees. Syn. Hepat. p. 723.—Elliott's Pass: an endemic species.

HYGROLEJEUNIA PTEROTA (Tayl.), Steph.; *Lejeunia pterota* (Tayl.), Gottsche, Lind. and Nees. Syn. Hepat., p. 367; *Jungermannia pterota*, Tayl. in Lond. Journ. Bot. (1845), p. 91.—Elliott's Pass. Known also from St Helena.

LICHENES.

THELOSCHISTES FLAVICANS., Nerm.; *Physcia flavicans*, D. C. Fl. France, vi. p. 189; Nyl. Syn. Lich., i. p. 406; Melliss' St Helena, p. 376; Hemsl. Chall. Bot. p. 47.—Elliott's Pass. A widely spread species.

PHYSCIA ADSCENSIONIS, Crombie (*Lecanora adscensionis*) in Journ. Linn. Soc. Lond., xvi. p. 212; Hemsl. Chall. Bot., p. 47.—Elliott's Pass. Probably endemic, but reported also from the Cape Verde Islands (Hemsley).

PHYSCIA sp.—This is an undeterminable specimen.

CLADONIA sp.—This specimen is likewise undeterminable.

ALGÆ.

TRENTOPOHLIA POLYCARPA, Nees. et Mont. Voy. de la Bonite Bot., p. 16; De Toni, Syl. Alg., p. 238.—A new record for Ascension. Known previously from Brazil to Fuegia and Staten Island.

TRANSACTIONS AND PROCEEDINGS

OF THE

BOTANICAL SOCIETY OF EDINBURGH.

VOLUME XXIII.

PART III.

EDINBURGH:
PRINTED FOR THE BOTANICAL SOCIETY BY
NEILL & CO., LIMITED.

1907.

CONTENTS.

TRANSACTIONS AND PROCEEDINGS

OF THE

BOTANICAL SOCIETY OF EDINBURGH.

SESSION LXXI.

MEETING OF THE SOCIETY,

November 8, 1906.

Professor Bayley Balfour, F.R.S., President, in the Chair.

The following Office-Bearers of the Society were elected for the Session 1906–7:—

PRESIDENT.

J. Rutherford Hill, Esq.

VICE-PRESIDENTS.

A. W. Borthwick, D.Sc.
R. Stewart MacDougall, M.A., D.Sc.
Percival C. Waite, Esq.
James Whytock, Esq.

COUNCILLORS.

Professor Isaac Bayley Balfour, M.A., M.D., D.Sc., F.R.S., F.L.S.
T. Bennet Clark, C.A.
M'Taggart Cowan, Jun.
Arthur E. Davies, Ph.D., F.L.S.
James Grieve, Esq.
Harry F. Tagg, F.L.S.
Professor J. W. H. Trail, M.A., M.D., F.R.S., F.L.S.
William Watson, M.D.
William Williamson, Esq.
William Young, Esq.

Honorary Secretary—William Craig, M.D., F.R.S.E., F.R.C.S.E.
Curator of Herbarium—W. Caldwell Crawford, M.A., F.R.S.E.
Foreign Secretary—Rev. D. Paul, M.A., LL.D.
Treasurer—Richard Brown, C.A.
Honorary Assistant-Secretary—W. W. Smith, M.A.
Artist—Francis M. Caird, M.B., C.M., F.R.C.S.E.
Auditor—Robert C. Millar, C.A.

LOCAL SECRETARIES.

Aberdeen—Professor J. W. H. Trail, M.A., M.D., F.R.S., F.L.S.
Bathgate—Robert Kirk, M.D., F.R.C.S.E.
Berwick-on-Tweed—Francis M. Norman, R.N.
Birmingham—W. H. Wilkinson, F.L.S., F.R.M.S., Manor Hill, Sutton Coldfield.
Bournemouth—John Archibald, M.D., F.R.S.E.
Calcutta—Professor S. C. Mahalanobis, B.Sc., F.R.S.E., F.R.M.S., Presidency College.
Cambridge—Arthur Evans, M.A.
Croydon—A. Bennett, F.L.S.
Dumfries—Professor G. F. Scott-Elliot, M.A., B.Sc., F.L.S.
Dundee—Professor P. Geddes, F.R.S.E.
East Liss, Hants—James Sykes Gamble, M.A., C.I.E., F.R.S.
Glasgow—Professor F. O. Bower, Sc.D., F.R.S., F.L.S.
 ,, Professor J. Cleland, M.D., LL.D., D.Sc., F.R.S.
 ,, Alex. Somerville, B.Sc., F.L.S.
London—William Carruthers, F.R.S., F.L.S.
 ,, J. F. Duthie, B.A., F.L.S.
 ,, E. M. Holmes, F.L.S., F.R.H.S.
 ,, Lieut.-Col. David Prain, M.D., C.I.E., F.R.S., F.L.S., Royal Botanic Gardens, Kew.
Melrose—W. B. Boyd of Faldonside.
Otago, New Zealand—Professor James Gow Black, D.Sc., University.
Perth—Sir Robert Pullar, F.R.S.E.
Philadelphia, U.S.A.—Professor John M. Macfarlane, D.Sc., F.R.S.E.
Ryde—George May Lowe, M.D., C.M.
San Remo—Sir George King, M.D., F.R.S.
St Andrews—Professor M'Intosh, M.D., LL.D., F.R.S.E.
 ,, Robert A. Robertson, M.A., B.Sc.
 ,, J. H. Wilson, D.Sc., F.R.S.E.
Toronto, Ontario—W. R. Riddell, B.Sc., B.A.
 ,, Professor Ramsay Wright, M.A., B.Sc.
Wellington, New Zealand—Sir James Hector, M.D., K.C.M.G., F.R.SS. L. & E.
Wolverhampton—John Fraser, M.A., M.D.

The TREASURER submitted the following Statement of Accounts for the Session 1905–6:—

INCOME.

Annual Subscriptions for 1905–1906	£43	10	0
Do. Arrears	1	10	0
Contributions of Life Members	29	8	0
Transactions sold	3	12	0
Subscriptions to Illustration Fund	1	10	6
Interest on Deposits in Bank	2	18	11
Sum received for Diploma	0	7	0
	£82	16	5

EXPENDITURE.

Printing (including Transactions for 1905–1906, £24, 7s. 5d.)	£38	10	5
Rooms for Meetings, Tea, etc.	8	18	0
Stationery, Postages, Carriages, etc.	4	10	0
Fire Insurance on Books, etc.	0	5	0
Excess of Income over Expenditure	30	13	0
	£82	16	5

STATE OF FUNDS.

Amount of Funds at close of Session 1904–1905				£113	6	2
Add—Increase during Session 1905–1906, as above				30	13	0
Funds as at close of Session 1905–1906				£143	19	2
Being:—Sum in Current Account with Union Bank of Scotland, Ltd.	£9	13	6			
Sums in Deposit Receipt with do.	140	0	0			
	£149	13	6			
Less—Due to Treasurer	5	14	4			
As above				£143	19	2

Note.—Subscription in arrear, 1905–1906, £2, 5s.

The TREASURER called attention to the satisfactory state of the finances, there being a balance of over £30 on the year's working. On the motion of the PRESIDENT a cordial vote of thanks was tendered to the TREASURER and to the AUDITOR, Mr. R. C. MILLAR, C.A.

The presidential address of the previous session, omitted from last year's publications, is printed now:—

By the favour of the Honorary Assistant Secretary, I am able to give the following state of the Roll of the Society:—

Honorary Fellows: Royal 1, British 6, Foreign 22; Ordinary Fellows: Resident 109, Non-Resident 46; Corresponding Members 41: Associates 6; Lady Members 6. Total 237.

During the past year the Society has been strengthened by the addition of:—

Ordinary Fellows: Resident 6, Non-Resident 1. Total 7. And during the same period it has lost by death:—Foreign Fellow 1, Ordinary Resident Fellows 4, Corresponding Members 3. Total 8.

PATRICK NEILL FRASER.—In Mr. Neill Fraser the Society has been deprived of one of its oldest members, and the ranks of British Botany became poorer by the loss of a recognised authority upon ferns. Of his early years and first introduction to botany we have no record, but may conjecture that his natural bent would be stimulated by association with Dr. Patrick Neill—so prominent a figure in botanical and horticultural circles in the first half of last century—whose namechild he was, and to whose business he, with his brother, succeeded in 1851. I find that in 1852 Mr. Neill Fraser enrolled as a second year general student in the Class of Botany at the Royal Botanic Garden—of the first enrolment I have found no trace. In the same year he joined the Class excursion to Ireland, and the published accounts of these excursions furnish evidence that then, as at later excursions, the group of ferns specially attracted him. During his whole life he amassed ferns from all regions, in part collected by himself—for he was a keen field botanist, particularly if there was a chance of finding ferns—and his herbarium of the group became one of the best in the country. I am glad to be able to say that it has been acquired for the Royal Botanic Garden, and when incorporated will add materially to the already good collection there.

At Rockville, his residence at Murrayfield, where the natural lie of the ground around an old quarry offered great scope for gardening, Mr. Neill Fraser brought together a large assemblage of hardy ferns, of alpine and herbaceous plants, and under glass a fine collection of filmy ferns: and in recent years the improvement of the polyanthus received special attention from him, and he raised some good forms.

Mr. Neill Fraser's work with plants was carried on in the leisure of business in which his capacity for detail, his care and method, demanded success. For many years (1857–1891) his business talent was placed freely at the service of this Society in his position as Honorary Treasurer, and he served the Royal Caledonian Horticultural Society in like manner for an equally long period.

Quiet in manner, he was always ready to help those with kindred taste who applied to him in the subject of which he was a master. His retiring character made him shrink from prominent public duties, and prompted, no doubt, his refusal of the Presidency of this Society. His death in an early month of the year removed a link with the older generations through whose enthusiasm this Society was founded.

Robert James Hunter.—The late Mr. Robert James Hunter was a native of Edinburgh, the third son of the late Mr. James Hunter, Managing Partner of Messrs. Tullis and Co., Paper Merchants. In this house, and afterwards in London, Mr. R. J. Hunter received his commercial training, and in 1890 was appointed Managing Director of Tullis & Co., Ltd. This position he held for fourteen years, until his death in December of last year. In spite of the heavy demand made by his business on his thought and energy, Mr. Hunter found time for other interests. He was a man of fine taste and high culture. He was widely read in the best literature, had travelled extensively, and was greatly interested in practical mechanics and in science, particularly botany and geology. As a Director of the Edinburgh Chamber of Commerce he did good service to that body, and also took an active part in promoting various philanthropic agencies. Mr. Hunter died very suddenly on the 12th December 1904. His widow survives him. [A notice, with portrait of Mr. Hunter, appeared in the "Papermaker" and "British Paper Trade Journal" for January 2, 1905.]

HAY HUNTER,
Minister of St. Andrew's Church,
Edinburgh.

ANDREW SEMPLE. — Surgeon - General Depute Andrew Semple, M.D. (St. Andrews), who became a Member of this Society in 1891, was born in the parish of Lesmahagow, Lanarkshire, to which place he bore through life a warm attachment. His father farmed a small holding of his own, and the family were long-established and well known in the neighbourhood. In Dr. Semple the feeling of kinship showed remarkable development; and any fact that concerned his ancestry, among whom he was proud to reckon some zealous upholders of Scotland's Covenant, was always of intense interest to him. He received his professional education in Glasgow University, and after some years of private practice entered the Army Medical Service. The Crimean War was raging then, and the young doctor saw life—and death—in the trenches. This was the beginning of a long and faithful service rendered to Queen and Country in various parts of the Empire. He was stationed at Scutari Hospital, saw campaigning in the Abyssinian War, served in India and New Brunswick for considerable periods, and held various appointments in London and Oxford. He was Medical Officer in Charge under Lord Chelmsford in the Zulu War, and saw the dead body of the ill-fated Prince Imperial of France. When he retired from the service, over twenty years ago, he was P.M.O. for Scotland. Thereafter till his death, at seventy-four years of age, he lived a quiet and studious life in Edinburgh, constantly adding to his large store of accurate and varied information by wide reading and by his connection with the various learned and scientific societies of the city. Of a most retiring disposition, he made few intimate friendships, but those who knew him best (and this was a highly-prized privilege of the writer of this note), loved him as one of the truest and kindest of men.

H. FARQUHAR,
Minister of West Dalkeith.

JOHN SIBBALD had been a Fellow of the Society since 1851, the year after his enrolment as a first year medical student in the University botany class. Studies did not press so hardly on the medical student in those days as they do now, and Sibbald, like others of his year, found time for botanical research, and he investigated the life of *Volvox*, and an account of this work was communicated to the Society and afterwards published. The claims of Psychiatry, a subject he made his own, absorbed him after graduation, and he became successively Deputy Commissioner and Commissioner of Lunacy in Scotland, in which position he received the honour of knighthood. He retired from active work in 1899, and died in April of this year (1905). Sagacious, broad minded, humorous, Sir John Sibbald was of the best type of medical man produced by our Scottish system of medical education.

FEDERICO DELPINO was an example of a man forced by overwhelming love of plants to sacrifice a civil career in order to devote himself to botany. Born near Genoa in 1833 he studied at the University there, and then entered the service of the State, rising to a prominent official position. Devoting himself, however, to botany, he in 1871 became Professor of Natural History at the Forest School of Vallambrosa, investigated the botany of Brazil as a member of the expedition sent out from Italy in 1874 on the frigate "Garibaldi." Thereafter he was successively Professor of Botany at Genoa and Naples. Delpino was a prolific writer. Three subjects interested him specially. Flower-pollination, in which his earlier work was done. He was one of the first to endeavour to group the known phenomena of flower-pollination in a definite biological system, and his results still hold the field. In phyllotaxy, another of his subjects, he contributed a large number of new facts to our stock of knowledge. His later work dealt with myrmecophily, to which he was doubtless drawn by the discoveries in Borneo of his compatriot Beccari, and he made known many interesting features of this curious form of symbiosis. Delpino was elected Corresponding Member of the Society in 1873 and Foreign Honorary Fellow in 1885.

LEO ERRERA, who at the time of his death in August last

(1905) was Professor of Botany in the University of Brussels, was elected a Corresponding Member of this Society in 1893. He was quite the most distinguished of the Belgian botanists. His work at first bore upon flower-pollination, but latterly he was entirely engrossed in the deep question of the excitation of protoplasm and its response to various extrinsic and intrinsic stimuli. In regard to this he published some valuable and suggestive papers. Errera's visits to Britain were frequent. The meetings of the British Association often found him in attendance. He was consequently well known to British botanists, with whom his frank and cheery manner made him popular, and who mourn his premature decease with a strong feeling of personal loss.

JOHN HORNE was a shrewd Scots gardener, one of those who the world over have compelled respect for the title and made it the synonym of excellence. From the Royal Gardens, Kew, he went to fill a subordinate post in the Government Botanic Garden at Pamplemousse, Mauritius. There his sterling qualities enabled him to rise to the position of Director, which he occupied for many years. During the period of his incumbency the preparation of the "Flora of Mauritius and the Seychelles" was undertaken at Kew by Mr. Baker, and the completeness of the published work was in great degree due to Mr. Horne, who not only added to the material already in the Herbarium at Kew from Mauritius but also made two botanical explorations of the Seychelles, and his collections formed the chief material for their Flora. A genial, hospitable man, he closed a successful career in Mauritius when he retired to St. Helier, Jersey, where he died in spring 1905. He was elected a Corresponding Member of this Society in 1887.

CHARLES MOORE.—The name of Moore has been a familiar one in the botanical and horticultural world for more than half a century through the life and work of two brothers—Dr. David Moore, for many years head of the Botanic Garden at Glasnevin, and Charles Moore, of whom I now speak. I may interpolate here with satisfaction that the reputation of the name is still worthily maintained by Mr. F. W. Moore, who succeeded his father at Glasnevin. Originally East Scotland folk—I think Kincardineshire — the Moores migrated to Ireland, where Charles Moore entered Trinity College Botanic Garden, under Dr. Townshend Mackay. Subsequently, on the recommendation of Professor Lindley, he was appointed Director of the Botanic Garden, Sydney, N.S.W., and his life was spent there. Under his direction the Sydney Garden became famous for its beauty and its rich collection of plants. He travelled widely in Australia at a time when that was not so easy as it is now, and he discovered many new plants, the best of which he introduced to horticulture. The familiar specific name *Moorei* attached to many of our garden plants - for example, of *Todea*, *Kentia*, *Macrozamia*, and others—indicates his connection with them. He retired from active official life some years ago, and at his death had reached the ripe age of 86.

The President then proceeded to discuss some of the problems of relationship of position and form of plant-organs to their environment that are at present receiving special attention from botanists. First of all, the question of gravitational sensitiveness was discussed. When a growing organ, say a root or stem which normally grows vertically, is laid horizontal it perceives the changed position and by curvature reverts to the normal. The currently advocated explanation of the mechanism of this perception attributes it to the presence of movable bodies, termed statoliths, usually starch-grains, of greater specific gravity than the cell-sap, which in the normal position are aggregated on the basal walls of the cells of the organ, and to this the cells are accustomed; when displacement to the horizontal occurs, the statoliths roll over to the lateral walls, now horizontal, and their weight gives the stimulus by which the movement of the organ to its original direction is induced. This statolith-hypothesis, although not yet generally accepted, finds a parallel in the mechanism of the sense of direction amongst some of the lower animals.

Next, light-perception was referred to. It has long been known that ordinary flat leaves bend and turn upon their stalks so as to place their upper surface at right angles to the direction of the brightest diffuse light—every one who has grown plants at a window knows that the leaf-surfaces always turn to the light. How does the plant perceive the differences in illumination to which it reacts? Recent work seems to bring us nearer an explanation. The epidermis or skin of the leaf consists of translucent cells without chlorophyll: they are full of sap of varying refractive index, and the walls are flat or curved in different degree, or thickened in places. These cells by their construction act as lenses of kinds, and are the light-sense-organs of the plant. When light strikes an epidermal cell of a normally expanded leaf vertically, a brightly illuminated field is formed in the centre of the protoplasmic lining of the inner wall of the epidermal cell, its intensity and sharpness varying with the optical character of the cells as lenses: around this central light-spot is a darker zone. To this the leaf is attuned. When the direction of incident light is changed, the position of the bright field on the inner wall is displaced, and the difference is perceived by the plant—the change acts as the stimulus which starts the movement of the leaf to bring its upper surface again at right angles to the incident light. The degree in which the epidermal cells are constructed as lenses varies; sometimes single cells only so act. This view of light-perception, only lately put forward, appears to be well-founded, and it opens up a wide field for further investigation and explains many well-known features of leaves. As an example: the velvety surface of the leaves of many wood-plants is caused by numberless papillæ, and capping each of these there are now found light-sense-organs which are thus raised to escape submergence in water lying on the leaf-surface by which the working of their optical apparatus would be interfered with. Similarly, the waxy coating of leaves, which prevents their being wetted, is apparently an arrangement to prevent their being blinded by rain, and the blinding of leaves by dust is probably one of the causes of failure of tree-growth in towns. That plants possess such light-sense-organs may surprise us, but in them we again find a parallel development with the ocelli of some of the lower members of the animal kingdom.

The later part of the address was devoted to the subject of convergence of form (homoplasy) and divergence of form of plants. A series of examples were shown of similar vegetative forms in widely separated groups of plants, and again of widely different forms within the same genus. The clue to the interpretation of these is to be found in environmental conditions, of which water is the dominant factor. From many starting-points and by many paths of evolution the same form has been attained in response to environment in the first series; from one centre many different forms have arisen in like response in the latter. It is a fertile field for research in nature, and it is satisfactory that under Sir John Murray the fresh-water aquatic flora of Scotland is being thoroughly investigated from this standpoint. The address was illustrated by a large series of lantern slides.

The retiring President said:—

By the favour of the Honorary Assistant Secretary I am able to give you the following state of the Roll of the Society:—

Honorary Fellows: Royal 1, British 5, Foreign 25; Ordinary Fellows: Resident 111, Non-Resident 44; Corresponding Members 63; Associates 9; Lady Members 6. Total 264.

During the past year the Membership of the Society has been strengthened by the addition of:—

Honorary Foreign Fellows 3; Ordinary Fellows: Resident 5; Corresponding Members 23; Associates 3. Total 34. And during the same period 2 Ordinary Fellows have resigned, and we have lost by death: Honorary British Fellow 1; Ordinary Fellows: Resident 1, Non-Resident 2, Corresponding Member 1. Total 7.

Thomas Hardie was an old Fellow of the Society, having joined it in 1868. In the earlier days of his membership he was a frequent attender at our meetings, in the business of which his retiring nature prevented him taking much active part. Latterly the calls of a large practice have kept him away. From a short notice of him in the "Medical and Surgical Journal" for April 1906 I take the following:—

After graduation as M.D. of the University of Edinburgh in 1858, Thomas Hardie acted as House Surgeon in the old Infirmary in Edinburgh, and thereafter studied abroad, and practised as an assistant in Yorkshire before settling down in his native town of Leith, where he acquired a large practice. In 1868 he became a Fellow of the Royal College of Physicians. A practitioner of the old school, he was known by everyone with whom he came in contact as a modest, courtly, polished, and kind gentleman—a type of man whose memory will linger long in the hearts of his townsmen and others. He died 28th February 1906.

JAMES FARQUHARSON.—In the Reverend James Farquharson, D.D., Minister of the parish of Selkirk, who died 25th April 1906, the Society has lost a keen botanist. In the matter of the subjects which are germane to the aims of the Society, Dr. Farquharson's work was of no mean character. A zealous field botanist, he published in 1876 his "List of the Flowering Plants and Ferns observed in Selkirkshire," and a good list it is of plants, all but three collected by himself.

The growth of plants in relation to meteorological conditions was a subject that occupied his attention, and he published, in 1876, a paper "On the Leafing of certain Trees, etc," which is, in fact, a record of the relative dates of leafing and flowering from 1861–1876 of three trees—the Scots plane, the Norway maple, and the lime-tree. He showed how the Scots plane is the hardier of the two maples observed, and is less influenced by climate, and that both of the maples come into active growth before the lime-tree.

In the same line of work was his record of the effects of the winter from 1878 to 1881 upon gardens and shrubberies in the neighbourhood of Selkirk.

Dr. Farquharson frequently attended the meetings of the Berwickshire Naturalists' Club, and he became its President in 1882. At the meeting at Holy Island in 1883 he found *Carex divisa* on the Island, the first record of its occurrence.

But perhaps the botanical work by which he is best known is that in connection with the "hained ground" of the Duke of Buccleuch at Bowhill. From the year 1829, Howebothom, an area of some 300 acres, a portion of old Ettrick Forest, and occupying the southern portion of the height upon which Bowhill stands, was hained, *i.e.*, preserved from the intrusion of sheep and cattle, by the Duke of Buccleuch, with the two-fold object of increasing the picturesqueness of the surroundings of Bowhill and of allowing the growth of the indigenous trees and plants of the forest, more particularly of the oaks, which tradition, and indeed legal documents, assure us grow plentifully in Ettrick. In the "History of the Berwickshire Naturalists' Club" Dr. Farquharson gave, in 1878, an account of the outcome of this interesting experiment. From the aspect of the areas in the vicinity, Dr. Farquharson pictures the ground at Howebothom, before haining, as a bare, treeless pasturage, bearing heather, the common hill grasses, carices, and rushes. That has now been replaced by a picturesque wooded area, which strikes one by its boskiness—a certain richness and fulness in the outline of the trees and bushes. The lesson he drew from the Howebothom experiment he states thus:—"In the old Forest of Ettrick there was not a stately and uniform growth of large timber. I infer that the ground along the valleys was clothed with a dense brushwood of hawthorn, birch, and sallow, mountain ash mingling with these, but flourishing more on the hill-sides; while above this lower growth rose at intervals many a semele tree—the fir, the ash, the oak; for although Howebothom offered no evidence that the oak is indigenous to the district, remains of it preserved in our peat bogs attest that it once flourished as a native in the vales of Ettrick and Yarrow. As to herbaceous plants, Howebothom has produced no rarities; but I think the present state of its vegetation shows that, given favourable conditions of soil and of shelter, certain strong growing plants, such as *Calluna vulgaris*, *Aira cæspitosa*, *Pteris aquilina*, will strangle their weaker neighbours and occupy the ground to the exclusion of every other species." Of course, draining of some wet parts has altered to some extent the original conditions of the area, and may have led to the exclusion of certain species.

Frank Townshend, a distinguished British botanist, was born at Rawmarsh, Yorkshire, where his father was rector, on December 5, 1822, and died on December 16, 1905, at Cimiez, Nice. Educated at Harrow and Trinity College, Cambridge, he early became acquainted with Babington and Newbould, with whom he took botanical excursions. An independent fortune procured him leisure to follow his botanical bent, and he took up successively the critical study of genera and species of British plants which have an aggregate character. The genus *Euphrasia* is the last one upon which he has worked, and his monograph of the British forms appeared in the "Journal of Botany," as did the majority of his other papers. His chief botanical work was, however, his "Flora of Hampshire," which appeared in 1883, and of which a second edition was issued a couple of years ago. Though the author of its Flora, Townshend was connected with Hampshire for but a short period, dating from 1865 (when he settled at Wickham) to 1874, when he succeeded to the family place, Wormington Hall, Warwickshire, where he resided during the rest of his life. He was Unionist member of Parliament for the Stratford-on-Avon division of Warwickshire from 1886–1892, and he led the life of an "ideal country squire." Elected a non-resident Fellow of our Society in 1846, he was at the time of his death one of our oldest Fellows. An excellent notice (with portrait) of Townshend, from the pen of Mr. Britten, appears in the "Journal of Botany" of April 1906, from which the foregoing facts have been derived.

Harry Marshall Ward. — The heaviest loss which botanical science has experienced during the past year is that of Professor Marshall Ward of Cambridge. He was one of our six honorary British Fellows, and if I have left notice of him to the last it is because what he has done has so informed our generation, and has so pointed the way for the future in the lines of botany in which he was expert, that I wish to use the occasion of this address for a survey of some of the work he accomplished. In these days of rapid absorption of new facts and ideas into the general stock of knowledge to serve as starting points for new discoveries of facts and further suggestions, the exact service of individuals is apt to be forgotten or overlooked. And therefore, although the retrospect of another generation will assuredly differ somewhat from the view we are able to take of the work of contemporaries, it is well that we put on record our opinion, especially in the case of those whom we regard as brilliant.

Into this category Marshall Ward comes. There has been in our time no more effective teacher, using the term in its widest acceptation. The present general knowledge of, the present recognition of, the importance of plant pathology and of disease caused by and affecting plant life in relation to great industries in this country, is in great measure an outcome of his teaching, whilst the attitude of science to the problem of biology involved in the relationship of organism to organism has solid support in the results of his researches.

In order to bring within near focus the course of his life, I give here a chronological table and also a list of his publications. In the preparation of these I have been greatly assisted by Mrs. Marshall Ward.

Chronology.

1854.	Born at Hereford, eldest son of Francis Marshall Ward.
About 1864?	Lincoln Cathedral School; and private school at Nottingham.
1874.	South Kensington, under Huxley.
1875.	Owens College, Manchester.
1876–79.	Christ's College, Cambridge.
1876.	Scholar of Christ's College, Cambridge.
1876.	Assistant at South Kensington.
1877.	Assistant at Owens College.
1879.	B.A., with First Class Honours in Nat. Sci. Tripos, Cambridge.
	Würzburg, with Sachs.
	Lecturer at Newnham College, Cambridge.
1880–82.	Cryptogamic Botanist to Ceylon Government.
1882.	Strassburg with De Bary.
	Berkeley Fellow, Owens College.
1883.	M.A., Cambridge.
	Assistant Lecturer, Owens College.
	Married eldest daughter of Francis Kingdon, Esq., Exeter.
	Fellow, Christ's College, Cambridge.
	Assistant Lecturer and Demonstrator, Owens College.
1885.	Professor of Botany, Cooper's Hill College.
1886.	F.L.S.
1887.	F.R.H.S.
1887–89.	Council of Linnæan Society.
1888.	F.R.S.
1888–92.	Examiner in Botany, University of Edinburgh.
1890.	Croonian Lecturer.
1892.	Lecturer at Institute of Brewing.
	D.Sc., Cambridge.
1893.	Royal Medal.
1894.	Hon. Fellow, Institute of Brewing.
	Lecturer at Royal Institution.
	Hon. Fellow, Manchester Literary and Philosophical Society.
	Examiner in Botany, University of London.
1895.	Professor of Botany, University of Cambridge.

1895. Fellow, Sidney Sussex College, Cambridge.
1895–96. Council of Royal Society.
1896. Hon. Fellow, Botanical Society, Edinburgh.
1897. Hon. Fellow, Christ's College, Cambridge.
President, Botanical Section of British Association at Toronto.
1900. Corresponding Member, Cryptogamic Society of Scotland.
1900–02. President, British Mycological Society.
1902. Hon. D.Sc., Victoria University.
Hon. Member, Nottingham Naturalists' Society.
1903. Corresponding Member, Deutsche Botanische Gesellschaft.
1904. President, Cambridge Philosophical Society.
1905. Examiner in Botany, University of Edinburgh.
1906. Aug. 26. Died at Torquay.
Sept. 3. Buried, Huntingdon Road Cemetery, Cambridge.

Publications.

1880. On the Embryo-Sac and Development of *Gymnadenia conopsea*. Q. J. Microsc. Sci., London, 1880.
A Contribution to our Knowledge of the Embryo-Sac in Angiosperms. London, J. Linn. Soc. Bot., **17**, 1880.
Preliminary Report on the Inquiry into Coffee Leaf Disease. Colombo, Sessional Paper, **30**, 1880.
Second Report. Colombo, Sessional Paper, 1881.
1881. Third Report. Colombo, Sessional Paper, **17**, 1881.
On the Morphology of *Hemileia vastatrix*, Berk. and Br. (the Fungus of the Coffee Disease of Ceylon). Q. J. Microsc. Sci., London, 1881.
1882. Researches on the Life-History of *Hemileia vastatrix*, the Fungus of the "Coffee Leaf Disease." London, J. Linn. Soc. Bot., **19**, 1882.
Researches on the Morphology and Life-History of a Tropical Pyrenomycete (*Asterina*). Q. J. Microsc. Sci., London, 1882.
1883. Observations on the Saprolegniae. Q. J. Microsc. Sci., London, 1883.
On Salmon Disease. Manchester, Mem. Lit. Phil. Soc., 1883.
On the Structure, Development, and Life-History of a Tropical Epiphyllous Lichen (*Strigula complanata*, Fée, fide Rev. J. M. Crombie). London, Trans. Linn. Soc. Bot., 2, **2**, 1883 (1884).
On the Morphology and the Development of the Perithecium of *Meliola*, a genus of Tropical Epiphyllous Fungi. London, Phil. Trans. R. Soc., 1883.
1884. Observations on the genus *Pythium* (Pringsh.). Q. J. Microsc. Sci., London, 1884.
On the Sexuality of the Fungi. Q. J. Microsc. Sci., London, 1884.
1885. Schizomycetes. Encycl. Brit., Edin., 1885.
1886. The Morphology and Physiology of an Aquatic Myxomycete. Manchester, Stud. Biol. Owens Coll., 1886.
Puccinia graminis. Q. J. Microsc. Sci., London, 1886.
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(With John Dunlop.) On Some Points in the Histology and Physiology of the Fruits and Seeds of *Rhamnus*. Ann. Bot., Oxford, **1**, 1887.

On the Tubercular Swellings on the Roots of *Vicia Faba*. London, Phil. Trans. R. Soc., **178, B**, 1887.

1888. Some Recent Publications bearing on the Question of the Sources of Nitrogen in Plants. Ann. Bot., Oxford, **1**, 1888.

A Lily Disease. Ann. Bot., Oxford, **2**. 1888.

Illustrations of the Structure and Life-History of *Puccinia graminis*, the Fungus causing the Rust of Wheat. Ann. Bot., Oxford, **2**, 1888.

1889. On the Tubercles on the Roots of Leguminous Plants, with special reference to the Pea and Bean. London, Proc. R. Soc., **46**, 1889.

Timber and some of its Diseases. London, Macmillan, 1889.

1890. The Fungi of Fermenting Vessels and Vats. Brewers' J., 1890.

The Relations between Host and Parasite in certain Epidemic Diseases of Plants. The Croonian Lecture. London, Proc. R. Soc. **47**, 1890.

1891. Notes on Botanical Characters serving to distinguish the Principal British Forest Trees. Appendix to Schlich's Manual of Forestry, Vol. II. London, Bradbury, Agnew & Co., 1891.

Diseases of Plants. London, Soc. Prom. Christ. Know., 1891.

1892. The Ginger-Beer Plant, and the Organisms composing it: a Contribution to the Study of Fermentation-Yeasts and Bacteria. London, Phil. Trans. R. Soc., **183, B**, 1892.

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The Action of Light on Bacteria. London, Phil. Trans. R. Soc. **185, B**, 1894.

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Laslett, Timber and Timber Trees. New Edition.

1895. Fourth Report to the Royal Society Water Research Committee. On the Biology of *Bacillus ramosus* (Fraenkel), a Schizomycete of the River Thames. London, Proc. R. Soc., **58**, 1895.

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Born at Hereford in 1854, the eldest son of Francis Marshall Ward, Harry Marshall Ward was educated at Lincoln Cathedral School and a private school at Nottingham. Inheriting considerable musical talent, the intention was that music should be his vocation. His real bent was otherwise. Natural science claimed him, and he went in 1874 to London as a prospective school teacher of science to the classes at South Kensington, then only recently established under Huxley as an outcome of the rebirth of Biology that followed upon the appearance of Darwin's *Origin of Species*. There is an element of romance in the circumstances that finally secured Ward for the career in which he acquired distinction. The fellow student who sat beside him in Huxley's laboratory was a Mr L. A. Lucas. He was struck by the quality of the work Ward did, and urged him to go to Cambridge, then also awakening under the stimulus of freer conception of living things. The *res angusta domi* barred the way, however, ambitious though Ward was to follow out the suggestion. Mr Lucas, being a man of private fortune, provided anonymously the necessary funds, and thus it came about that Ward went to Cambridge, became a scholar of Christ's College, took his degree from there in 1879, obtaining First Class Honours in Botany in the Natural Science Tripos. It was a life regret to Ward that his benefactor died early in the East, and before he could know the benefit to science that his benefaction had brought.

During this period of education Ward worked for a time in the laboratories of Sachs at Würzburg and of De Bary at Strassburg, and he also had preliminary training as a teacher by co-operating in the science classes at South Kensington (1876), and at the Owens College, Manchester (1877), and by lecturing at Newnham College, Cambridge (1879).

After graduation he spent two years in Ceylon as Cryptogamist to the Ceylon Government, and on his return became Berkeley Fellow of Owens College (1882), and subsequently assistant lecturer and demonstrator in Botany there (1883). Meanwhile his old college at Cambridge elected him to a Fellowship (1883). In the same year he married the eldest daughter of Francis Kingdon, Esq., of Exeter. Two children survive.

The year 1884 nearly brought Marshall Ward to Scotland as Professor in Glasgow. That he did not come was a disappointment to him. I may take this opportunity to tell the story of how this came about, and to remove misapprehension that has gathered round the circumstances. My election from the Regius Chair of Botany in Glasgow to the Sherardian Chair in the University of Oxford at the beginning of March 1884 left but a short period for the election of my successor by the Crown before the opening of the summer session. The experience of the University of Glasgow in a preceding vacancy did not encourage it to risk an appointment delayed beyond the beginning of the session, and I was therefore invited by the University to carry on the work of Professor of Botany during the following summer session. As my Oxford work did not begin until October and the Vice-Chancellor acquiesced, I accepted the invitation. The University resolved not to accept my resignation and not to intimate a vacancy to the Government until the close of the summer session. This information was conveyed to several aspirants to the Chair, amongst them to Marshall Ward. The session was about three weeks gone when my colleague in the Chair of Anatomy (Professor Cleland) received a letter from Professor W. R. M'Nab of Dublin to the effect that he had been appointed by Sir William Harcourt, then Home Secretary (in whose hands such appointments then were), to the Chair of Botany at Glasgow, and asking information as to my movements. How this appointment came to be made I do not know. The University of Glasgow would not accept it, holding, as was true, that no vacancy had been announced by it to the Crown, and that the selection had not been made from an adequate field of candidates, and in particular mentioned Marshall Ward's name; at the same time I was asked to defer my resignation until the University desired me to send it in: this did not happen until near the close of the year, and then both M'Nab and Marshall Ward were passed over.

At Manchester Ward remained until 1888, when he took up the appointment of Professor of Botany at Cooper's Hill College, a college which this year (1906) has ceased to exist. There he remained for ten years, until, on the death of Babington, he was called in 1895 as Professor of Botany to the University of Cambridge. For some years he had been suffering from an ailment that wrought sore havoc upon his frame, and his death in August last, at the early age of fifty-three, came as no surprise to those who had seen him recently.

By his death a warm friend and keen man of science has gone from us, to whose admirable personal qualities many tributes have been paid by pens of those who knew him well.[1] Here I will only say that my sense of individual loss is deep, for our friendship began in 1880, as we voyaged to the East, and was strengthened by intimate association in many things during after years.

As a teacher in the institutions to which he was attached, the dominant characteristic of Marshall Ward was his boundless enthusiasm, which overflowed to his pupils. The gift of ready and lucid exposition was his, and he thought clearly. His facile draughtsmanship, giving life to his delineations, added to his power. Full of knowledge of his subject and its bearings, he at times overwhelmed his hearers with apt reference and technical illustration. Always interesting in the lecture hall, in the laboratory his dexterity and industry were a stimulating example to the beginner, to whom he rightly gave much personal attention, and his direct help and suggestive outlook encouraged the advanced pupil.

But Ward's teaching was not only thus confined. He

[1] See Vines in *Nature*, September 1906: Balfour in *Cambridge Reporter*, October 1906; Bower in *Journal of Botany*, 1906. A sketch of his life, with portrait, will appear in *Annals of Botany* for 1907.

appealed to a wide audience besides his academic one. Practical problems associated with the activities of plants, whether useful or hurtful, always attracted him, and he readily responded to the many claims made upon him to discourse on the scientific principles underlying practice in large industries which were based upon plant life. Thus brewing was a subject to which he gave much attention, investigating the fungi of vats and crystallising the points of his teaching in contributions to the periodicals of the industry. The question of timber and its diseases came prominently under his notice as an instructor at Cooper's Hill of young men about to enter the Indian Forest Service, and his books on the subject, as well as upon plant-disease as a whole, have done much to spread sound knowledge. No botanist of our time has done so much to promulgate correct views upon the work of plants as factors in our everyday life. The economic side of plant life fascinated him indeed, and in his address at the British Association at Toronto he took this as his subject. Marshall Ward was a great teacher. But the greatness of a teacher lives, however, only by tradition, and this weakens as those who have been directly influenced by it disappear. A new generation has its own teachers without basis of comparison with the old. Marshall Ward has, however, written his name large on the roll of fame to all time through the brilliant contributions to natural knowledge he has made, by his illuminating treatment of biological problems, and by the new lines of research he has initiated. No one of our generation has done more solid work for botanical science. The twenty-seven years of his active work of investigation were full years. The records of his work are laden with achievements and fertile suggestion.

At the outset of his career, and under the influence of the researches which Strasburger in particular was giving to the world, Marshall Ward took up the question of embryo sac development in Angiosperms, and in the two papers which he published he established many new basal facts, now the common property of botanists.

Later, in 1887, in a paper upon the fruit and seeds of *Rhamnus*, he, along with his pupils, published the results of an investigation which was of the greatest interest, for he showed that in the raphe of the seeds there is localised a ferment which, when in water it comes in contact with the glucoside xanthorhamnin located in the pericarp, breaks it up into glucose and the crystalline yellow rhamnin which is the matter of the yellow dye of the Persian berries, as the fruits of *Rhamnus* are called. By this discovery he gave the scientific explanation of empirical points that troubled dyers. Why, for instance, the crushed fruits yield a satisfactory colouring matter, whilst the pericarps alone do not. Further, he advanced reasons for thinking that the glucoside is a storage material for the young plant, quoting as analogous cases the well-known ones of the amygdalin glucoside and emulsin present in separate cells of the seed of bitter almond, and the myrosin ferment and myronate of potassium in mustard.

I mention these researches first because they are the only cases of elaborate investigation published by Marshall Ward outside the group of the Fungi, Mycetozoa, and Bacteria. They show, however, that in any field he entered upon he would have obtained brilliant results.

The critical moment that determined the chief field of Marshall Ward's research was that when in 1879 he was appointed to investigate in Ceylon the coffee-leaf disease. From that moment Fungi in the widest sense and their work were the subject of his assiduous research. On him in fact descended the mantle of Berkeley, our great Cryptogamic botanist of the nineteenth century. During the past couple of decades Marshall Ward has been our recognised authority upon the group and its activities, and he has given us story after story of the life and inter-relations of different forms, sketched with the accuracy of observation and judgment of circumstance that became one who had been in touch with De Bary and through him had acquired the tradition of the school of the Tulasnes. Dominating all his brilliant inquiries is the endeavour to solve the questions involved in parasitism —the influence exercised by the host on the parasite, and conversely of the parasite on the host and the mechanism of the attack—in fact, the fundamental problem of the interaction of living organisms.

His first study in this group was that of *Hemileia vastatrix*, the fungus of the coffee-leaf disease. It will be within knowledge of many of you that in the seventies the plants on the coffee estates in Ceylon were attacked by an epidemic which brought ruin to the cultivation, and in response to the appeal of the planters the Colonial Government appointed Ward to investigate it. There is always a wide gap between determination of a cause in such a case and the devising of an effective remedy. The first of these Marshall Ward succeeded in doing with absolute clearness. As regards the second, the planters ultimately adopted the radical cure of abolishing the cultivation of coffee and betaking themselves to other crops. That the industry should thus disappear was no reflection on Ward's work. The fungus itself was shown by Ward to be a Uredine, and in working out its history many problems of infection and development presented themselves, and became, if not solved at the time, objects of attack in the future. Whether or not from this early association with a Uredine, the group became a favourite one with Marshall Ward. As you know, it is a classic group, inasmuch as it was in it that De Bary first traced the wonderful history of a metoxenous pleomorphous parasite and established the condition know as Heterœcism. The very last research in which Marshall Ward was engaged was concerned with the elucidation of problems in the group first suggested by his studies in Ceylon.

It would be impossible for me in the time at my disposal to deal as I would wish with all the discoveries of Ward in the domain of the Fungi. I propose to select for mention to you some through which a clearly marked step forward was the outcome of the research. As then I was talking of the Uredines, I may first of all refer to this group, though his most suggestive work on it was the last Ward did.

Specialised parasitism is one of the most interesting facts that have become known in connection with their life histories. We now know that, for example, the classical *Puccinia graminis* is really an aggregate of *morphologically* different forms, but over and above this there are also *physiologically* different forms, i.e. forms which, though indistinguishable outwardly and structurally, yet are sharply distinct in their parasitism. Thus the *Puccinia graminis* of wheat does not attack rye, barley, and others of the grasses. This is what is meant by specialised parasitism, the forms being variously called adapted species, or races, biological species, and so on. What is the cause of this? The problem here is the old one of immunity and susceptibility. And to the solution of this Ward set himself vigorously.

The suggestion that anatomical considerations, presence of hairs, wax, etc., were important factors, was advanced frequently and received some support, but Ward was able to show conclusively that these have nothing to do with it. He forces us to recognise that there are two stages, one of *application* or *inoculation* by the spore, which germinates and sends a tube into the air chamber of the stoma, but that is not necessarily followed by the *infection*, which means the entry of the germ tube through the cell wall bounding the air chamber. And ultimately he was able to prove that the infection depends upon the reciprocal presence of enzymes and toxins and antitoxins in parasite and host. Nor was this all. Marshall Ward was able to establish his theory of *inuration* and bridging species. That is to say, he found it possible to educate a parasite which was harmless to a particular host species to attack it successfully through cultivation successively upon allied forms. Thus, given a parasite growing upon a grass A, but to which grass E is immune, it is possible by growing the parasite successively upon certain forms B, C, D, to educate it so that it will attack E. These intermediate forms Ward termed bridging species.

All this work on the Uredines brought Ward into conflict with the well-known Swedish agricultural professor Eriksson, who had given much attention to the study of the epidemics of rust that occur in Sweden. The point of conflict concerned the method of perennation of the metoxenous Uredines. When it was discovered that plants like the barberry, *Rhamnus*, *Anchusa*, were hosts of stages in the pleomorphous life history, the prophylaxis that naturally suggested itself was destruction of these in the vicinity of cereal crops. That has been a matter of policy in many areas. But now, despite this abolition of the host of an essential winter stage of the parasite, it is found that the epidemic of rust is as virulent as ever. How is this to be explained? All observers, from De Bary and Ward, have sought in vain for a perennating mycelium, and it has been shown by Ward and others that uredospores may perennate and germinate in the next season, and thus a satisfactory explanation would be forthcoming of the occurrence of the epidemic. Eriksson, however, will have none of this, but he introduces what he calls "the intracellular mycoplasm life of the fungus," what he calls for shortness his *mycoplasm theory*, according to which, by some mysterious method, the protoplasm of the fungus becomes combined in a long latent symbiotic life with the protoplasm of the host, forming a mycoplasm, and only shortly before the eruption of the rust pustules does it enter into a visible state assuming the form of a mycelium. Of this hypothesis Marshall Ward, after the fullest examination and discussion, was merciless in his condemnation. Savouring as it did of the fanciful. not susceptible of any optical demonstration, he would have none of it, and his last appearance at a meeting of botanists was at the British Association at Cambridge last year, when the question was fully discussed, and not to the advantage of Eriksson.

On the recrudescence of the question of the nitrogen supply of green plants in 1886, brought about by the work of Frank on the mycodomatia of *Leguminosæ* and the mycorrhiza of forest trees, Ward entered the field, and by his discovery of the method of infection of the root hair and the subsequent stimulus of the root to the development of the mycodomatia, practically settled the question. Ward thought that the organism entering the root hair was a mycelial fungus. At that time the curious coenobial forms of bacteria had not been investigated. Now we know that Ward's infection thread is really a bacterial colony. This does not detract from the merit of Ward's discovery, which, as I have said, was crucial.

Another critical piece of work was that in 1888 upon a disease of the lily, for in course of this he was able to show the exact method by which a fungus mycelium pierces the cell wall of its host, and to isolate the ferment by which the penetration is effected.

In the middle eighties the organism known as the ginger beer plant came into special notice. Many botanists received specimens with requests for information regarding it. As you know, the plant consists of lumps of gelatinous substance which has been long in use in country districts for the manufacture of home-made ginger beer. When the gelatinous lumps are placed in a saccharine solution with some bits of ginger in a bottle, a fermentation is set up which results in the liquor so commonly used. Mythical histories attached to the origin of the gelatinous mass—brought from the Crimea, Italy, and so on—and the plant was handed on from family to family.

In 1887 the plant came to Professor Marshall Ward, and he began an investigation—one which ultimately extended over several years. The outcome of it was that the ginger beer plant was shown to be composed of two essential ingredient plants, with several others present as accessory non-essential forms. Of the essential, one is a bacterium, *B. vermiforme*, a distinct species, the gelatinous sheaths of which make up the jelly of the ginger beer plant. The other is a yeast, *Saccharomyces pyriforme*, also a distinct species, to which the alcoholic fermentation is due. Not only was this determined by analysis, but also by synthesis. Further, the reseach led to the development of a new conception in that of *symbiotic fermentation*, i.e. the bacterium is favoured by obtaining some substance or substances directly they leave the sphere of metabolic activity of the yeast cells. The yeast, on the other hand, benefits by these substances being removed and destroyed, and amongst these the CO_2, which seems to be essential for the bacterium. (A comparison with the symbiosis of a gelatinous lichen naturally suggests itself.) This idea of symbiotic as compared with *metabiotic*, where one organism prepares only the ground for another, and *antibiotic*, where one organism ousts the other by poisoning the medium, is a fertile one.

I now come to speak of an investigation the labour of which would have daunted most men. I refer to that of the bacteriology of Thames water. This he undertook for the Royal Society in 1892, in conjunction with Professor Percy Frankland. The actual bacteriological part of the work was taken up by Marshall Ward himself. For work of this kind he was well prepared, having already published his views upon the characters employed in the classification of *Schizomycetes*. It is difficult for an outsider to realise the industry, the constant attention, required for this bacteriological work. It involved the isolation and growing through all their life-stages in pure culture of the many forms met with in the water and then the determination of their several capacities, whether these made for health or disease in the user of the water containing them. But it was the kind of work in which Marshall Ward revelled. Such of the results as are published in the Reports of the Royal Society are compendious and thorough. With his characteristic intuition, Marshall Ward did not fail to follow up clues that might lead to framing of a general conclusion, and one of the most valuable products of this bacteriological work was his demonstration that light arrests development of the bacteria and ultimately kills them. This was no more than might be expected, and had indeed been vaguely forestated. But Marshall Ward went further, and by an elaborate series of experiments proved beyond question that the bactericidal action lay in the blue region of the spectrum. As a side issue the question of colour in bacteria in its relation to the action of light was a subject of investigation, and its parasolar value was demonstrated. The line of work initiated by this discovery Marshall Ward had proposed to follow up through other processes of the vegetable kingdom, but had not accomplished this at the time of his death.

The references that have been made will suffice to indicate the extent and far-reaching character of Marshall Ward's work in Mycology, and one cannot but feel assured that they establish his claim to be reckoned one of the great investigators of our time, who has not only added to the sum of knowledge, but opened up new avenues to further victories over the unknown.

The following communications were read :—

Note on New Disease on Picea pungens.
By Dr. A. W. Borthwick.

The disease is caused by a fungus which attacks the buds and produces large, black, conical swellings in which numerous fructifications of the fungus occur. The bud is either immediately destroyed, or it may produce a very much twisted and cankered shoot which frequently dies off at an early period. The fungus is one of the ascomycetes, and shows characteristics resembling those of the genus *Cucurbitaria*.

Note on New Disease on Abies pectinata.
By Dr. A. W. Borthwick.

This disease occurs on the leaves, and is caused by an ascomycete. The affected leaves are scattered over the twigs of the current year. They become first light brown in colour, and finally very dark brown. The perithecia arise below the epidermis, which they ultimately rupture to allow the spores to escape. At maturity these fructifications may be seen as small, black, spherical swellings on the infected leaves. Considerable damage may be done to the trees thus attacked.

Both the above, as yet unnamed, are under further investigation.

Note on Juncus effusus, var. spiralis.[1] By Mr. Magnus Spence. Communicated by Prof. I. Bayley Balfour.

This plant is pretty common in Orkney. I have seen it in several localities. It is to be found in Birsay—the most westerly parish of the Mainland of Orkney; in Deerness, the most easterly, and in most of the intervening parishes. It grows most abundantly in boggy moors. The specimens exhibited were taken from a bog to the south-east of the public school of St. Andrews, a parish in the East Mainland. In this bog *J. effusus* var. *spiralis* is more numerous than *J. effusus*, and bears the proportion of 3 to 2. When, however, one reaches the higher and drier ground the proportion is reversed, and farther still it becomes rare. One can at a glance notice the great difference in the appearance of the tussocks. Most of the individual plants of the tussock spread out at an angle of from 30° to 40° to the ground. The more upright forms of *effusus* and *conglomeratus* are easily distinguished from the graceful stems of *J. e. spiralis.* The tussocks of the two plants grow apart and do not intermingle.

[1] This is probably the first record of its occurrence in a wild form in Scotland. See Jas. M'Nab in "Trans. Bot. Soc. Edin.," xi., 1873, pp. 502–504.

Note on a Peculiar Tussock-Formation.

By W. W. Smith, M.A.

During a visit to the Isles of Scilly in August 1906, I came across a somewhat unusual formation in one of the marshes of the main island of St. Mary's.

There is a deep depression one mile north of Hugh Town, forming an extensive tract of marsh. This marsh is well sheltered from the prevailing winds, and even in dry weather remains moist. At the upper end of this marsh is a sluggish watercourse—practically the only stream to be seen in the group, if we except the large "drain-cuttings" in the Town Marshes. The area around this watercourse is moist and muddy even in the height of summer. In one corner of this area I found that *Carex paniculata* was plentiful—a *Carex* tending to form small tussocks.

Combined with the *Carex*, there occurs a quantity of *Arundo Phragmites* and *Pteris aquilina*, and when these are found together the tussock-formation is very considerably enlarged. The largest forms recall at once in outline the salient features of a tree-fern—there is a stumpy base, rising in some cases to four or five feet, and the leaves of the above three plants form a large crown at the apex.

I quote the measurements of two individuals:—

No. 1. Height of stump $5\frac{1}{2}$ feet; total height 10 feet, circumference of stump at thickest $8\frac{2}{3}$ feet.

No. 2. Height of stump 4 feet; girth at 3 feet, 7 feet; circumference of crown 12 feet.

The three plants mentioned are present in varying proportions—sometimes the *Arundo* is awanting. But it is the presence of the *Arundo* and the *Pteris* in the mass which, in my opinion, gives the extra size to the clump (for several pure *Carex paniculata* tussocks are also present, and these are less than one foot high). The peculiar tree-fern-like aspect is also due to the admixture; the bases of the leaves of the *Pteris* and *Arundo* persist, and clothe the surface of the stump as in a *Cyathea*. The character of the ground must also have its influence, as I did not observe any similar growths in the remainder of the marsh-land; the conditions at this one spot served to prevent the levelling-

T. N. Allison phot.

1. TUSSOCK-FORMATION. Isles of Scilly.

W. Balfour Gourlay phot.

Huth coll.

2. FASTIGIATE BEECH.

up of the surface, so that these clumps stood conspicuously above the general level of the vegetation.

I broke up one or two of the larger stumps and found the component parts throughout; if the *Pteris* and *Arundo* are subsequent members of the mass, they must become so at an early stage. In some cases the *Pteris* seemed to predominate, though usually the *Carex* is the chief component.

The commoner accessory plants were noted:—*Rubus* sp., *Solanum nigrum*, *Digitalis purpurea*, *Apium nodiflorum*, *Oenanthe crocata*, *Carduus palustris*, *Myosotis repens*, *Osmunda regalis*, and *Lastrea dilatata*.

The accompanying figure serves to illustrate the formation. Plate I. fig. 1.

Mr. D. S. Fish exhibited photographs of various pendulous trees; a variegated form of *Vaccinium Vitis-Idæa* and *Senecio albescens*, Burbidge and Colgan (*S. Cineraria*, DC., × *S. Jacobæa*, Linn.).

Mr. James Grieve showed *Cypripedium insigne* var. *Sanderi* in fine flower.

R. Stewart MacDougall, M.A., D.Sc., showed specimens of *Tetranychus tiliarum*. This species infests lime trees. The web—a specimen of which was shown—is sometimes found forming a glaze over the stem. The specimen shown was over a foot long, and was found hanging from a branch. Inside the web were thousands of the mites *Tetranychus* is a genus of which perhaps the best known species is the Red Spider of greenhouses and other plants.

Mr. R. L. Harrow showed the following plants in flower from the Royal Botanic Garden:—*Agathæa cœlestis*, *Begonia prismatocarpa*, *Exacum zeylanicum* var. *macranthum*, *Leptosyne gigantea*, *Crowea latifolia* var. *major*, *Nicandra violacea*, *Habenaria carnea*, *Gongora armeniaca*, *Phalænopsis Esmeralda*, *Pleurothallis rubens*, *Pleurothallis Grobyi*, *Cœlogyne Lagenaria*.

Mr. W. B. Boyd exhibited branches of *Sequoia gigantea* in good fruit.

W. Caldwell Crawford, M.A., showed a fungus, *Pleurotus decorus*, found by Mr. Grant of Drumnadrochit—a new record for Great Britain.

MEETING OF THE SOCIETY.

December 13, 1906.

J. Rutherford Hill, Esq., President, in the Chair.

The following were elected Resident Fellows:—

R. Stephen Adamson, B.Sc., George Bryce, B.Sc., Mr. Humphrey G. Carter, Mr. John Hunter, and Mr. Alexander M'Cutcheon.

The following communications were read:—

A Further Note on the Australian Tuberous Droseras. By Mr. Alexander Morrison. Communicated by Professor Bayley Balfour, F.R.S.

The specimens now sent show a striking difference in two species—*D. macrantha* and *D. gigantea*—from that seen in the type represented by *D. erythrorhiza*. In the latter type the organic apex of the bulb is kept on the mesial or inner side, and for present convenience might be called "introrse," but in the two first-named they would be named "extrorse," because the apex is situated on the external aspect, though closely drawn in, so as to be quite close to the axis of the plant, the unilateral development of the consolidated bases of the "leaves" of the bulb taking place on the inner side. In the *erythrorhiza* form the "centripetal" growth of the bulb leads to its penetration of the old one and its formation within it in an "endogenous" manner, but in the other type there is a divergence of the new bulb from the old one, and though the tips of the bulb scales in *D. macrantha* are not discernible on its surface, that is because it is in immediate contact with the soil, so that in erosion a roughening of the surface is caused. The bulb of *D. gigantea* is usually "sessile" on the end of the old rootstock, and remains covered by the old membranes, but sometimes it is borne on the end of a strong stolon-like process, which carries it an inch or two deeper into the soil, below the old bulb. This was seen in some specimens found in water-logged sand, and it appeared as if the plants wanted to reach the clay that without doubt lay a short distance below.

I wish to get as many as possible of the species of *Drosera* examined to see in what relation the variations of bulb-formation stand to the character of leaf and flower, and I hope to have a larger number examined in the course of the incoming spring, and then place at your disposal a more complete series of notes. In the meantime, these few notes, and specimens illustrating them, will furnish information that might otherwise reach you before very long at second hand.

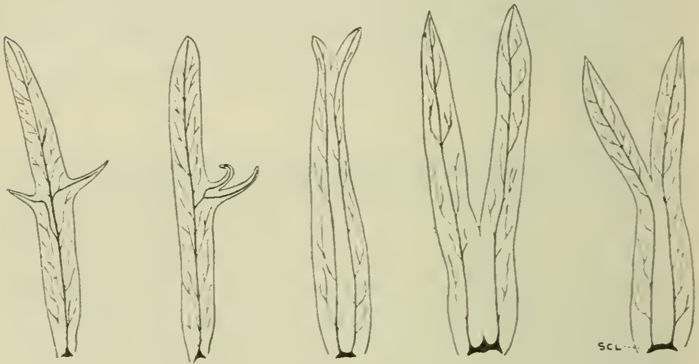
Note on Abnormally Branched Leaves of Hippuris vulgaris, Linn. By H. F. Tagg, F.L.S. (With figures.)

Among some leafy stems of *Hippuris vulgaris* which were collected some years ago I find a number of specimens with leaves which differ from the narrow linear leaves with entire margins characteristic of the normal *Hippuris vulgaris*.

In the abnormal specimens, while some are entire, many of the leaves in each whorl are provided with one or two or as many as four sharply-pointed tooth-like branches arranged pinnately on the leaf-margins. In some cases one margin only is branched, in others both margins are involved, and when this is so the branches are roughly opposite. A leaf with opposite branches is shown in fig. 1. When two branches occur on the same margin, the lower is, as a rule, the larger, and in some instances, as in fig. 2, the second branch is formed in the upper angle of the first. Other leaves on the abnormal plants are more or less bifurcate, and are provided with two distinct apices, figs. 3, 4, 5.

These differences in form, as one would naturally expect, are accompanied by modifications in the leaf venation. The venation of the normal leaf is very simple. Only one strand of vascular tissue, the midrib, is at all conspicuous, and this runs direct to a very characteristic water-pore at the leaf-apex, its lateral ramifications being few and none of them extending quite to the leaf margin.

Water-pores similar in structure to those of the normal leaf-apex are present on the apices of the bifurcations and on the tips of the lateral branches of the abnormal leaves. Running out to these are prominent strands of vascular tissue. In the case of the leaves with lateral branches, the vascular strands are lateral and pass off from the midrib, while, where the leaves are bifurcate, two strands more prominent than others, and free from one another, run from the leaf-base, and pass out one into each branch of the bifurcation.



Abnormal Leaves of *Hippuris vulgaris*, L.

FIG. 1. Leaf with opposite lateral branches. FIG. 2. Leaf with two branches on the same margin. FIG. 3. Leaf with forked apex. FIGS. 3 and 4. Bifurcate leaves ; *scl.*, sclerenchyma at leaf-base. × 4.

At their point of origin at the leaf-base, the two strands are fused with a mass of sclerosed tissue (fig. 5, *scl.*) occupying the centre of the leaf-base in a position which, in the normal leaf, is filled by the thickened basal portion of the midrib.

Believing that the material among which the abnormal specimens were found had been collected from a certain bed of *Hippuris vulgaris* growing in the Royal Botanic Garden, Edinburgh, I have, since the above notes were written, carefully examined these plants, and my search has been rewarded by the discovery of several plants growing there at the present time which exhibit teratological features similar to those described above.

Mr. JAMES FRASER exhibited mounted specimens of the following interesting alien and casual grasses recently found in the neighbourhood of Edinburgh, where their presence was clearly due to casting out of refuse from foreign grain. New records for Britain are indicated by a star.

**Avena barbata*, Brot. (a native of Asia Minor, Arabia, and the Mediterranean region); *Apera intermedia*, Hackel (first found in 1904 by Drs. Penther and Zederbauer in the Erdschias-Dagh, Asia Minor, once since found as a casual in England and several times near Edinburgh; it occupies a place midway between *A. Spica-Venti* and *A. interrupta*); **Gaudinia fragilis*, Beauv. (frequently found here during the last four years, probably often mistaken for a form of *Lolium italicum*); *Phleum græcum*, Boiss. and Heldr. (often occurring and in great quantities, with spikes varying from four inches to one-eighth of an inch in length); *Phalaris minor*, Retz.; *P. cærulescens*, Desf.; *P. intermedia*, Bosc.; **P. tuberosa*, L.: *P. paradoxa*, L.; **Trisetum pumilum*, Kunth; **Agropyron triticeum*, J. Gærtn.; **Kœleria phleoides*, Pers.; **Poa persica*, Trin.; **Bromus japonicus*, Thunb.: **B. divaricatus*, Rhode (the last named has been placed under *B. macrostachys*, Desf., by several authorities, but is a very distinct plant, which seems to deserve specific rank).

Mr Fraser also exhibited specimens of ergotised grains of *Melica nutans* from near Lochan na Lairige, Perthshire.

Dr. A. W. Borthwick exhibited branches and cones of *Picea rubra*. In the year 1869 Mr. William Gorrie read a paper to this Society on *Abies rubra*, and exhibited specimens taken from trees grown on the railway bank near Tynehead Station in Midlothian. The trees at that time were about fifteen years planted, and were from 12 to 18 feet high. Some of these trees still remain, and are now about 40 feet high, and appear to be still thriving, although damaged to some extent by smoke from the passing trains.

Professor Bayley Balfour, F.R.S., showed a specimen of *Polygonum pseudo-dumetorum*, H. C. Wats., found in the neighbourhood of Edinburgh; also an old and very fine portrait of Linnæus.

Mr. R. L. HARROW showed the following plants in flower from the Royal Botanic Garden :—*Aspidistra typica*, *Dalechampia Rœzliana*, *Calanthe Veitchii* ×, *Calanthe Veitchii* × var., *Calanthe oculata*, *Cypripedium tonsum*, *Muehlenbeckia complexa*, *Leucadendron argenteum*, *Acacia alata*, *Senecio macroglossus*, *Corynostylis Hybanthus*, *Momordica cochinchinensis*; *Pelargonium echinatum*.

Mr. L. STEWART showed plants of *Euphorbia uncinata*, *Pedilanthus aphyllus*, and *Utricularia oligosperma*.

R. J. NICHOLSON, M.A., B.Sc., sent for exhibition two casuals from Wigtownshire—*Senecio Doria* and *Lamium maculatum* var. *album*.

MEETING OF THE SOCIETY,

January 10, 1907.

J. RUTHERFORD HILL, President, in the Chair.

The following communications were read:—

REPORT OF THE SCOTTISH ALPINE BOTANICAL CLUB EXCURSION, 1907. By MR. ALEXANDER COWAN.

The members left Princes Street Station, Edinburgh, on Wednesday the 8th August by the 5 p.m. train to Greenock, and crossed by the night steamer to Dublin, travelling thence next morning by the 9.15 train for Recess, Connemara, where the Railway Hotel was made the headquarters for the first portion of the excursion. The object of this was to visit the district where *Erica Stuarti* and *Erica Mackaiana* var. *flore pleno* (Crawford's variety) were discovered, and if possible to find these plants again, it being a considerable number of years since the Club visited this district.

The country between Dublin and Galway is for the most part flat and uninteresting, and the train, which is called an express, only stopped at the principal towns. At Galway the party had to change into the slow train for Clifden, which stopped at every station, and gave the members a good opportunity of seeing the Irish peasantry, numbers of whom travelled between the local stations.

The party were much struck by the extreme poverty of these natives of Connemara, their appearance being in every way in keeping with the barrenness of the land in which they live, and while some of them are picturesquely dressed, others have much more the appearance of scarecrows than of human beings. Some of the garments appeared to be nothing else but patchwork, sewn together in numerous cases with string; others, while not patched, were in every conceivable state of raggedness. These garments were almost entirely made of Irish frieze, and in every case appeared saturated with peat reek, which could be easily smelt at several yards' distance. Almost without exception, men, women and children, met with outside the towns, stopped to beg.

On the afternoon of the day of arrival, viz. the 9th August, the following plants were found on the roadside within half a mile to the west of the hotel:—*Anagallis tenella*, *Ceterach officinarum*, *Drosera anglica*, *Eriocaulon septangulare*, *Erythræa Centaurium* and var. *alba*, *Hydrocotyle vulgaris*, *Lobelia Dortmanna*, *Menziesia polifolia*, *Nuphar lutea*, *Schœnus nigricans*.

On Friday the 10th the party drove to a point on Roundstone Moor, about nine miles from Recess, where the road to Roundstone branches off the main road from Cashel to Clifden, near the spot where Dr. Stuart found *Erica Stuarti*, but, unfortunately, no one was able to see anything like it. After spending an hour or two at this point, the party were advised by a native to move on about a mile and a half to the west, to a low hill which he said was visited by many botanists. Here *Erica Tetralix* var. *Mackaiana* was found in great quantity, also a white form of *Erica Tetralix*.

The following plants were also found:—*Menziesia polifolia* in splendid flower and great abundance, *Cladium Mariscus*, *Drosera rotundifolia*, *Drosera longifolia* and *Drosera anglica* both abundant, *Lastræa æmula*, *Lycopus europæus*, *Erica Tetralix* var. *alba*, *Erica Tetralix*, smooth, without glands, *Ulex nanus*, and a variety of *Utricularia*.

The party, on the way back to Ballinahinsh Station, whence the return journey was made by train, found some interesting varieties of *Lomaria Spicant* and *Athyrium Filix-fœmina*.

On Saturday the 11th, four of the party went by train to Clifden in order to explore Ballinaboy Bog. Considerable difficulty was found in procuring a conveyance, but the delay incurred enabled the travellers to learn how well the office-clerk, the boots, and the ostler of the hotel could shift the blame for its non-appearance on to other shoulders, and to inspect the weekly market which was held in the public square, whither small donkeys, harnessed with panniers, had brought the country produce, and poorly-clad fisherwomen were exposing dried fish in bundles for sale. The public trow was of the most primitive character, as was seen also in Oughterard, and consisted of a three-fold shears to which was attached the plainest of scales. No one seemed to be in a hurry, so that the impatience of the party accorded ill with the prevailing humour. At length a somewhat rickety car, horsed with a still more jibbing nag, was procured, and without incident, though with many a suggestive jerk, the party drove out towards the coast, in the belief that they were striking a point in the bog whence a comparatively easy passage up it might be made. On the roadside were noticed magnificent widths of *Fuchsia Riccartoni* in splendid flower, which appeared to be remnants of a neglected road-side hedge; and in a disused quarry, facing a tenantless mansion, a luxuriant growth of *Escallonia micrantha*. On leaving the car, which was timed to return at 3 o'clock and convey the party back along the Cashel and Roundstone road, the members skirted a newly erected Marconi telegraph station, probably the nearest in the island to the American coast, and at once prepared to cross the bog in the direction of the point where on the preceding day they discovered *Erica Mackaiana*. This was found to be impracticable, as the surface of the bog was all more or less under water, and walking was accomplished at considerable risk. During the former day's excursion *Rhynchospora alba* had been very abundant, but as yet no record of *R. fusca* had been made. This, therefore, proved the chief object of search; and after heavy plodding and plunging, the find was made on the margin of one of the many lakes round which the circuitous route adopted forced the party to meander. The plant was in fine flower, and though not very plentiful, sufficient to supply the wants of those in search of it. Not far from this lake, and on the boundary turf-dyke of a croft a few hundred yards from the Cashel and Clifden road, one of the party found an exceptionally good form of *Lomaria Spicant*, all the fronds being beautifully crested. This was quite the best varietal form of fern found during the excursion.

In addition to this the following plants were found:—*Aster Tripolium, Cladium Mariscus, Cotyledon Umbilicus, Convolvulus sepium, Drosera longifolia* and *anglica*, *Erica Tetralix* var. *alba*, *Erica cinerea* (*foliis aureis*), *Hypericum elodes, Juncus maritimus, Lathyrus macrorrhizus, Samolus Valerandi. Senecio aquaticus, Ulex nanus, Utricularia minor*.

Two of the party who did not go to Clifden spent the day in the neighbourhood of Recess and explored the woods on the opposite side of the lake; here *Lastræa æmula* was found in great quantity and in great beauty, plants with fronds nearly 3 feet high being found; on the roadside leading to the wood a few plants of *Lastræa montana* were found, also a large clump of *Lomaria Spicant* with all the fronds caudate, and in a dyke some plants of *Asplenium Trichomanes* with the tips of the fronds all more or less fingered.

Sunday forenoon, the 12th of August, was spent quietly in the neighbourhood of the hotel. In the afternoon a visit was paid to the marble quarry on the hillside about half a mile away to the north of the hotel, where large blocks of the well-known green-coloured Connemara marble were seen. During the walk home some forms of *Utricularia* were gathered, also a plant of *Erica cinerea* with white flowers. This was the finest day experienced during the visit, all the others having been spoiled by heavy showers of rain at intervals. The whole district is exceptionally barren and wild, and farming operations appeared to be carried on in a most primitive style. Most of the country consists of either bog, stone, or water, and no attempt whatever seems to be made to render the heath land more suitable for grazing purposes by cutting open sheep drains, such as are seen in this country. The absence of sheep was conspicuous.

On Monday morning, the 13th August, the party left Recess by an early train, and on reaching Galway put up at the Railway Station Hotel, a large but poorly appointed building. Four of the members left Galway by steamer at 11 o'clock for Ballyvaughan, in order to spend the day with Mr. P. B. O'Kelly in visiting the limestone formation in this district of County Clare. Mr. O'Kelly met the party on the quay and drove them to his nursery, about a mile and a half out of the village, on the way to Lisdoonvarna. Here a large and varied collection of both British and foreign shrubs and herbaceous plants was seen, also many varietal forms of British ferns, some of which have been found by Mr. O'Kelly himself in the neighbourhood.

The party, on the way back to Ballyvaughan, were conducted by Mr. O'Kelly along the base of the limestone hill to the east of the village, where he was able to point out some rare and interesting plants, as the following list will show:—*Arum maculatum*, *Carlina vulgaris*, *Centaurea Scabiosa*, *Chlora perfoliata*, *Dryas octopetala*, *Euphorbia Peplus*, *Gentiana Amarella*, *Gentiana verna*, *Geranium rotundifolium*, *Origanum vulgare*, *Rosa spinosissima*, *Sambucus Ebulus*, *Samolus Valerandi*, *Veronica polita*, *Verbena officinalis*.

Of the above, *Dryas* was seen in great quantity, both in flower and in fruit, and numerous plants of *Gentiana verna* were got, and *Sambucus Ebulus* was growing in a large mass within fifty yards of the village (Ballyvaughan).

After a most excellent tea at Kerin's Hotel, the long drive was commenced on an outside car to the nearest station at Ardrahan, fifteen miles distant. The route for the first half of the journey led through a series of valleys, bordered on each side by high limestone hills with very little vegetation on them—indeed the highest portions of them looked absolutely bare.

The party (six in all) much regretted that they had been unable to secure sufficient accommodation in Mr. Kerin's Hotel, in order to spend a few days in this most interesting district, as the hotel, though small, was clean, and a great contrast in this respect to the Railway Hotel, Galway. As there are two other hotels in Ballyvaughan, it would have been easy for the whole party to have found accommodation, but the information given beforehand was that there was only one hotel in the town.

The party journeyed by rail from Ardrahan *via* Athenry to Galway, which was reached about 9 o'clock.

Owing to the high wind and heavy rain that fell in the morning, two members of the party, who did not care to risk the crossing by steamer or in getting wet either at Ballyvaughan or during the long drive to the station at night, went by rail from Galway to Oughterard, in order to botanise on the shore of Loch Corrib, a mile or two from the town.

There the following plants were found:—*Alisma ranunculoides*, *Asplenium Trichomanes* var. *cristatum*, *Hottonia palustris*, *Mentha aquatica* var. *hirsuta*, *Sparganium simplex*, *Utricularia* sp.

On Tuesday the 14th the party drove about two and a half miles along the road to Menlough, and spent the day among the limestone ridges to the north of the town of Galway and on the shore at the south-east end of Lough Corrib. These ridges are mostly flat, but are intersected in all directions by hollows and cracks of various depths, in which *Scolopendrium vulgare* grew in great quantity, while in the small débris *Ceterach officinarum* and *Asplenium Ruta-muraria* were everywhere abundant.

The following plants were found:—*Apium nodiflorum* var. *repens*, *Aquilegia vulgaris*, *Arum maculatum*, *Bidens cernua*, *Carex extensa*, *Carlina vulgaris*, *Chlora perfoliata*, *Erythræa Centaurium*, *Gentiana Amarella*, *Gymnadenia conopsea*, *Habenaria bifolia*, *Hippuris vulgaris*, *Hypericum Androsæmum*, *Inula crithmoides*, *Oenanthe Phellandrium*, *Oenanthe fistulosa*, *Ophrys apifera*, *Rosa spinosissima*, *Veronica polita*.

On the roadside, on the way back to Galway, *Ceterach officinarum* was found in greater luxuriance than on any other day. A plant of *Asplenium Ruta-muraria* with branched fronds was found by the president, and, next to the crested *Lomaria* found near Clifden, was the best varietal form of fern found during the excursion. The members left by the morning train on Wednesday the 15th August, and on arriving at Dublin went straight to the Botanical Gardens, Glasnevin, where they were kindly shown round by Mr. M'Ara, in the absence of the curator, Mr. Moore. The party were struck with the excellent order in which the Gardens in general were kept, and especially with the fine condition of the plants in the houses, the collections of water lilies in flower in the open, and of British ferns, and a fine plant of *Romneya Coulteri* in full flower over 6 feet high. The party left Dublin by the evening steamer, and arrived in Edinburgh on the forenoon of Thursday the 16th, when they separated.

Note.—2nd October 1907.—Since the above paper was read it is interesting to record that a plant gathered by a member of the party on the 10th August, on Roundstone Moor, and not at the time identified, has since proved, on flowering under cultivation, to be the true *Erica Stuarti*.

Preliminary Note on a Peculiarity in the Pith of a Species of Cucurbit. By J. W. Bews, M.A., B.Sc.

The stem of this species of cucurbit has the usual central cavity extending the whole length of the internode. The vascular bundles are of the bicollateral type, with large vasa in the centre, and phloem on the outside and also on the inside.

In one part of the stem certain cells form a projection into the central cavity. This projection appears to have originated as a single cell, and afterwards in the centre of it there is meristematic tissue. As this structure is followed along the stem, it increases in size till it gradually fills up the whole of the central cavity. But before it has altogether done so, in the centre of the projecting portion—that is to say, in the centre of the meristematic tissue—another cavity arises which differs entirely in appearance from the original central hollow. It is bounded by a very regular layer of cells, which have thicker walls than the other cells of the stem, and have abundant cell content. Two or three rows of cells next to this layer also differ from the others.

From the surrounding layer of cells there project outwards into the cavity hairs of two kinds, pluricellular and glandular. The former are the more numerous, and are of the kind described by De Bary as conical multicellular hairs.[1] The foot cell differs slightly in appearance from the others. There may be as many as seven or eight cells in a hair. All the cells are full of protoplasm.

The glandular hairs are not nearly so numerous. They are similar to those which De Bary calls capitate glandular hairs,[1] *i.e.* the free end is swollen to form a round head, the transverse section of which exceeds that of the stalk. The stalk is short, 1–3 celled.

The outside of the stem is also covered with hairs, both pluricellular and glandular, and these are absolutely identical in appearance with the hairs which fill the cavity.

The cells surrounding the cavity are exactly like the cells of the epidermis.

These facts point to the conclusion that we have here an internal epidermal structure. It is not exactly the case, however, that the cells surrounding the central hollow, in response to an air environment, have started to produce an epidermis with hairs. Such would doubtless be a likely and natural explanation if it were not for the way in which the hair cavity arises.

[1] See De Bary, "Comparative Anatomy of Phanerogams and Ferns," p. 59.

As far as I could see, there was no appearance of any wound on the surface of the stem. There was no disarrangement of the vascular bundles, nor any other irregularity in the appearance of the stem or distribution of the tissues.

The material which I examined was among that which had been supplied from the Edinburgh Royal Botanic Garden for the use of students in the winter class of Botany. It consisted of short pieces of the stems of several cucurbits. I was able to find three or four short pieces, probably cut from the same plant, which contained this hair cavity, and in one I was able to trace its origin as above described.

It extended for several inches along the stem, but I was unable to follow it to an end. It was difficult to say to what species of cucurbit the little piece of stem belonged, but after examining the large number of cucurbits which are grown in the Royal Botanic Garden I have come to the conclusion that it was very probably *Benincasa cerifera.*

Dr. Borthwick exhibited a series of lantern slides illustrating the natural regeneration of coniferous woods under shelter trees as practised on dry, chalky soil in Bavaria.

Mr. H. F. Tagg, F.L.S., exhibited a specimen of *Hyoscyamus niger*, Linn., var. *pallidus*, Waldst. et Kit. The plant was sent to the Royal Botanic Garden, Edinburgh, in September 1906, by Mr. Lumley, gardener at Culross Abbey, and was identified by Mr. J. F. Jeffrey as the *Hyoscyamus pallidus* of Waldstein and Kitaibel. Mr. Lumley, in a communication accompanying the specimen, stated that the plant was found growing upon an embankment, the soil forming which was taken from below the Abbey during excavations carried out in 1905, and that the appearance of a plant, not hitherto observed in the district, in such a situation had given rise to much conjecture regarding its origin.

Another specimen of the same variety, found by Mr. Jeffrey among the specimens in the herbarium of the Royal Botanic Garden, was also exhibited. The label on the plant ran as follows:—C. E. Parker, 1874, Teignmouth, Devon. Mr. Tagg pointed out that the published records of the occurrence of the variety in Britain were very few, and quoted in this connection the following localities and authorities as the only records he had been able to find: Esher, Surrey (H. C. Watson in "Cybele Britannica"); near Portobello, Edinburgh (Boswell in Sowerby's "English Botany"); Fincham, Norfolk (Smith in "English Flora").

MR. H. F. TAGG, F.L.S., exhibited a spike of a Foxglove, the flowers of which showed adesmy of the corolla and other teratological features.

In all the flowers on the spike was observed a separation of the parts of the normally gamopetalous corolla into a varying number of petals which were free from one another, except at the extreme base, where they were united with the stamens to form a short collar surrounding the lower portion of the ovary. In many cases the petaline structures were narrow and strap-shaped, in others they took the form of long tapering threads, in others again they were reduced to short tooth-like prolongations not exceeding the length of the ovary.

The stamens, normally adnate to the corolla for a considerable part of their length, were in this specimen free, except at their base, where their filaments contributed to the formation of the short petaline collar, already described.

The number of stamens varied. In some flowers four only were present, in others as many as eight. The filament portion of many of the additional stamens was broad and petaloid, suggesting a petal origin.

The specimen was found among a group of Foxgloves growing in a garden at Haddington, and was sent to the Royal Botanic Garden by Mr. A. Burnett, Letham Bank, Haddington.

MR. H. F. TAGG, F.L.S., exhibited a flowering spike of *Habenaria bifolia* R. Br., var. *chlorantha*, Bab., the flowers on which were without spurs, while many possessed additional petaloid structures within the perianth proper.

These additional petals, in the opinion of the exhibitor, were derived from some of the staminodal structures, which in the normal flower of *Habenaria* are combined with other flower-parts to form the column. Reference was made to petalody of stamens, a teratological feature common in many families with which the petalody of the staminodes of the flowers exhibited was compared.

The specimen was one donated to the Museum of the Royal Botanic Garden, Edinburgh, by Mr. Arthur S. Reid, Trinity College, Glenalmond, Perth, who found the specimen exhibited and subsequently two others of a similar character on a moor in the Glenalmond district.

Mr. R. L. Harrow showed the following plants in flower from the Royal Botanic Garden:—*Anoiganthus breviflorus*, *Ceropegia Thwaitesii*, *Clematis grewiæflora*, *Crassula lactea*, *Cyphomandra betacea*, *Hymenocallis tubiflora*, *Illicium anisatum*, *Ipomœa Horsfallia* var. *Rheedii*, *Calliandra Harrisii*, *Merendera sobolifera*, *Sedum Goldmanni*.

Mr. L. Stewart exhibited plants of *Euphorbia viperina*, *E. neriifolia* var. *variegata*, *E. xylophylloides*, *E. aphylla*, and *E. colletioides*.

W. W. Smith, M.A., exhibited a proliferous inflorescence of *Daucus Carota*. The umbellate inflorescence was repeated several times. The specimen was found in St. Mary's, Isles of Scilly.

MEETING OF THE SOCIETY,

February 14, 1907.

J. Rutherford Hill, Esq., President, in the Chair.

The following communications were read :—

Note on *Pinguicula vulgaris*, Linn., and its variants towards *grandiflora*. By Dr. Wm. MacLean. Communicated by Professor Bayley Balfour, F.R.S.

While botanising along the coast of Black Isle in June 1905 I was struck by the unusual size and vivid colour of some colonies of *Pinguicula*. On examining some specimens they showed the overlapping segments and bifid spur usually associated with *P. grandiflora*. In the following year careful examination showed that the range of distribution was fairly wide—I examined along five miles—and that the gradations from the ordinary small flowered form with the long subulate spur to the large one with richly purple corolla and bicornuate spur shaded off into one another by fine stages, and between the two extremes, one found the gradual differentiation in all stages of size of corolla and condition of spur (*cf.* similar condition in Pyrenees).

The large form : the scapes are numerous—six to eight from a single plant, are over 6 inches in length, corolla over $\frac{1}{2}$ inch at greatest, spur not merely notched but distinctly bicornuate. Color a rich purple, intensifying towards the spur, faintly veined.

Note on the Flora of the Black Isle. By the Rev. Canon Spence Ross. Communicated by Professor Bayley Balfour, F.R.S.

Pinguicula grandiflora has been found in two localities in the Black Isle, Ross-shire—one near Fortrose, the other near Ferrintosh, Dingwall. *Atropa Belladonna* has been found growing not far from the town of Cromarty, and the coral root, *Corallorhiza innata*, has been found in a moist bit of wood near Fortrose. I am very glad that *P. grandiflora* has been found in Scotland. Now we have the whole set of *Pinguiculas* in this country, and we have three, if not all the four, in this district of Ross-shire. If one had time to keep searching, doubtless many more rarities would be found in many different localities.

Mr. J. F. Jeffrey exhibited some Compositæ from Yunnan and Chinese Tibet, collected by Mr. George Forrest.

The Herbarium of the Royal Botanic Garden, Edinburgh, has recently been enriched by a beautiful collection of plants containing many novelties from Yunnan and Eastern Tibet, made by Mr. George Forrest in 1904–05, when collecting seeds for Mr. A. K. Bulley, of Neston, Cheshire.

The Compositæ of this collection, which number rather more than one hundred species, after having been carefully compared with the extensive series of plants from the same region preserved at Kew, were found to contain about a dozen new species,[1] but not one new generic type.

As has been pointed out by Mr. W. B. Hemsley, there is a much larger element of the Himalayan flora in the province of Yunnan than of the flora of China generally. So far as the Compositæ go, the present collection entirely bears this out, for about 50 per cent. of Mr. Forrest's plants are known to occur in the Himalaya mountains, while the percentage for the whole of British India is even higher. Again, of the thirty-seven species restricted to China, twenty-seven are not known to extend beyond Yunnan and the neighbouring province of Szechwan, except it be in Eastern Tibet.

The genus *Senecio* is represented by sixteen species in Mr. Forrest's collection, including one very fine undescribed species. Of this genus thirty-five species are recorded in "Forbes' and Hemsley's Enumeration of Chinese Plants" (1888), and new species described from China since then have brought the number up to one hundred and twenty-nine. *Saussurea*—another genus of remarkable diversity of habit—contains ninety-two species already known from

[1] The new species will appear in a forthcoming part of the "Notes from the Royal Botanic Garden, Edinburgh."

China, of which several striking forms are among the collection under notice.

One fact of great interest regarding the plants of this region is that they are almost all hardy in Britain, so that we may hope before long to have many important additions to our gardens from this rich hunting ground of the botanical collector.

W. T. Gordon, M.A., B.Sc., exhibited two seed-like organs from the Calciferous Sandstone Series of Fife and two of their modern allies. The first seed-like organ was an example of *Cardiocarpon anomalum* (Williamson), which was renamed in 1901 by Dr. D. H. Scott, *Lepidocarpon Wildianum*. Described originally as a true seed, its occurrence in a strobilus excited suspicion, and a detailed research revealed the presence of four megaspores inside, only one of which matured. The so-called micropyle was shown to be really a slit and the whole organ to be a megasporange round which outgrowths from the sides of the sporophyll had grown. This organ is then an integumented megasporangium containing one mature and sometimes three other decayed megaspores. The modern ally exhibited was a *Selaginella* with the four megaspores in the sporangium.

The second seed-like organ was *Conostoma ovale* (Williamson). This was a seed having affinities with the Cycads, probably belonging to the Cycado-filices. The section was slightly tangential, missing the micropyle, and passing through the wall of the pollen chamber. The apex of the nucellus was seen below the pollen chamber, but there were no traces of archegonia. Vascular bundles could be seen above the pollen chamber, so that the bundles belong to the integument and not to the nucellus.

A specimen of *Bowenia spectabilis*, cut longitudinally through the micropyle, was exhibited for comparison.

Mr. James Whytock showed *Hamamelis arborea* in flower and a branch of *Elaeagnus glabra* var. *foliis variegatis*.

Mr. R. M. Adam showed a series of photographs illustrating the saxifrages, etc. in the Rock Garden of the Royal Botanic Garden.

Mr. R. L. HARROW exhibited the following plants in flower from the Royal Botanic Garden :—

Acacia Drummondii, *Brunfelsia calycina*, *Cotyledon fulgens*, *Eriostemon Hillebrandii*, *Grevillea sericea*, *Lycaste Skinneri*, *Maytenus ilicifolia*, *Platyclinis glumacea*, *Sempervivum Youngianum*, *Skimmia Veitchii*, *Styphelia viridis*.

Mr. L. STEWART showed *Aloe variegata*, *Laportea moroides*, *Kalo-rochea langleyensis*, and *Crassula lycopodioides*.

Mr. H. F. TAGG, F.L.S., exhibited an apple attacked by the fruit-rot fungus, *Monilia fructigena*, Pers., which showed in a very characteristic manner the remarkable jet-black colour which the fungus sometimes imparts to affected apples. The fungus is said to be unable to attack perfectly sound apples, but as a wound-parasite gains a lodging in the fruit through injuries to the epidermis caused by insects, etc. As a result of the activity of the fungus-mycelium within the tissues, the flesh of the apple ultimately turns brown, and, as a rule, patches of the gonidial spores very soon make their appearance on the surface. More rarely, as in the specimen exhibited, black sclerotia form within the tissues, accompanied by the formation of a dark coloured mycelium which fills the tissues of the rind. It was stated that it is the presence of this dark mycelium under the skin which gives apples so affected their peculiar jet-black colour.

Mr. TAGG showed also a series of sections of American woods.

MEETING OF THE SOCIETY.

March 14, 1907.

J. RUTHERFORD HILL, Esq., President, in the Chair.

The following communications were read:—

NOTE ON CERTAIN CONIFERS, WITH EXHIBITION OF TWIGS AND CONES. By DR. A. W. BORTHWICK.

A series of fruiting branches of conifers were exhibited to illustrate the distinctive features of different genera and species.

ON THE OCCURRENCE OF PARTHENOGENESIS IN LOPHYRUS PINI. By R. STEWART MACDOUGALL, M.A., D.Sc.

Experiments made with *Lophyrus pini*, the Pine Sawfly, proved that the progeny from the eggs of virgin females were always males. *See* "Journal Econ. Biology," vol. ii., pt. 2, 1907, for full account.

DR. R. STEWART MACDOUGALL exhibited the cocoons and caterpillars of *Nematus Erichsoni*, the large Larch Sawfly; also specimens of *Nematus maculiger*. The record of the former Sawfly on Larch is the first in the forest literature of Britain.

MR. JAMES FRASER exhibited mounted specimens of the following alien and casual grasses found near Edinburgh (all of which are new records for Britain), viz.:—

**Triticum peregrinum*, Hackel, sp. nov. This plant, whose native habitat is unknown, was found in connection with grain siftings or refuse. It belongs to the sub-genus *Ægilops*, and was named by Professor Hackel.

**Triticum crassum*, Aitch. and Hemsl., var. *oligochætum*, Hackel (var. nov.), has been frequently met with in different localities around Edinburgh; the native habitat of the typical form is Central Asia.

**Lepturus cylindricus*, Trin.

**Phalaris brachystachys*, Link, was met with in three different, widely separated places. Some authorities place it as a variety of *P. canariensis*, and others reverse the relationship, but it seems a distinct plant, worthy of being ranked as a species.

**Triticum caudatum*, Gren. and Godr., was once found at Leith. It is figured and described as *Ægilops cylindrica* in the Flora Græca.

Bromus Danthoniæ, Trin., is perhaps a diminutive form of *Bromus macrostachys*, Desf., being then the variety *triaristata*, Hackel, of that species. It is a native of Afghanistan and Western Asia.

W. C. CRAWFORD, M.A., showed a malformation on a branch of *Acacia* caused by a species of *Loranthus*. The *Acacia* was from South Africa, where the name of "wooden flowers" is given to such malformations.

Mr. R. L. HARROW showed the following plants in flower from the Royal Botanic Garden:—*Anemone intermedia*, *Corydalis cheilanthifolia*, *Crassula quadrifida*, *Clerodendron infortunatum*, *Draba Mawii*, *Genista Hillebrandii*, *Medinilla javanica*, *Omphalodes verna*, *Saxifraga apiculata*, ×; *Saxifraga Burseriana*, *Saxifraga Kotschyi*, *Saxifraga oppositifolia*.

MEETING OF THE SOCIETY,

April 11, 1907.

J. RUTHERFORD HILL, Esq., President, in the Chair.

The following communications were read:—

A NEW MECONOPSIS FROM YUNNAN. By Lieut.-Col. D. PRAIN, F.R.S. (Plate II.)

In a review of the known species of *Meconopsis* the writer has suggested ("Ann. Bot.," xx. p. 340) that our knowledge of the genus is probably still incomplete. The surmise thus offered has been very soon confirmed. To the kind courtesy of Professor Bayley Balfour, F.R.S., the writer is indebted for an opportunity of examining the specimens belonging to this genus obtained by Mr. G. Forrest in South-Western China. Among these specimens there is material, collected in August 1905, and accompanied by full field-notes, of a species hitherto undescribed. At the instance of Professor Balfour, Mr. R. M. Adam has prepared from this material the accompanying excellent illustration. Mr. Forrest speaks of the species as a magnificent but very local plant; he seems to have met with but one patch of it, two or three acres in extent, on a dry, barren, rock-strewn limestone ridge in the mountainous country which constitutes the Mekong-Salween divide, at 12,000 to 13,000 feet above sea-level, somewhere between lat. 27° and 28° N.

Though the material communicated is scanty, and does not include ripe fruits or seeds, the specimens and the accompanying notes suffice to show that the species differs from all the hitherto known species of *Meconopsis*, and to indicate with accuracy its position and affinities. The closely set simple prickles which beset the leaves, stems, sepals, and ovaries place it at once in the group *Aculeatæ* of the section *Eumeconopsis*. The other members of this group are *M. aculeata*, Royle, the well-known prickly "Blue Poppy" of Kashmir; *M. sinuata*, Prain, the representative of *M. aculeata* in the Eastern Himalaya; *M. rudis*, Prain, the representative of these two species in Western China; and *M. horridula*, Hook f. and Thoms, which includes as a variety *M. racemosa*, Maxim., the prickly "Blue Poppy" of Tibet. From *M. aculeata* and *M. sinuata*, Mr. Forrest's plant differs in having more than four petals; from *M. rudis* and *M. horridula* it differs in having pinnately lobed leaves. As regards foliage, Mr. Forrest's *Meconopsis* agrees most closely with *M. aculeata*, but, besides having more petals than four, it differs in having no bracts under the pedicels. The flowers, too, are larger and more closely set than in the other species of the group *Aculeatæ*, and this species promises, if seeds can be procured, to prove a welcome addition to European rock-gardens.

Meconopsis (§ Eumeconopsis) *speciosa*, Prain. Folia aculeata, oblongo - lanceolata, pinnatipartita lobis ovato-oblongis; flores in cymas racemiformes dispositi, pedicellis ebracteis; petala 5–8; torus vix ampliatus.

CHINA OCCIDENTALIS. In Yunnan; in saxosis alpinis, 12–13,000 p.s.m.

Aculeata spinis patentibus brunneis densius obsita. *Rhizoma* . . . . *Folia* radicalia, oblongo-lanceolata, pinnatipartita lobis ovato-oblongis, utrinque glauca sparse aculeis brunneis induta ceterum glabra, basi sensim in petiolum attenuata, laminis 8–15 cm. longis 2·5 cm. latis. *Caulis* ad 90 cm. usque altus, simplex, scapiformis, versus apicem dense 10–15-florus, prorsus dense aculeatus. *Flores* 5–7 cm. lati, in cymas racemiformes dispositi pedicellis dense aculeatis ebracteis 2 cm. longis vel brevioribus. *Sepala* ovata, extra sparse aculeata. *Petala* 5–8, suborbicularia, 3 cm. lata, cœrulea, glabra. *Stamina* ∞, pluriseriata, filamentis gracillimis discretis intense cœruleis glabris, antheris luteis. *Ovarium* densius aculeatum; stylus glaber, 4 mm. longus; stigma oblongum lobis decurrentibus contiguis.—Yunnan; in montibus inter fl. Mekong et fl. Salween interjectis, in locis saxosis, 12–13,000 p.s.m., in lat. 27°–28° bor., *Forrest* No. 468!

EXPLANATION OF PLATE II.

1. Upper portion of flowering stem, *nat. size*; 2, radical leaf, *nat. size*; 3, ovary, *enlarged.*

R. M. Adam del.

MECONOPSIS SPECIOSA, Prain.

Patrick Blair, Surgeon Apothecary, Dundee. By Mr. Alexander P. Stevenson. Communicated by Professor Bayley Balfour, F.R.S.

When, on Friday, 25th January 1884, Professor Struthers, in the show-yard in East Dock Street, dissected the famous Tay whale, whose articulated skeleton now figures in the City Museum, I suspect very few knew or remembered that nearly two hundred years before another equally monstrous mammal underwent the same treatment, and its skeleton and counterfeit presentment figured in a Dundee "Hall of Rarities" of that period. I don't know that the pomp and ceremony of the one dissection could be compared with the other, for in the former case there had been some attempt made to make the dissection possible and so far easy, and, in the words of the veracious reporter of the *Dundee Advertiser*, "the band of the 1st Forfarshire Rifle Volunteers discoursed during the day airs of a lively and popular character, which undoubtedly rendered the proceedings less solemn than they might have been, and may have helped, as was remarked, 'to keep down the smell.'" In the other case, where the Dundee doctor and naturalist of whom I wish to tell you first comes to view, there was no arrangement of any kind; it was merely a fortunate accident, and his ready action and skilful hands and eyes, which made the dissection possible, and so it happened that "the first elephant dissected in Great Britain" was this Dundee specimen.

The story, I think, will prove interesting; many details are given in the communication made to the Royal Society of London by the anatomist "Mr. Patrick Blair, Surgeon Apothecary, Dundee, Scotland."

Robert Chambers, in his "Domestic Annals of Scotland," gives 1680 as the year when the first elephant was seen in Scotland, and quotes from a contemporary writer a very quaint description of the "great beast" which was shown through the country, and which formed the subject of some litigation, those who farmed it out refusing to pay the fee of £400, "as it did not fulfil all the owners promised it would do," to which they pleaded that it "could not drink every time it was shewn."

The elephant with which Dr. Blair had to do, had been exhibited over a large part of Europe, and ultimately found its way to these northern regions, and Dr. Blair in his paper heads a paragraph "HOW THE ELEPHANT FELL IN OUR WAY."

After some stay in Edinburgh, her keepers conducted her to the North, and on their return came along the sea-coast, but there being but few places on the road for making advantage, by long and hurried marches they came towards Dundee, and when they were within a mile of this place the poor animal, much fatigued and wearied, fell down. All their endeavours to get her on foot again proved ineffectual. What followed smacks of the wise men of Gotham. "They digg'd a deep Ditch, to whose Side she might lean till she were sufficiently rested; but that prov'd her Ruin; for shortly afterwards there fell great Rains, which filled the Ditch with Water. So that, after lying in the puddle a whole Day, she died next Morning, being *Saturday*, April 27th, 1706." When the keepers saw that she was dead, they came to the magistrates of the burgh, and having made oath that they had done her no designed injury, they got a certified attestation to that effect. The magistrate, Captain George Yeaman, then Bailie, afterwards Provost, and ultimately Member for Dundee in the United Parliament in London, was made a present of the "Cadaver" or carcase. Captain Yeaman went to see the dead animal, taking Dr. Blair with him "in order to have the Skin flea'd off, which," says the Doctor, "was his chief design, and the Body opened, which was mine. As I was very glad of the Opportunity, so was I concern'd because of the disadvantage I was at, which kept me from prosecuting what I design'd: For there went out a great Multitude, the Day was very hot, and being the last Day of the Week the Subject could admit of no delay, especially since it lay in the high Way and open Fields; so that I scarce had any convenience to pry into, or see anything of moment, much less to enquire nicely into the Structure of Parts, as the Subject required." And then the unwieldy hands of the "unruly Butchers" were making sad havoc in their progress of opening the animal, and, "whether I would or not, they did so slash the *Sternum* and mangle several of the *Cartilages*, as to render them useless, cutting and tearing wheresoever their clumsy hands came." Left to himself, he had not much above an hour to dissect the subject when light failed, and all the time he had to work as best he could "amidst a Throng and Rabble," and "in mighty hot weather." Night fell and Sunday intervened, wherein no anatomist might work, at least in the open, and on Monday the "mighty hot weather" had made itself apparent on the cadaver, and some of the parts had been carried away by the country people; however, thanks to the pains and care of Provost Yeaman, these parts were afterwards recovered, and ultimately Dr. Blair managed to elaborate, from the material he secured, an exhaustive paper, which, entitled "Osteographia Elephantina," with four large copperplates, filled over a hundred pages of the Philosophical Transactions of the Royal Society for 1710. The article was published in a separate form in 1713, largely due to the fact that papers on the minute anatomy of the hair and skin of the same elephant were being read to the Society by Leeuwenhoek, the famous optician and microscopist. These sections had been secured by him when the animal was being exhibited in Holland. Dr. Blair, then M.D. and F.R.S., dedicates the book to Dr. John Arbuthnot. His plates, he says, "might have been finer done in London; but since I had the Original by me, whereby I was able from time to time to correct in the Engraving what Errors happened in drawing the Figures, I rather chose to have them done in Dundee." The four plates bear that they are done at the expense of Patrick Blair, and that the engraver was Gilb. Oram. Taodunensis. Before leaving this part of the subject, it may be sufficient to say that Dr. T. Thomson, in his history of the Royal Society, speaks of Blair's paper as "a most surprising one. If we consider that all his observations were made from one animal, we must admit his exertions must have been uncommon and his address great to have made his account so minute as it is," while the author of a paper on the elephant in the "Transactions" in the early years of the nineteenth century mentions Blair's account as "wonderfully accurate." [1]

[1] I have lately learned that Professor Boas, Copenhagen, who is at work on a monograph on the anatomy of the elephant, thinks very highly of Blair's work, and has pointed out that certain points of anatomical structure were more correctly stated in his paper than by any observer who has written since.

Dr. Blair, however, was not like "Single-speech Hamilton"; he did other work which is worth noting, and had a life history full of interest. As a physician, as a botanist, and as a man, his is a personality which deserves to be better known. It is frequently stated he was born in Dundee. That is very probable, but I cannot say so definitely, nor fix the date of his birth. Maclaren, in his edition of Thomson's "History of Dundee," says he was born about 1680—on what authority he does not state; but as Blair in 1717 speaks of having been in practice for twenty-eight years—that is, from 1689,—he must have been born many years previous to the date given by Maclaren. His family was connected with Dundee, and in 1625 a namesake, also a medical man, was made an honorary burgess of Dundee for "meritorious service to the Commonweal"; probably enough for doing his duty in one of those epidemics which devastated some of our towns in the good old times. Our Patrick Blair says in one of his books—and the passage is worth quoting, both for its reference to his family and the illustration it gives of his botanical methods—"I have known the *Vicia dumetorum multiflora flore albo* continue in the same spot, at Glesclune, in Perthshire, my brother's estate, a good many years. I found the *Artemisia flore albo* at Lethindy, my Father's Estate, near to the former, had it cultivated in a Garden, and it never altered. I found *Anagallis aquat. S. Becabunga off.* with a white flower near Perth, had it cultivated in several Gardens, and it still continued the same. I found only one stalk of the *Campanula pratens flore conglomerato albo*, among a great many others, from a dark purple to this pure white, growing at Maidlengare, now Magdalen Green—*gare*, from old Saxon *garth* or meadow—near Dundee, in great abundance, propagated it in my own and several other Gardens, and it never vary'd." (His point was that the white flowered varieties are "real species," "they never degenerate or vary, as the finest Flowers in Gardens do.") Where he got his training I have not been able as yet to ascertain. He is familiar with Edinburgh men whom we know to have been Leyden graduates, and a search I made in the list of English-speaking graduates at Leyden shows a Patrick Blair, but at the date given (1734) Dr Blair was dead.

In an account he gives of a case of poisoning at Peasehill, in

Fife, opposite Dundee, in 1694, when "there was a great famine in Scotland, so that the poor People gathered what kind of green Herbs they could get and made a green Broth, sprinkling some Oatmeal amongst them, the Farmer's family used the *Cynoglossum marinum procumbens* (which is found plentifully as you go to Naughton, among the dry pebbly or channelly Sand)," taking it for Colewort, with disastrous consequences. He says this was reported to him, as he "was then in the Low Countries for my further Improvement in my Profession."

He details surgical cases with which he had to do in Flanders in 1695 and 1697, the results of fighting, duelling, and accidents; and in his botanical reminiscences, he speaks of this or that plant having been seen by him growing profusely near Ghent, in Flanders, or near Vilvorde, in Brabant, and at other places. His intimate acquaintance with the work of Continental botanists would also seem to indicate that his wander years abroad had been somewhat prolonged. In 1706, as we have seen, he is in Dundee; but from the position he then held it would be safe to assume that he had been some considerable time in practice.[1] In a poisoning case, he was asked by the magistrates to open the body, and, with other physicians in town, was *subpœnaed* to the trial in Edinburgh. I have tried to find the date of this case, and of the trial, but have failed; it would be subsequent to 1702, however. It forms the substance of a letter Blair wrote to Dr. Richard Mead, in which he indicates how useful Mead's book on the "Mechanical Action of Poisons" had been. The death was caused by arsenical poisoning, and the methods

[1] Bower, in his "History of the University of Edinburgh," referring to Blair as an "eminent philosopher who has been most unaccountably neglected in Scotland," proves that he was settled in Dundee in 1701. He quotes an advertisement from the "Edinburgh Gazette," of 29th September of that year, in which Mr. Blair, who designates himself "surgeon-apothecary in Dundee," proposes to publish a "*Manuductio ad Anatomiam*, or a plain and easy method of dissecting, preparing, or preserving all the parts of the body of man, either for public demonstration or the satisfaction of private curiosity." The work was then ready for the press, and, upon suitable encouragement, would shortly be published. I suspect the encouragement was not forthcoming, and consequently the work never reached the press or the public. Writing to Petiver, of date 8th February 1709, Dr. Blair mentions the work as one of several treatises that he has by him, "which in time I design to expose to (the) publick." Sloane, MSS. 3321.

which nowadays can actually collect the arsenic used on the tissues being then unknown, the medical men had to rely upon the fact that the conditions the post-mortem revealed were those which followed the action of arsenic, and they appealed to Dr. Mead's book as justifying their statements, and the judge accepted their finding.

Next we find Dr. Blair in correspondence with Sir Hans Sloane, interested in his collections and the Royal Society, of which at that time Sloane was secretary. Then came the episode of the elephant, and a correspondence with Sloane's friend and co-worker, the apothecary, naturalist, and collector, Mr. James Petiver. These were the days when earth and sea, at home and abroad, were being searched for their natural history productions of every kind, the outcome of which, so far as the plant world was concerned, was the Method or Classification that would arrange, co-relate, or identify the finds, and which, through Morison the Scotsman, Ray the Englishman, and Tournefort the Frenchman, led up to the great system of Linnæus. Blair preferred Tournefort to Ray, but admired the Aberdonian Morison still more. He preferred Morison, writes a friend, somewhat caustically, "with more nationality than judgment." We have seen how the elephant was dissected and the account sent on to Sloane for the information of the Royal Society. This also led to the formation of a Natural History Society in Dundee. Blair engaged the "interest of several honourable and learned Gentlemen in the Neighbourhood, and the Physicians and Surgeons in Dundee, to use all means for Improvement in the Natural History." They erected a public hall, at their own private charges, to hold their collections, with which, writing to Petiver, July 26th, 1708, he says they have come a good length, and had established a Physic Garden, whereof he was overseer. In this hall was stored the stuffed skin and the mounted skeleton of the elephant.[1]

Some paragraphs in the "St. Andrews University Bulletin," quoting from the University minutes, show the doctor was in request for his skill as a working naturalist.

[1] Blair, when sending Petiver "an guinea for the treatise you design, whereof in your last," asked him to "design me in the subscriptions, Fellow of the Society for natural improvements of Dundee." (Sloane, MSS. 3321).

LIBRARY BULLETIN OF THE UNIVERSITY OF ST. ANDREWS.

No. 7. *July* 1902. Vol. 1.

(THE STORY OF A SKELETON.)

Library Annals.

1707, *Jan.* 30. The University being met, appointed Mr Scrimsour (the receiver of the Library money) to give four dollars of the Library money to the Rector, to be given by him to Mr Arnot, chirurgeon, for his assisting at the dissection, and an extract of this shall be his warrant.

University Minutes, vol. ii. p. 151.

1707, *Feb.* 17. The University appointed Mr Scrimsour to advance, out of the Library money, six fourteins shilling pieces, for transporting the bones of the scelet to Dundee.

University Minutes, vol. ii. p. 152.

1707, *May* 22. The University being met, and it being propos'd that Mr. Blair, having now brought over the sceleton, should be pay'd for the same, which was judg'd reasonable, and therefor they appointed Mr. Alexander Scrimsour, Library Questor, to advance ane hundred merks Scots out of the Library money for the said Mr. Blair, his pains and expences for making the said skeleton and bringing it over, and three pounds Scots to his servant of drink money, and to give out two pounds sixteen shillings Scots upon incidental expences, and this act to be his warrand.

University Minutes, vol. ii. p. 156.

Mr. Maitland Anderson, the St. Andrews University Librarian, who drew my attention to this incident, said his impression was the "sceleton" was still in the University; but Dr. Jas. Tosh, of the Natural History Department, assures me he can find no trace of it, which perhaps is not surprising, seeing the bigger preparation has disappeared, not to speak of the "Hall of Rarities" itself. In the account of the town of Dundee, prepared by Dr. Robert Small, the parish minister in 1792, for Sinclair's "Statistical Account of Scotland," it is stated that the skeleton was in existence a few years before, but all search for it has been fruitless. In 1825 a letter of inquiry appeared in the "Dundee Advertiser," but practically there was no answer. except that someone had heard that some proverbially thrifty townsman had had the bones ground down to make a top dressing for some of the fields in Strathmore, and so the "poor beast" of Blair's narrative got back to earth again. The Physic Garden also has vanished; no trace of it can be found, unless it be that some of the plants which Dr. Blair told Petiver he required—and most probably got—as they were not to be had in this neighbourhood, are the progenitors of those which now are come across in and around Dundee.[1] This loss of the Garden is a pity, for, as Professor Bayley Balfour writes me, "The interest in the Dundee Garden lies in this, that it would be one of the earliest founded in Britain. Oxford is first, then Edinburgh (1670), next would come Dundee." Other papers, anatomical, botanical, and surgical, were contributed to the Royal Society by Blair, and in 1712 he was elected an F.R.S., an honour he ever highly esteemed, and tried, by his natural history work, especially botanical, to maintain. In the many letters which passed between Petiver and himself, and which now form part of the Sloane MSS. in the British Museum, the Doctor is a very interesting and likeable figure. Concerned about some botanical and pharmaceutical MSS. of his which are in Sloane's hands, which he (Sloane) seems to think highly of, and which have had the approbation of Dr. George Preston, Professor of Botany, at Edinburgh, "will they likely be taken up by the publishers?" Unfortunately, Mr. Ray's books were a glut in the market, and no bookseller would look at other books in Latin on Botany. It was disheartening, and Mr. Petiver's suggestion that they should

[1] By the formation of Whitehall Street in 1883, an early residential part of Dundee was largely destroyed. In this closely packed block of buildings, extending from Crichton Street on the east to Couttie's Wynd on the west, many of the leading families of the town had their residences in the seventeenth and eighteenth centuries. Closes intersected the block, passing down from Nethergate to Fish Street. Sometimes the pathway was open to the sky; at others the way led through dark arched passages under the houses. In Scott's Close there was a low-roofed passage some 40 feet long. Covering half the length of this was a cross house of one storey, while over the rest of the passage was an open space which at one time had been a garden. "The ground for this overhead garden had been rich loam for the cultivation of flowers, although latterly it became merely a trodden platform" (Lamb's "Old Dundee"). The Dr. Patrick Blair of 1625 (see *ante*, p. 264) possessed property in this quarter, and it is possible that *here* was the "physic-garden" of his descendant. Only an enthusiast like the later surgeon-apothecary would have been at the pains to make use of so unlikely a site.

be Englished was worth considering; but there was no English terminology as yet to take the place of the Latin. And then there was this pupil and that friend come to London whom "dear Mr. Petiver" was asked to be of service to. One youth "had an impediment in his speech, but was otherwise very knowing in the apothecary art," was on his way to Jamaica; "would Mr. Petiver (who also was an apothecary) try and recommend him to a shop to keep him from being idle till he can have passage." Mr. Lyon, by the way, got passage, but had the misfortune to be taken prisoner on his voyage to Jamaica and carried into France, and a year later he is back at Mr. Petiver's and still set on going to the West Indies.

Again, Mr. James Dundas bears a letter to Petiver, a special friend of the Doctor's, "whose particular study is the mathematics, wherein he has attained to such a degree of knowledge that he has acquired a great esteem in these parts"; would Mr. Petiver give himself the trouble to introduce Mr. Dundas to such as he thinks would be useful to him in that science? Mr. Dundas will tell him all about the Garden, which has now been in existence for three seasons.

He tells how Dr. Wm. Raitt, a neighbour, had recently called on Tournefort, and from what he had told him he, Dr. B., was not surprised to hear of Tournefort's death; it was, however, "a general loss to the vegetable kingdom." The letters are mostly dated from Dundee, although occasionally, in 1711 and 1712, "Coupar-in-Angus" appears, and then the desire grows to have a personal knowledge of Sloane and Petiver, "although the loss to his business here for such a time and the charge of the journey are two great impediments." Still, he thinks the seeing and communing with his friends would "abundantly compense that, because I may acquaint you with a great many things that paper will not bear."

The journey was made, but there is no information given as to how the distance was covered, whether by ship from Dundee or Leith, as his specimens and drugs came or went, or by that coach which in October 1712 began to run between Edinburgh and London, performing the journey, as the advertisement states, "in thirteen days without any stoppage (if God permits), having eighty able horses to perform the whole journey, each passenger paying £4, 10s., allowing each passenger 20 lbs. of luggage; all above, 6d. per lb. The coach sets off at six o'clock in the morning."

Dr. Blair proposed leaving Dundee in February or March 1713, but I have come across no account of his stay in London, nor the meeting of the friends, although no doubt there would be pleasant times—the London botanists made the most of their "herborisings." Petiver, for example, writes to a kindred spirit, giving a description of one of their outings, and tells that when they reached Winchelsea they were entertained at the Mayor's house, and the place not affording any wine, they were regaled with excellent punch made by the Mayoress, "every bowl of which was better than the former one" (Sloane MSS. 344, p. 279).

In a letter dated Birmingham, October 9th, 1713, Dr. Blair gives his "kind landlord and special friend" Petiver some news as to his homeward journey. He had been at Oxford and saw Bobart, who had charge of the Botanic Garden there, and as Bobart was also a believer in Morison,[1] and ultimately worked out and completed the system of classification which Morison's accidental death prevented there would be some congenial talk. He saw the Ashmolean Museum, "but was so surfeited in his appetite after seeing Sloane's and Petiver's collections, that he had no extraordinary relish for it, though there be abundance to satiate an hungry stomach." He went to Lichfield to see Sir John Floyer, the medical man who is perhaps best known from the fact that by his advice young Samuel Johnson was sent to be touched by Queen Anne for scrofula—King's Evil. They discoursed upon several parts of the practice of medicine, particularly the cold bathing, as to the virtues of which the two were agreed. Blair related an experience of his own, which Floyer passed on to another medico, and which later on appeared in print, somewhat different from the original tale. In one of his memoirs Dr. Blair gives his original version, which is worth repeating here, from its local connection, as a sample of the narrator's style, and as an illustration of how they did things in this city of ours two hundred years ago. I may premise that in the paper

[1] "He (Bobart) is as biggot on Morison's Method as you are upon Ray's."

from which I quote there is a good deal of sensible and clear writing apart from the "case" given.

"There was a Man so raving Mad, that he was bound in Fetters; having first tried all Evacuations usual in such Cases, together with Opiates in great Quantity, but to no purpose, I at length plung'd him *ex improviso* into a great Vessel of Cold Water, and at the same time throwing with great Violence Ten or Twelve Pails full of Cold Water on his Head; but that not succeeding, the next Day, having the Conveniency of a Fall of Water about half a Mile off, I caus'd him to be placed in a Cart, and strip'd from his Cloathes; and, being blindfolded, that the Surprize might be the greater, there was let fall on a sudden a great Fall or Rush of Water, about 20 Foot high,[1] under which he was continued so long as his Strength would well permit: This succeeded so well, that after his return home he fell into a deep Sleep for the Space of 29 Hours, and awaken'd in as quiet and serene a State of *Mind* as ever, and so continues to this Day, it being now about 12 Months Since." Later on in the paper, the Doctor rather naïvely admits that "in some hypochondriac and paralytic Cases, I have not found it—the bathing—succeed so well."—Letter I., Misc. Obs.

When Dr. Blair visited London again, he went under very different conditions, and his next meeting with his friends Sloane and Petiver was within the walls of Newgate Prison. My friend Professor Balfour wrote once of that "arch-Jacobite Blair,"[2] but I do not think there is quite sufficient justification for this expression. Undoubtedly Blair was familiar with many who were strongly attached to the Stuart cause. His friends and correspondents included Dr. Arthur, who, in 1715, was mixed up in the attempt to capture Edinburgh Castle for the Jacobite cause. Dr. Archibald Pitcairne was known to him, and they had consultations together over some special patients. His friend Lord Colville (of Ochiltree), to whom he refers as drawing his attention to certain plants,—"a learned and curious nobleman, skilled in music, and well versed in botany and other parts of the natural history,"—was one of the steady opponents of the Union of 1707 in the Scots Parliament, and, according to Defoe's History, his name was invariably among the "Noes." Dr. Blair was sufficiently

[1] I am inclined to think this must have been the Dens' Burn, now enclosed in the extensive works of Messrs. Baxter Bros., Ltd.

[2] "Scottish Notes and Queries," November 1904, p. 77.

acquainted with the Earl of Mar to ask Mr. Petiver to call upon him. He tells him that the Earl "was a most curious person," and would readily become a subscriber to his "Gazophylacium." And further, Blair's father, his brother, and, later on, his nephew, were all Stuart partisans, and both in 1715 and 1745 suffered for the cause, being amongst those excluded from the Act of Amnesty. The Doctor, perhaps, had other objects in view than sight-seeing and converse with medical men and botanists in that protracted journey of his back from London. That may be, though I doubt it. Certain it is, his next appearance in London is as prisoner in Newgate. In the "Registrum de Panmure" an account is given of the Battle of Sheriffmuir, and the rescue of the Earl of Panmure, who was wounded, and had fallen into the hands of the Hanoverian troops. In the stirring story of this rescue, we learn that the Earl's brother, Harry Maule of Kelly, was assisted by a Dr. Blair, who, both by Jervise and A. C. Lamb in "Old Dundee," has been identified with the Naturalist, and it was always a puzzle to me how Dr. Blair, if he was at Sheriffmuir, and accompanied Panmure abroad, yet could about the same time be a prisoner in Newgate. The Stuart papers in the King's collection at Windsor, published some time since in the Hist. MSS. Com. Reports, drew my attention to the fact that there was a Dr. *John* Blair—probably also a Dundee man—who was active in the cause, and to whom a commission was given as "Physician to the King" (James VIII.). I got on the track of Dr. *Patrick* Blair when I found among the list of the officers of Lord Nairn's battalion who surrendered at Preston, "Patrick Blair, Chirurgeon." As the surrender took place on the same day Sheriffmuir was fought (November 13th, 1715), it was evident the Dr. Blair of the rescue must be another person. From Preston the prisoners were removed to London, the journey being made in severe and wintry weather, and extending from 3rd November to 9th December. It was made on horseback, the prisoners marching between troopers, with hands and arms pinioned. On their arrival in London the numbers were so large that they had to be distributed to various London prisons until they could be brought to trial. Blair was placed in Newgate, and his trial took place on March 31st,

1716. He pled "guilty," and, like his companions, was sentenced to death. Many of his fellow-prisoners emitted the same plea. It was their best hope. By pleading guilty there was a chance of pardon; whereas in the case of a conviction on evidence, clemency was less likely to be had. In Newgate, Blair was visited by his friends Sloane and Petiver. Sloane was a person in favour at Court, and his services were in request to secure Blair's pardon.

In a statement prepared for Sloane's use, Dr. Blair says that "he was in no respect accessory to the late troubles, but happening to reside near the parts in which the rebellion broke out, the gentry forced him to accompany the army as a medical attendant" (Sloane MSS. 4038). There seems to have been considerable delay in securing the pardon. Letters passed between Blair and Petiver, in which the Doctor inclines to think Sloane was indifferent to his fate, and somewhat tardy in his actions, and certainly the official intimation came under rather dramatic circumstances. On the evening of the day preceding the date fixed for his execution, some friends, at his request, came to see and spend the evening with him. Still no word of the pardon was forthcoming. Petiver, in a letter to Sloane, tells the story. "The Doctor," he said, "sat pretty quietly till the clock struck *nine*, and then he got up and walked about the room; at *ten* he quickened his pace; and at *twelve*, no reprieve coming, he cried out, 'By my troth, this is carrying the jest too far.'" The reprieve, however, came soon after, and in due time the official pardon.

Dr. Blair, as may well be supposed, found himself stranded in London when set at liberty. He need not return to Dundee; his business there would be quite gone. Presumably his friends there, whose support was the chief reason of his joining the division led by Brigadier Mackintosh into England, were all scattered. Dundee was strongly Jacobite; so much so that when Argyll reached the town after Sheriffmuir, he found it necessary to appoint new magistrates and town-clerk, all the town's officials having thought it their safest plan to leave the neighbourhood. Blair's friends and admirers in the Royal Society, no doubt, did what they could, and his Scots fellow-countrymen encouraged him to start practice in London. He resumed his acquaintance, among others, with Alex. Geckie, "surgeon and citizen of London," who left his library to his native village of Kettins, and "mortified" such sums, that pupils of that village school are still receiving the benefit of this kindly remembrance of the donor's home at Baldowrie. In a short time Blair became intimate with the most active botanists of the time, and joined them in their herborisings. He gathered together a collection of his "Observations in Physick, Anatomy, Surgery, and Botanicks," which was published in 1718. A "Discourse on the Sexes of Plants," which he read before the Royal Society, gave such an exhaustive and experimental demonstration on this subject, that he was induced to amplify his matter and publish a volume on this, and on the common physiology of plants and animals. This work—"Botanick Essays"—published in 1720, is the one by which he is best known. It strengthened the arguments in proof of the sexes of plants by sound reasoning, and some new and striking experiments.

But all this time he was finding the struggle for existence very severe. He writes Sloane in 1719 that he "was nearly ruined," and ultimately he was forced to consider the question of retiring to some country place, where he might live a quieter life, and have more opportunity of securing a reasonable livelihood for himself and his family. In April 1720 he removed to Boston in Lincolnshire, and here he remained till his death, and from which his last work was issued in decads or sections, and this, practically, was the English version of the work he had started upon when in Dundee. Previous to his leaving London, however, in August 1719, as Dr. John Martyn carefully records, he came across a young man, the son of a London merchant, and at that time occupied in his father's counting-house in the city, but whose tastes lay strongly towards botany and natural history. This led to an intimacy between the old man and the young inquirer which is one of the most cheering episodes in Blair's life. He always had, as I said before, an interest in the young men who were his pupils, and now this "agreeable sweet youth" of twenty quite captivated the heart of the older man. All his wide knowledge was at the young man's disposal; they "herborised" together while he was yet in London, and after his removal to Boston an uninterrupted correspondence was maintained between them till Blair's death.

They found that they had both been working upon a "new method" by which to classify plants, founded upon "the seed-leaves"—cotyledons, we now call them. Blair tells his friend all he knew, the experiments he hopes to make in the spring. A reference by Martyn to some observations of Cæsalpinus (d. 1603), "giving the first hint of the circulation of the blood, upon which Harvey afterwards so handsomely enlarged," leads the Doctor to write, "that this has frequently been seen in a great many discoveries made within these three hundred years in Natural History, where the hints have been given by one, enlarged by another, discovered by the third, and still greater improvements made by the fourth"; and then he goes on to show how previous vegetable anatomists had given hints as to the "sexes of plants," "but Dr. Nehemiah Grew was he who made the full discovery." Their own experiments on this subject are then discussed, and he advises that the *Lychnis* tribe be "strictly examined by you and all your other acquaintances." This letter, he says, is the first he has "written in his newly formed greenhouse," which, in its way, was used as his laboratory, much as that still more famous greenhouse at Down, in Kent.

I do not know what practice or income Dr. Blair made for himself in Boston. He writes hopefully, and apparently he had no desire to follow the example of his friend Dr. Arbuthnot, to whom he dedicated his book on the Elephant. Arbuthnot worked away for a time at Dorchester, until one fine morning he mounted his horse and left the place in sheer disgust. "No one would die there," he said, "and he could not live in it." Blair did, however, live in Boston, and evidently made the most of it. The flats of Lincolnshire, its sands and seashore, reminded him of the other "Holland" of his earlier years; the teeming bird-life of fen and shore gratified his love for ornithology, and gave him opportunity to add to his young friend Martyn's collection. And it is not the least pleasant aspect of those later days of Dr. Blair's that his regard for this "amiable youth" was as sincerely returned; Martyn, amongst other services to his friend, revising Blair's proofs for his London printers.

Dr. Blair had high hopes of the work Martyn would do. "If you live to see the number of years I have done," he wrote him, "I rejoice at the thought of your own contributions to the advancement" of the science they both loved so well. Dr. Blair's intuitions and hopes were well founded. John Martyn lived to be the first Professor of Botany at Cambridge, and spent a long and active life in the interests of his science. He never forgot his helpful, admiring Scots friend, and always insisted that Dr. Blair "was his preceptor in Botany, and the most intimate friend of his early years." It is worth remembering that this Dundee doctor thus helped to inspire the good work which Cambridge has done for Botany, and which is associated with the names of the Martyns (father and son holding the chair between them for ninety-two years), Henslow and Babington.[1]

The "Pharmaco-Botanologia, an Alphabetical and Classical Dissertation on all the *British* Indigenous and Garden Plants of the New *London* Dispensatory," Blair's last work, was published in decads, and passed through the press from 1723 to 1728. In his preface he tells the story of its origin. "Being obliged to give Botanical Lectures (at Dundee) to some Students in Physic and Pharmacy, then under my Care, I first planted the Dispensatory Plants alphabetically in my Garden, and then dictated a History of them in Latin." The efforts to publish the work I have already referred to, and this, as I have said, is practically an Englished version of it. Referring to his lectures to the Royal Society on the sexes of plants, etc., he says that "now being retired to a Country Place, I have proposed to employ my leisure Hours in discoursing on the Practical, as formerly I did on the Theoretical part of the Indigenous and Home-bred Vegetables." "Yet"—careful Scotsman as he was—"not to withdraw myself from the Exercise of my Profession in too close a Pursuit of a prolix Subject," he "propos'd to parcel out a few Plants at a time," to give his reader "Time to Ruminate upon one Part while I am preparing another for his Entertainment." His reader, he goes on, "will soon see no ostentatious Affectation, no vainglorious Itching to be an Author, has prompted me to publish a Work upon a Subject of this Nature; I plead not the Desire and Solicitations of Friends; what I have most in my View, is, to manifest the Glory of God and his Omnipotence

[1] The record of the Chair of Botany at Cambridge is surely unique:—

John Martyn, 1733–1761	J. S. Henslow, 1825–1861
Thomas Martyn, 1761–1825	C. C. Babington, 1861–1895

in endowing Man with a rational Faculty to discern these wonderful Productions of his divine Wisdom, and his providential Care over Man; who, as he has since the Fall been liable to such Infirmities as the Weakness of his Nature, the Mismanagement of himself in this lapsed State, or perhaps vicious Inclinations or his immoderate Debaucheries have brought upon him, and made him subject to divers Diseases, and various Tortures, Torments, and bodily Pains and Afflictions; so he has provided such a vast Variety of Remedies, always, almost in his View, which applied in a regular Manner, by knowing and well skilled Persons, are capable, if not to Cure, at least to lighten a burdensome and heavy Load of Sickness, and assuage the Vehemency of his Pains. Nor is the Providence of God less observable in providing to every Climate the fit Antidotes to remove the Epidemical Infections the Inhabitants of such a Soil or Climate are most obnoxious to," a pregnant instance of which, he says, was to be seen in his first decad, where *Artemisia* is treated. "Such a potent Febrifuge as Wormwood abounds in a place where Agues and Fevers are so Epidemical." One may smile at some parts of Dr. Blair's confession of his faith and practice, but at least it is a not unworthy one. Neither is his desire to advance the knowledge of Botany. "I must adapt my Discourse to those of the meanest Capacity, and convert the Technical Words or Botanical Terms of Art into such English as may be easily understood, otherwise I could do no Service, because I am sensible the expressing them in the Original Greek or Latin is one of the Reasons why Botany has hitherto been so long neglected by those whose Business it is to know it; and I rather chuse to render so delightful a Science so easy, that it may be universally known, than that it should remain as a hidden Treasure in the Hands of a very few. So that my principal Business must be . . . . to allure the Reader and stir him up into a desire of diving more deeply into it."

The work did not come out monthly as anticipated, but at irregular intervals, and ceased altogether in 1728, when the letter H had been reached. The usually accepted explanation was, that the stoppage was due to the author's death. The supposition was correct. A document I had the good fortune to come across in the Register House, Edinburgh, records his death at Boston in February 1727—or, as we should say, February 1728, for at this time the legal year did not begin till March,—January and February forming the closing months of the year, coming naturally after the ninth and tenth months—November and December. His death must have been somewhat sudden; there is evidence that he was in London in December 1727, arranging for the issue of a new edition of his "Miscellaneous Observations."

Some day I am hopeful I may obtain further information as to his later years, but meantime this sketch may draw attention to the little known life of this interesting and attractive Dundee doctor and naturalist of two hundred years ago

Additional Notes on the Flora of Portuguese South-East Africa. By Mr. J. A. Alexander.

Cruciferæ.—*Senebiera didyma*, Pers. A South American annual that has spread over all tropical countries.

Sterculiaceæ. — *Hermannia Gerardii*, Harv. Abundant in some places.

Ampelideæ.—*Vitis cirrhosa*, Thunb. This is a common species on the coast, and into the interior to 3000 feet above sea level. Some 30 species are known in South and East Africa.

Leguminosæ.—*Indigofera grata*, E. Mey. A not uncommon species. Mostly all are annuals, and come up very thickly in abandoned land—over 60 species are found in Africa.

Acacia pennata, Willd. A common tree on the coast, wood very hard, and resists white-ants.

Cassia comosa, Vog. A very showy shrub, found in abundance in the open sandy ground by the coast and low lands.

Indigofera rostrata, Bolus—not uncommon.

Crassulaceæ. — *Crassula rosularis*, Haw. Found on the low lands, generally in isolated patches.

Cucurbitaceæ.—*Coccinia palmata*, Cogn. An ornamental creeping plant, with pretty scarlet fruit.

Umbelliferæ.—*Alepidea longifolia*, E. Mey. Common weed in the grass lands.

Rubiaceæ.—*Oldenlandia caffra*, Eckl. and Zeyh. Common weed. Some of the species are showy plants found by mountain marshes and streams.

Compositæ. — *Vernonia anisochætoides*, Sond. A very attractive plant, flowering profusely on the coast and low lands.

Berkheya maritima, J. M. Wood. Common coast plant.

Gerbera ambigua, Sch. Common on open ground. This is one of the many daisies—as they are commonly named—found in Africa.

Sapotaceæ. — *Sideroxylon inerme*, Linn. Small bushy tree, abundant.

Ebenaceæ.—*Royena pallens*, Thunb. Common evergreen shrub.

Mystroxylon eucleaforme, Eckl. and Zeyh. Common in the dry country.

Apocynaceæ.—*Oncinotis inandensis.* I have not been able to certify to the name of this plant, and I think it is known under another name.

Asclepiadeæ.—*Cynanchum natalitium*, Schlechter. Found climbing over the shrubs.

Gentianeæ.—*Belmontia natalensis*, Schinz. This is given as a Natal species, but is found extending on the east coast.

Amarantaceæ. — *Sericocoma chrysurus*, Meissn. Very abundant on the low lands.

Orchideæ.—*Stenoglottis longifolia*, H.K. This is not a common plant, generally found in grass land.

Irideæ. —*Gladiolus Ecklonii*, Lehm. This species is found on the higher range of grass lands.

Dierama pendula, Baker. Found under shade of trees or in grass cover.

Amaryllideæ.—*Brunsvigia Josephina*, Gawl. A very showy plant found in grass lands, the flowering spike appearing before the leaves.

Liliaceæ.—*Chlorophytum elatum*, R.Br. Found in forest cover and grass lands.

Gramineæ.—*Olyra latifolia*, Linn. Very ornamental. Found in damp ground and by river banks.

Eragrostis curvula, Nees. A very abundant grass in the interior; ornamental, not used as fodder.

Professor Bayley Balfour, F.R.S., exhibited the seeds of *Crossosoma.*

Mr. R. L. Harrow showed the following plants in flower from the Royal Botanic Garden:—*Androsace pyrenaica, Corydalis Alleni, Cytisus kewensis* ×, *Draba aizoides, Draba dicranoides, Draba olympica, Draba Salamoni, Erodium hymenodes, Lithospermum oleæfolium, Cheiranthus Menziesii, Pinguicula alpina, Rhododendron Chamæcistus.*

Sir Archibald Buchan-Hepburn exhibited an orchid, *Phaius japonica*, doubtfully hardy in Britain.

MEETING OF THE SOCIETY,

May 9, 1907.

Professor BAYLEY BALFOUR, F.R.S., in the Chair.

The following communications were read:—

NOTE ON WARTY DISEASE OF THE POTATO. By Dr. A. W. BORTHWICK.

Dr. BORTHWICK exhibited potato tubers which had been attacked by the black scab fungus, *Chrysophlyctis endobiotica*. This disease made its first appearance in England only a very few years ago, the outbreak occurring in Cheshire. It was also reported from North Wales, and has now evidently reached Scotland. A full account of the outbreak will be found in "Notes from the Royal Botanic Garden, Edinburgh," No. xvii. pp. 115–119, t. 23.

NOTE ON PETALOPHYLLUM RALFSII AND PALLAVICINIA HIBERNICA. By BERTRAM COCKBURN, Ph.C. Communicated by Mr. J. RUTHERFORD HILL.

These two Hepatics grow in damp, sandy, grassy hollows or salt marshes near the sea, but not touched by the tide. They often grow together, but are quite distinct. *Petalophyllum Ralfsii* is very rare, and easily overlooked. It was first distinguished by Wilson, who gathered it in Anglesey in 1830. He gave it the name *Jungermania Ralfsii*, following Hooker in his generic nomenclature. The name *Petalophyllum* was given by Gottsche. Ralfs gathered the plant at Hayle, Cornwall, in 1842, and it has been gathered by Holmes at Redcar, and at Airsdale Sands, near Southport. It has also been gathered on the Irish coast by Dr. Moore. The localities for *Pallavicinia hibernica* are practically the same. It has also been reported from Fifeshire and Forfarshire. The name *Pallavicinia* was first given by Gray and Bennett in 1821. In Pearson's "Hepaticæ of the British Isles" there are three species, *P. Lyellii*, *P. hibernica*, and *P. Blyttii*. Gottsche gave it the name *Moerckia Blyttii*, but the latter is a distinct plant which grows on riversides in the Highlands of Scotland. Ingham thinks the Redcar plant is identical with the *Pallavicinia Flotowiana* of Lindenberg's "Synopsis Hepaticarum." Both specimens were found in Coatham Marshes, Redcar, close to the sea, near the mouth of the river Tees. The ground is half meadow and half marsh. Some parts are bare sand, and the water in several small ponds is decidedly brackish. A wall of slag separates it from the shore, but at high water in a storm a good deal of spray will be dashed over this barrier. The plants grow at a distance of about 200 yards from the sea, and about 200 yards further inland are large ironworks. Consequently the vegetation is considerably coated with soot. For the most part the plants are scattered singly over the ground, but in one place there was found a patch of *Pallavicinia* about 5 inches square, and in another spot quite a colony of *Petalophyllum*.

Dr. BORTHWICK exhibited specimens and photographs of the nuts of *Cœlococcus carolinensis* which are used in the manufacture of buttons and other articles made of vegetable ivory.

Mr. H. F. TAGG, F.L.S., exhibited a specimen showing fusion of leaves in *Strelitzia reginæ*, Banks. The ventral surfaces of the petioles of the leaves were completely fused, and the midribs also for the greater part of their length: while the lateral laminal expansions were quite free. Sections of the vaginal portion of the compound leaf-stalk showed a fusion of parts of the ventral surfaces of the vaginæ; the free edges of the vaginæ being closely rolled around one another.

Mr. R. L. HARROW showed the following plants in flower from the Royal Botanic Garden:—*Arabis Halleri*, *Aster Pattersoni*, *Cheiranthus Allioni*, *Cheiranthus Marshallii*, *Chrysanthemum ceratophylloides*, *Cyrtanthus* "Flambeau," *Greyia Sutherlandii*, *Myosotis alpestris*, *Phlox verna* ×, *Polemonium humile* var. *pulchellum*, *Ranunculus graminifolius*.

Mr. H. G. Carter forwarded for exhibition, from the neighbourhood of Exmouth and Dawlish, *Romulea Columnae*, *Teesdalia nudicaulis*, and *Senecio squalidus*.

T. Bennet Clark, C.A., showed specimens of the Pine Sawfly with twigs illustrating the damage done.

Mr. W. B. Boyd exhibited a specimen of *Lastraea remota* from the Ben Lomond district. This is probably the first record of this rare fern from Scotland. Mr. Boyd showed also several specimens of fasciation in the Ash.

James Waterston, B.D., B.Sc., sent for exhibition *Raoulia eximia*—the vegetable sheep of Australia—and a larva of *Hepialus* sp., attacked by *Cordiceps*.

MEETING OF THE SOCIETY,

June 13, 1907.

J. Rutherford Hill, Esq., President, in the Chair.

The following communications were read :—

Note on Effect of Frost on Conifers. By Dr. A. W. Borthwick.

Dr. Borthwick exhibited specimens of Silver Fir and Spruce, the terminal buds of which had been killed by frost, and this had resulted in the production of a rosette of new buds at the base of the one destroyed. In some of the specimens these rosette buds had grown out into shoots, producing a very characteristic appearance typical of this kind of damage.

Note on Ophrys hybrida, Pokorny. By Mr. J. F. Jeffrey.

Ophrys hybrida, Pokorny = *O. aranifera*, Huds. × *O. muscifera*, Huds.

A fresh specimen of this supposed natural hybrid between the Spider and the Fly Orchids was sent to me at the end of May from the chalk downs at Wye, Kent, where it was first recorded for Britain in 1905. *Ophrys aranifera* and *O. muscifera* both occur freely in the vicinity, but the hybrid appears to be very scarce.

This interesting plant has long been known in Europe, *see* "Reichb. fil. Ic. Fl. Germ.," xiii., xiv., p. 79, t. 465, f. 1, where it is stated to have been found growing with the two species named, near Vienna, in 1846. *See* also Rolfe, in "Orchid Review," xiii. (1905), pp. 233–235, with fig., and Rendle in "Journ. Bot.," 1906, pp. 347–349.

The specimen, together with an example of both parents, is preserved in the Museum of the Royal Botanic Garden, Edinburgh.

I am indebted to my friend Mr. W. H. Hammond of Canterbury for the following notes made from the living plant when first found in this country and whose photograph has been reproduced in the "Orchid Review," as cited above:—

Sepals resembling *O. muscifera*, lateral ones rather broader at the base. Petals—the lower or labellum emarginate, lobed as in the fly, but broader. This petal altogether larger and broader than that of the fly. Markings as in the spider. Eyes smaller, not so conspicuous as in spider. Two upper petals like those of the spider, not serrated, and nearly the same width their whole length (not like antennæ, as in the fly). No beak to anther, resembling the fly, cells and pollinia also resembling the fly. Rostellum, bracts, and ovary as in fly. Stigma as in spider. Habit of growth that of the fly, with a slender stem a foot or more in height.

Dr. A. W. BORTHWICK exhibited a specimen of *Nectria ditissima* in fine fruit; also *Aecidium strobilinum* from Aberdeenshire.

Dr. R. STEWART MACDOUGALL showed the tunnels and cells of the leaf-cutter bee (*Megachile centuncularis*). The female hollows out a burrow, and cuts oval pieces of leaf from rose (common) and from other plants, including forest trees. These oval pieces are fitted into a cell in which the bee places a store of food material, and then lays an egg; afterwards she covers all up with a series of lids made of circular pieces of cut leaves. The first-laid eggs develop into females, and these take a longer time to develop, so that the upper cells have given out their inmates before the lower.

Mr. R. L. HARROW showed the following plants in flower from the Royal Botanic Garden:—*Aphyllanthes monspeliensis*, *Aquilegia truncata*, *Campanula Allionii* var. *hirsuta*, *Carmichaelia Enysii*, *Corydalis* sp. from China, *Erigeron trifidus*, *Erodium trichomanefolium*, *Leucopogon Fraseri*, *Phyteuma anthericoides*, *Trientalis americana*, *Veronica catarracta* var. *compacta*, *Viola Zoysii*.

Mr. D. M'GLASHEN showed *Erysimum orientale* as a casual.

Mr. W. Balfour Gourlay exhibited a photo of a fastigiate Beech from Dawick near Peebles. (See Plate I. fig. 2.)

T. Bennet Clark, C.A., forwarded a specimen of the Daffodil-Fly—*Merodon equestris*, Fab.

Mr. W. Evans writes with regard to this fly:—"This was doubtless originally imported into this country and is so still in the larval stage in narcissus bulbs from the Continent. It was first definitely identified as British near London in 1869, and has been recorded as doing much damage on narcissus bulbs in Cornwall, etc. The first specimen recorded from the Forth area was taken by myself in June 1899 in a nursery garden, Newbattle Terrace, Edinburgh, as recorded in my note in the 'Annals Scot. Nat. Hist.' 1900, p. 251. It was previously recorded from Kinnoull Nursery, Perth (Grimshaw, 'Annals,' 1899), and since from Aberdeen (Mearns, 'Annals,' 1901)."

1.

2

5.

3

4.

W. Edgar Evans phot. Ruth coll.

1. Riccia crystallina. 2, R. sorocarpa.

3, R. glauca. 4, R. Lescuriana.

5, R. fluitans f. canaliculata.

MEETING OF THE SOCIETY,

July 11, 1907.

J. RUTHERFORD HILL, Esq., President, in the Chair.

Mr. LAURENCE STEWART gave a description of *Carludovica palmata*, a specimen of which was exhibited from the Royal Botanic Garden.

Mr. W. M'HARDY sent for exhibition a specimen of *Peridermium pini* var. *corticola*.

Mr. R. L. HARROW showed the following plants in flower from the Royal Botanic Garden:—*Abelia floribunda*, *Campanula pulloides* var. *kewensis*, *Gentiana Regeli* var. *alba*; *Hypericum fragile*, *Hypericum intermedium*, *Hypericum polyphyllum*, *Lithospermum Frœbelii*, *Orchis hircina*, *Oxytropis montana*, *Potentilla*, sp. n., from E. Tibet; *Sedum sempervivoides*.

Mr. D. M'GLASHEN exhibited several specimens from Bolivia, including the bark of certain dwarf trees (coniferous) growing on the sides of volcanoes; also pieces of "*Yareta*," a resinous plant occurring profusely all over the sides of the mountains. It is only found at altitudes over 10,000 feet. The Indians collect it for transport to mines, etc. It is a serious competitor with coal, as the price of the latter is prohibitive.

ON THE RICCIÆ OF THE EDINBURGH DISTRICT.

By WILLIAM EVANS, F.R.S.E. (Plate III.)

At a meeting of the Botanical Society of Edinburgh held on 9th November 1905, I exhibited living plants of five species of *Riccia* obtained at the reservoirs in this neighbourhood.[1] For over a year, but especially during the spring, summer, and autumn of 1905, the reservoirs had been remarkably low, some, indeed, being almost empty. Large stretches of mud-banks were in consequence left uncovered. On those parts which had been longest exposed—they were naturally, as a

[1] See the "Transactions" for last session, p. 122.

rule, where the feeding streams enter—Riccias made their appearance in due course, and during the autumn were in great profusion.

Being at the time on the outlook for *Hepaticæ* to submit to Mr. S. M. Macvicar in connection with his "census" of the Scottish species, I visited practically all our reservoirs between the latter part of September and the beginning of November for Riccias, which at that season are in good condition for determination. Mr. James M'Andrew was also in search of them for the same purpose, and on 22nd September we both gathered *Riccia crystallina*, L.—an addition to the Scottish list—at Glencorse reservoir, in the main valley of the Pentlands. It was in great abundance on the drier portions of the mud-banks from the mouth of the Kirk Burn to the top of the reservoir, stretches of a dozen or more yards in places being literally covered with it. It occurred also, but much more sparingly, at the head of Loganlee reservoir, higher up the glen, and at Torduff and Clubbiedean ponds, on this side of the hills. I likewise found it at the Burntisland reservoir in Fife on 4th October.

The next best discovery was *Riccia (Ricciella) fluitans*, L., which I found on 29th September in profusion at Threipmuir, near Balerno, from the bridge above Redford Wood to half way down the north side of the reservoir. It was also plentiful at the upper end of Harelaw reservoir, which lies immediately below the Threipmuir one. Mr. Macvicar has only two previous records for Scotland, the later of them from Tentsmuir, dating as far back as 1864. The other was from a pond near Alloa. The plant from our reservoirs in 1905 is the mud form *canaliculata*.

Besides the above, three other species, namely, *R. sorocarpa*, Bisch.—which is the commonest and most generally distributed species in this district—*R. glauca*, L., and *R. Lescuriana*, Aust. (=*R. glaucescens*, Carr.), were likewise found at the reservoirs. In 1868 I gathered a Riccia at one of the Pentland reservoirs, and marked it *R. glauca*, a name which had then a wider application than now, and is the only one given in our local Floras. I feel sure, however, the specimen which I saw not long ago, but have unfortunately mislaid, was really *sorocarpa*. In recent years I have found *sorocarpa* in damp fields and by roadsides, etc., in many localities around Edinburgh, but, apart from the reservoirs, I have only once certainly collected the true *glauca*, namely, in a field near South Queensferry in November 1903. *R. Lescuriana* grows on the coast at Dalmeny, where it was first detected by Mr. M'Andrew in October 1903. When once known, *sorocarpa* is easily distinguished from *glauca* and *Lescuriana*, but these last two, in some of their forms, are not so readily separated from each other. There are, however, structural differences, such as the size of the spores, which specialists rely on. In cross section *sorocarpa* is more distinctly V-shaped than the others.

So far as I am aware, only one other *Riccia*, namely, *R. bifurca*, Hoffm., has been obtained in Scotland. Mr. Macvicar records it from Mid-Perth ("Transactions" of this Society for 1902, p. 232).

The distribution of the five species among our reservoirs in the autumn of 1905 is shown in the following table. Crosswood reservoir was also visited, but not till November, by which date the water had risen and covered any places on which Riccias may have grown.

I may mention that another liverwort, *Fossombronia cristata*, Lindb., was growing plentifully along with the Riccias at most of the reservoirs.

Photographs of living plants of the five *Ricciæ*, taken by my son, W. Edgar Evans, are reproduced in the accompanying Plate.

TABLE SHOWING DISTRIBUTION OF RICCIAS AT THE RESERVOIRS AROUND EDINBURGH IN AUTUMN OF 1905.

Species of *Riccia*.	Reservoir.														
	Torduff.	Clubbiedean.	Bonaly.	Glencorse.	Loganlee.	Harelaw.	Threipmuir.	Harper-rig.	Cobbinshaw.	North Esk.	Portmore.	Gladhouse.	Rosebery.	Edgelaw.	Burntisland.
R. sorocarpa, Bisch. . .	×	×	×	×	×	×	×	×	×	×	×	×	×	×	× ?
R. glauca, L. .					×	×	×	×		×		×	×		×
R. Lescuriana, Aust. . .		×				×	×								
R. crystallina, L.	×	×		×	×										×
R. fluitans, L. .						×	×								

Mr. J. ALEXANDER forwarded to the Society several seeds and specimens of fibre from Portuguese South-East Africa.

These included the fruit and leaves of *Landolphia Watsoniana*, *L. owariensis*, *L. florida*, *L. Kirkii*, and the pod of *Afzelia africana*.

TRANSACTIONS AND PROCEEDINGS

OF THE

BOTANICAL SOCIETY OF EDINBURGH.

VOLUME XXIII.

PART IV.

EDINBURGH:
PRINTED FOR THE BOTANICAL SOCIETY BY
NEILL & CO., LIMITED.
And to be obtained from the SECRETARY OF THE SOCIETY *at the Royal Botanic Garden.*
1908.

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OF THE

BOTANICAL SOCIETY OF EDINBURGH.

ERRATA.

Page 211, line 16 from top of page, *for* "Delipno" *read* "Delpino."

„ 217, line 8 from bottom of page, *for* "Frank Townshend" *read* "Fredk. Townsend."

„ 218, line 11 from top of page, *for* "Wormington Hall" *read* "Honington Hall."

„ 241, top of page, *for* "1906" *read* "1907."

„ 241, line 6 from top of page, *for* "Scott. Alpine Bot. Club Excursion, 1907," *read* "1906."

Plates I.–III. in Part III. *to be altered to* "Plates IV.–VI."

HUMPHREY G. CARTER, Esq.
ALEXANDER COWAN, Esq.
M'TAGGART COWAN, Jun., Esq.
JAMES WHYTOCK, Esq.
WILLIAM YOUNG, Esq.

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TRANSACTIONS AND PROCEEDINGS

OF THE

BOTANICAL SOCIETY OF EDINBURGH.

SESSION LXXII.

MEETING OF THE SOCIETY,

November 14, 1907.

J. Rutherford Hill, Esq., President, in the Chair.

The following Office-Bearers of the Society were elected for the Session 1907–8:—

PRESIDENT.

J. Rutherford Hill, Esq.

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T. Bennet Clark, C.A.
James Grieve, Esq.
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Assistant-Secretary—J. F. Jeffrey.
Artist—Francis M. Caird, M.B., C.M., F.R.C.S.E.
Auditor—Robert C. Millar, C.A.

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Bathgate—Robert Kirk, M.D., F.R.C.S.E.
Berwick-on-Tweed—Francis M. Norman, R.N.
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,, E. M. Holmes, F.L.S., F.R.H.S
,, Lieut.-Col. David Prain, M.D., C.I.E., F.R.S., F.L.S., Royal Botanic Gardens, Kew.
Melrose—W. B. Boyd, of Faldonside.
Otago, New Zealand—Professor James Gow Black, D.Sc., University.
Perth—Sir Robert Pullar, F.R.S.E
Philadelphia, U.S.A.—Professor John M. Macfarlane, D.Sc., F.R.S.E.
Ryde—George May Lowe, M.D., C.M.
San Remo—Sir George King, M.D., F.R.S.
St Andrews—Professor M'Intosh, M.D., LL.D., F.R.S.E.
,, Robert A. Robertson, M.A., B.Sc.
,, J. H. Wilson, D.Sc., F.R.S.E.
Toronto, Ontario—W. R. Riddell, B.Sc., B.A.
,, Professor Ramsay Wright, M.A., B.Sc.
Wolverhampton—John Fraser, M.A., M.D.

The President delivered his opening address.

The following communication was read:—

A West of Scotland Garden: Achnashie, Rosneath, 1906.

By the Rev. David Landsborough, LL.D., Kilmarnock.

Rosneath is one of the most charming parishes in the whole of Scotland. It is bounded on the south by the Firth of Clyde; on the east by Gare Loch; on the west by Loch Long; and on the north by those lofty, rugged and sublime mountain ranges facetiously termed "The Duke of Argyle's Bowling Green."

One never tires of the views around Rosneath Castle, richly adorned with remarkably varied and beautifully arranged wooding, among which an ancient avenue of yew trees, some of them twelve feet in circumference, is conspicuous. But all the trees of the parish are thrown into the shade by the two famous silver firs which grow here near the site of the old mansion of the Campbells of Carrick. They are supposed to be among the first planted in Britain. In September 1903 they were measured by Messrs. Renwick and M'Kay, who found the height of the one 118 feet and of the other 106; while at 4½ feet the girth of the higher was 21 feet 11½ inches, and of the lower 22 feet 4½ inches.

The Established Church manse on the right hand of the road as one leaves the pier has special attractions. Here lived the Rev. Robert Story, father of the late Rev. Dr. Story, Principal of the University of Glasgow.

The beauty of the north of the parish is no less striking. Here by traversing the half mile or so betwixt the main road and the sea we reach ground overhanging the water. How singular our position! In front, stretching for miles, are Loch Goil and Loch Long, while behind is Loch Long undivided. There are thus seemingly three grand lochs all in view from the same spot, one behind and two in front, while the loveliness of the two is set off by the grand mountains towering beyond. In the union of the sweet and lovely with the wild, rugged and sublime, I have seldom seen the equal of the spot.

But my aim is to give some account of the botanical glory of Rosneath, the garden and grounds of Achnashie.

A book has been kept giving a botanical record. It is written by the proprietor, Robert S. Campbell, and is arranged under the following headings: Introduction, Climate and Position, Bulbs, Herbaceous and Rockery Plants, Heaths and Lilies, Flowering Shrubs, Roses, Ornamental Shrubs, Grasses and Climbers, Hardy Shrubs and Trees, Bamboos, Birds.

The Introduction states that the garden was laid out in the beginning of last century by Mr. Angus, who was then proprietor. The Rev. Dr. Campbell of Row, a clergyman very highly respected by all who had the pleasure of his acquaintance, came to Achnashie in 1869, and died there in 1872. By him, and afterwards by his widow, who resided there till 1881, trees and shrubs were added. In 1884 three sons who were then the joint proprietors of Achnashie came home on leave from India.

A feu of several acres of land adjoining allowed of the Achnashie grounds being laid out to much greater advantage and further improved by the planting of clumps and belts of conifers and other trees. In 1898 Sir James M. Campbell, then the sole proprietor, came home finally from India, and from that time resided at Achnashie until his death in 1903. He spared neither time nor money in developing the place to the utmost. The result is that Achnashie is now, in many respects, the most remarkable garden of the West of Scotland.

The garden and grounds face the east and are open to the sun in the south. They are most exposed to the N.W. winds, and sometimes suffer a good deal from them. There is an average yearly rainfall of 55 inches. In the great cold of 1894–5 the thermometer sank to 6° when at the Queen's Park, Glasgow, it was 2° below zero; and at Lamlash, Isle of Arran, 22° above it. The soil is rather heavy and somewhat peaty; but it is thoroughly drained.

BULBS.—"These begin with snowdrops and winter aconite, both of them flowering in the end of January; crocuses, scillas and chionodoxas in February and early March; dog's tooth violets, grape hyacinths, and early yellow daffodils in March; yellow daffodils of all kinds in full glory in early April; white narcissus and tulips in the end of April; and bluebells in May. These bulbs, in all their varieties, are planted throughout the grounds, with the result that the garden and orchard and the field from the middle of April and early May are a wonderful sight. It may be mentioned that the narcissus and the daffodil multiply rapidly; that the snowdrop, winter aconite, chionodoxa and grape hyacinth, common scilla and *Scilla nutans*, do splendidly, but hyacinths and tulips deteriorate when left in the ground—hyacinths falling off rapidly, while tulips flower year after year, but the flowers become poor. Dog's tooth violets are very satisfactory, as are also several kinds of iris—*I. germanica*; *I. sibirica*; *I. Kæmpferi*; *I. Xiphium*, and *I. xiphioides*."

Flowers in Winter.—We are ready to regard winter as flowerless. How far this is from being the case at Achnashie appears from the following extract: "In 1906, with a mean minimum temperature in January of 38°·13, the following were in bloom: Christmas rose, hellebore, wallflower, hepatica, primrose — various colours, polyanthus, lithospermum, St Bridget anemone and *Anenome blanda*, yellow fumitory, creeping forget-me-not, large periwinkle, small periwinkle, double white arabis, sweet coltsfoot, and lungwort."

When there is so gallant a show in winter it may be surmised how brilliant it is in spring and summer.

We, however, pass this as well as that of autumn, and give the notes on the following:—

Acanthus.—"On the lawn this does excellently and has flowered two years—in October 1903 and October 1906. It is covered well with manure in winter."

Gunnera scabra (prickly rhubarb).—"Near the stream this plant is very fine in the end of summer and in autumn until damaged by frost or severe storms. Measured October 1906—stem, 5 feet 6 inches; leaf across, 5 feet 1 inch."

Funkia (bantam lily).—"*F. Sieboldiana*, *F. lancifolia* var. *albo-marginata*, *F. undulata* var. *variegata*, *F. ovata*, bloom well."

Parnassia palustris (grass of Parnassus).—"This" (which competes with buckbean (*Menyanthes trifoliata*) for supremacy as being the most beautiful of all our native flowers) "does well on the wet part of the bank and blooms in September."

Heaths and Lilies.—Heaths are represented by five varieties of *Menziesia* and fifteen of *Erica*. Of lilies there are seventeen varieties, and regarding them we have the following notes:—"Lilies do very well; but they are a good deal affected by the varying weather of different seasons. A dull, damp time coming when they are in bud keeps them much back, and they are often terribly battered by a turn of wind and rain when they are coming into full bloom."

Lilium auratum "in all its varieties, and also *L. candidum*, find our soil too cold in winter. They deteriorate and need to be renewed to give satisfaction. The other kinds do not suffer, and some of them, particularly *L. speciosum* and *L. Szovitzianum*, thrive splendidly."

"We have some years a magnificent display of *L. auratum*. In 1898 a bed with 64 stalks and 486 blooms."

L. Henryi.—"This year (1906) one stem was 8 feet high with 30 blooms. *L. giganteum.*—10th July 1901, one stem was 8 feet 4 inches high with a number of blooms. *L. Szovitzianum* blooms beautifully in July; *L. speciosum*, var. *roseum*, and *L. album*, var. *Krœtzeri*, particularly well in September and October: *L. pardalinum* in July."

FLOWERING SHRUBS.—"Flowering shrubs, such as azaleas, rhododendrons, kalmias and the like, do exceptionally well at Achnashie. They seem to like the soil and the climate, and the time when they flower (May and June) is at Rosneath the dryest and brightest of the year. The azaleas and the hybrid rhododendrons begin to flower about or soon after the middle of May, and are at their best in the first part of June."

Next comes a list of the best azaleas and rhododendrons, followed by the note: "The position and arrangement of the grounds display these shrubs to the greatest advantage. The lawn and grounds sloping up from the sea to the house, and behind the house and garden the steep bank with its terraces and winding paths give an opportunity of seeing the shrubs from below and above, and give many effects of brilliant colouring which could not be had on level ground."

Himalayan Rhododendrons.—"In 1901 and 1902, as an experiment, we planted several Himalayan rhododendrons. They grew well, but did not begin to bloom till this year (1907). They were *R. arboreum*, *R. Luscombei*,[1] *R.*

[1] This is a hybrid.—ED.

barbatum, *R. cinnamomeum*, *R. Thomsoni*, and *R. cinnabarinum*." (At Cromla, Corrie, Isle of Arran, *R. arboreum* did not begin to bloom till thirty years planted.)

Camellia.—"Two plants of the double pink were planted in 1902. They have bloomed this year (1907)."

Magnolia.—"*M. conspicua* was planted in 1885. It blooms freely, as does also *M. Soulangeana*, planted more recently."

Among a great variety of other shrubs the following may be mentioned:—"Fuchsia grown as bushes, hedges, and on walls and trellises. We prune freely, and cut the hedge down every year. It grows to the height of about 4 feet, and flowers freely." *Daphne Mezereum* (white and pink); *Diervilla florida* (*Weigela rosea*), and *W. præcox*; *Choisya ternata*; *Deutzia*; *Spiraea*; *Forsythia*; *Leycesteria*; *Olearia*; *Buddleia*; *Pittosporum eugenioides*, etc.

Roses.—Four pages are devoted to roses. I mention only one—the Banksian. This rose is much cultivated in Southern Europe, and travellers are familiar with it and desire to have it at home. For half a century one has grown luxuriantly overhanging the front door, looking east, of Cromla House, Corrie, Isle of Arran. One summer it had buds, but they did not expand. Has it succeeded at Achnashie? Yes. "One was planted here in 1897, against the south wall of the house, the dryest and most sunny position. Everything was done for it, but in vain. There was no bloom. Something uncommon had to be done if we would have success. A thought occurred. This year (1906) the roots of one planted in 1897 were pruned. The chastisement was effectual, and it bloomed. It is evident that it is most likely to bloom should it be grown in poor soil."

I only add that 24 species and varieties of tea-rose and hybrid tea-rose are mentioned as having been "found most satisfactory"; and the same commendation is bestowed upon 15 hybrid perpetuals—the names given of both. A list is also given of 14 pillar roses. "These are a great feature in the Achnashie garden, and they flourish particularly well."

Two notes are added. First. "It is much better to have *iron than wooden pillars, arches and trellises*, as there is great danger of the wood giving way just when the roses have grown to their greatest beauty. Second. Iron supports and wire, if galvanised or painted, in no way injure the roses grown over them."

Ornamental Shrubs, Grasses and Climbers.—I might mention a number of these, but there is one so rare and also so specially attractive—the exquisite Japan maple—that I confine myself to it, giving in full what is recorded.

"*Acer japonicum* (the Japanese maple) is one of the greatest ornaments of the Achnashie garden and grounds.

"We have several varieties, all of which do well. They are lovely with their early shoots in spring, and in the beginning of summer they are exceptionally beautiful. All summer they are excellent, and in autumn the brilliancy of their changing leaves is very striking. They were introduced to the garden in 1885. Two of these have grown into particularly fine plants. On 18th October they measured :

"*A. palmatum*, var. *dissectum ornatum*, 4 feet high ; 24 feet in circumference ; stem 10½ inches in girth. It is a beautiful compact weeping bush with branches and leaves hanging thickly and gracefully to the ground. It is difficult to say whether it is more beautiful in June in its full fresh foliage, or in October when its leaves become of a wonderfully brilliant colouring ere they fall.

"*A. atropurpureum*, var. *palmatum*, height 8 feet 6 inches; circumference 24 feet ; girth of stem 9 inches. This is of quite a different habit from the other, growing tall ; branches open and spreading and away from the ground. It is very beautiful in spring and early summer, but in autumn the leaves wither very early.

"Gratified by the success of these two, between 1899 and 1903 we got a number of additional varieties which have done excellently—those which were fortunate in situation, splendidly."

The following is our list :—

Acer japonicum, var. *versicolor*.
" " " *roseo-marginatum*.
" " " *roseo-marginatum dissectum*.
" " " *polymorphum purpureum*.
" " " *aureum*.

Acer japonicum, var. *palmatum sanguineum.*
" " " " *atropurpureum.*
" " " " *dissectum.*
" " " " *dissectum ornatum.*
" " " " *septemlobum elegans purpureum.*

Climbers.—I only mention that nine species and varieties of these elegant plants are recorded.

Hardy Shrubs.—Among these, seven varieties of the hawthorn are given. Of one of them—*Cratægus Carrièrei*—it is mentioned that "the berries are as large as cherries."

Bamboos.—I confess that I had no idea that bamboos could be grown successfully in this country. About ten years ago, however, happening to be at Rosneath, a kind lady, knowing my love of plants, took me to Achnashie. All was beautiful and attractive. But I was amazed at the sight of the bamboos. I could hardly believe that I was in Scotland. It seemed to me as if I had been transported to the south of Europe, if not nearer to the equator. In his garden-book Mr. Campbell devotes considerable space to them and his experiments with them. I give the preface in full.

"The beginning of growing bamboos at Achnashie entirely out of doors was made in 1880. In 1871 we had received some small plants of *Arundinaria* (*Thamnocalamus*) *Falconeri* in pots. They were kept in the pot for some years, being placed in the verandah in summer but taken into the greenhouse in winter. In 1880 the experiment was made of planting some of them from the pots to the open soil. It was successful. They did well, and increased in size. In the spring of 1885 they were planted out in an excellent situation, sheltered from strong winds, and open to the sun. They did admirably, and grew into two large clumps reaching 20¼ feet in height by the end of 1904.

"From these clumps from time to time plants were taken and clumps were formed in different parts of the ground, proving very ornamental.

"No attempt was made to get any other kind of bamboo till 1896, when my brother, Sir James M. Campbell, who was at home from India for a short time and was living at Achnashie, got a plant of *Arundinaria japonica* (métaké) from the Rev. Dr. Watson, Largo.

"Two years later, when my brother retired from the Indian Service and settled at Achnashie, he procured a considerable number of other bamboos of different kinds. Of these one or two failed, being unsuitable, or not suiting the places in which they were planted; but the rest did well. Encouraged by this, several more were got in 1900 and 1901, and two in 1905—thus raising the number of species or varieties to a quarter of a hundred." I give the notes regarding a few.

Arundinaria (*Thamnocalamus*) *Falconeri*.—Planted 1885. 1906—height, 20 feet 3½ inches; circumference, 20 feet at 5 feet. It stood 26 degrees of frost in 1895 without injury.

Arundinaria nitida.—Planted 1900. October 1906—height, 9 feet 6 inches. By far the daintiest and most attractive of all its genus, and also exceptionally hardy.

Arundinaria japonica (métaké).—Planted 1896. 1906—height, 10 feet 8 inches; circumference, 13 feet.

Arundinaria Hindsii.—Planted 1901, transplanted 1905. 1906—height. 7 feet.

Bambusa fastuosa.—Planted 1900. 1906—height, 8 feet 8 inches. "This very stately and noble plant stands out quite conspicuously among its fellows." See *Bamboo Garden*, p. 105.

Bambusa nana.—Planted 1901. 1906—height, 3 feet 6 inches.

Bambusa palmata.—Planted 1898. 1906—height, 5 feet 6 inches; circumference, 13 feet. Very flourishing. It is conspicuous for the great size of its leaves.

Phyllostachys aurea.—Planted 1898. 1906—height, 8 feet 9 inches.

Phyllostachys Henonis.—Planted 1900. 1906—height, 10 feet; circumference, 12 feet. "The embodiment of every grace to which plant life is heir." See *Bamboo Garden*, p. 149.

Phyllostachys mitis.—Planted 1898, transplanted. 1906—height, 7 feet. "In pride of stature this is the noblest of all the bamboos generally cultivated in our country" (Britain). See *Bamboo Garden*, p. 117.

Flowering of Bamboos at Achnashie.—"It was not till the summer of 1904 that any bamboo flowered at Achnashie. The first to do so were *Phyllostachys nigra* and *Arundinaria Simoni*, both in that year; while *Phyllostachys Henonis* did so in the following, and *Thamnocalamus Falconeri* in 1906. Though plants should bloom frequently, the seed fails to ripen. At Achnashie, however, seed was obtained from *Arundinaria Simoni* in 1905, and in 1906 from *Thamnocalamus Falconeri*. The seed of both has been sown and has germinated: so that we have plants of both from home-grown seed."

The following notes are given:—First, seed germinates more quickly when it has been allowed to become perfectly hard and dry. Second, the seed requires considerable heat—only in the stove-house does it spring satisfactorily. Third, birds are fond of the seed. Fourth, before flowering the plants become brown and the leaves fall, causing the plants to look miserable.

Birds of Achnashie Garden.

"No account of Achnashie and its garden and grounds would be complete without reference to the birds which add so much to the beauty and enjoyment of the place." A list is therefore given of the birds seen during the years 1900–1906, with notes regarding them. These are under the headings—

1. Residents all the year.—A list of seventeen.
2. Residents seen occasionally.—A list of fourteen.
3. Summer visitors.—A list of nineteen.
4. Autumn visitors.—A list of three (siskin, redwing, fieldfare).
5. Game birds.—A list of four (snipe, woodcock, grouse, pheasant).
6. Birds on the shore and on the loch within half a mile of Achnashie.—A list of thirty-two.

Special notes are given of five birds, from which I take the following extract:—

"*Tringa alpina* (dunlin, sea-lark, commonest sandpiper).[1] Arrives about the middle of April; generally seen at first in pairs. During summer parent birds are seen with their

[1] Mr. Wm. Evans, F.R.S.E., says this description applies to the Sandpiper *Totanus hypoleucus*.—Ed.

young. In autumn flocks of full-grown birds. Leave generally in October; but have been seen in November. The nest is only a slight hollow lined with rootlets and dry leaves. Eggs four in number.

"In 1899 a pair raised a family on the grass between the road and the sea, about ten yards above high-water mark and close to the Achnashie landing-place. In 1900 apparently the same pair, who clearly had found their 1899 nesting-place too public, made their nest on the bank above the garden near the summer-house and about 180 yards from the sea-shore. They raised their brood successfully, but had great difficulty in getting the young birds to the shore. It took some days to make out the journey. At first the parent birds were heard in the evening in great excitement among the laurels on the bank near the summer-house. They were apparently getting the young birds safe for the night. Next evening there was similar excitement among the currant bushes in the garden about half-way to the sea. The following day they were still heard, but ultimately they got safe to the shore.

"In 1902, on the 6th of June, when one of the gardeners was working in the garden, about 100 yards from the shore, he disturbed a dunlin, which flew away, leaving an egg. The gardener went to report the matter, and when he returned the egg was not to be found. A pair of dunlins were seen daily about the garden, bank and shore; but till the 12th we failed to discover their nest. On the bank we found one with four eggs near the foot of a tree within a few yards of the place of the nest of 1900. It seemed clear that the parent birds had carried the one egg from the rockery to the old place up the bank, and about eighty yards further from the shore, and that three more eggs had been laid. The young birds were fledged successfully, and the parents conducted them by degrees to the shore. There was the same excitement at first on the bank, and by stages through the garden, until ultimately the beach was safely reached. The family party were seen in the garden, on the lawn-tennis court, and in the field, as well as on the shore. By the end of July the young birds seemed nearly grown. In August and September the whole party were often seen about the shore; while in October flocks of dunlins were often seen in the Castle Bay apparently getting ready to leave. In 1903, and also in 1904, broods were also hatched.

"It is very interesting to watch the parent birds with their young upon the shore. The moment the parents call 'twee-wee-wee' the little ones crouch motionless and cannot be distinguished from the stones of the beach. It is much more difficult for them to hide when on the grass or in the garden, but it is surprising how quickly the little creatures find cover when the warning of the parents is heard. The parents were terribly excited when the young ones were among the big laurels and rhododendrons on the bank; but they became much more easy in mind when they saw their young on the lawn-tennis ground or the grass in the open part of the garden. At times a parent bird perches on the post of a pillar rose and watches how the little ones are getting on—surely an unusual thing for a shore bird.

"After the young birds have got safely to the shore and can fly, the family party sometimes comes back to the garden; but when the young are fully grown the garden is no longer visited, the birds being seen only on the beach or near the shore.

"After the nests had been for two seasons on the rockery near the tennis court, the dunlins had become wonderfully tame, so that though I or the gardener came near when the hen was hatching, it sat quiet and seemingly unconcerned.

"*Motacilla flava* (blue-headed yellow wagtail).[1]—We first observed this wagtail in March 1901, and we have seen it often since. Seebohm says of it: 'It is chiefly known as an accidental straggler on migration to our islands'; and Gordon writes: 'Has occasionally bred in Durham; but generally a straggler over here on migration.' There is, however, no doubt that it is a regular visitor at Rosneath, and that it breeds here. In December 1906 I was glad to find it at Christchurch, Hampshire, in Mr. Hart's delightful collection, and I was much interested to learn from him that it breeds regularly at Christchurch. He was interested to hear of it being found at Rosneath, and said that he had often thought it curious that it was not known and acknowledged as a regular British bird.

"During March, April and May 1901 we often saw a pair

[1] Mr. Wm. Evans, F.R.S.E., says this description applies to the Grey Wagtail *Motacilla melanope*.—Ed.

about the glen and the waterfall and its neighbourhood. We thought they must have a nest near, but we failed to find it. In the end of May we saw the parent birds with their young flying about the glen near the stream; and a few days afterwards we saw the young birds with their parents on the shore at the mouth of the stream. In August we came across their nests on the bank of the stream under an overhanging ledge of rock.

"Next year a pair were seen in the last week of March, during April and in the beginning of May, in the glen near the waterfall. On the 13th May we found their nest on a ledge of rock near the waterfall and about thirty yards down stream from the nest of the previous year. There were three young birds just fledged. Alas! that night was most unusually cold—7 degrees of frost—and next day the young birds were dead. There was no sign of foul play. The parent birds had disappeared, and we saw them no more that summer, nor the following. In April 1904 and 1905 they returned, and were seen also in 1905 in September, and in 1906 in May and in August. We have found no nest since 1902; but we have not looked for one.

"This wagtail is the smallest of all the family, and is easily recognised by its blue head and yellow breast, and also by its size, 6½ inches, as compared with pied wagtail, *Motacilla lugubris*, 7½ inches, and grey wagtail, *M. melanope*, 8 inches.

"*Muscicapa grisola* (spotted flycatcher).—The spotted flycatcher is one of the most interesting of our summer visitors, and adds much to the life of the garden and lawn. They appear in the beginning of June. They have nests somewhere about the place, as we invariably have a number of young birds about during summer. We have not looked for their nests; but in 1905 there was one in the ivy on the wall of Achnashie near the drawing-room window which we watched with much interest, specially enjoying seeing the parent birds feeding and training the young birds. The lawn-tennis court is one of their favourite places. The wire fence round the lawn gives a capital vantage position for the parent birds, and it is very amusing to see a little one perched on a croquet hoop with gaping mouth for the parent bird to give it a fly. Soon, however, the young gain strength and boldly dash from their perch to flycatch on their own account.

It was a very pretty sight to watch the whole family, old and young together, whirling, flying and flashing in pursuit of their rapid winged prey, and it is wonderful to see the number of flies, midges, and other insects which they seem to catch.

"We are favoured with them till August; but almost all are gone ere the end of that month, though we have noted one early in September; but it may have spent the summer farther north, and it may have been so far on its migration.

"*Turdus iliacus* and *Turdus pilaris* (redwing and fieldfare).—One of the most interesting bird-sights of Rosneath is the autumn visit of large flocks of fieldfares and redwings.

"The famous yew avenue at Rosneath by its berries seems specially to attract these birds, and from it they scatter to the gardens and shrubberies around, making, wherever they visit, a clearance of yew and rowan-trees of their berries. Having during November finished these they disperse, and are not seen during the winter; but in April they appear in large flocks in the fields near the castle, apparently preparing for their migration in spring.

"The date of arrival varies, no doubt affected by the prevailing winds. With continuous east wind the birds come early; but when west and south-west winds prevail the arrival of the birds is delayed. We have recorded the following dates of arrival in the yew avenue—

1902,	November	5.
1903,	„	7.
1904,	„	22.
1905,	„	15.
1906,	„	21.

"Whatever the date of arrival the scene is the same. Large flocks of birds are busy at the berries of the yews—very wild, very noisy, and apparently very quarrelsome, but so timid that on the slightest disturbance they fly to the tops of a line of tall lime trees which run parallel with the avenue of yew.

"In a few days they are much less excited, and do not fly away so hurriedly when any one approaches. Soon they begin to appear throughout the neighbourhood—a great number of fieldfares and a fair number of redwings at

Achnashie enjoying our yew and rowan berries; but these finished they are speedily away.

"While there are large numbers both of fieldfares and of redwings, the former are generally more numerous than the latter."

Dr. R. STEWART MACDOUGALL showed Twigs of Plum infested by *Xyleborus dispar.*

THOS. ANDERSON, M.A., sent for exhibition a specimen of *Orchis pyramidalis*, collected by him on the Links west of Archerfield, East Lothian, in August 1907. The plant was growing close to the shore in pure sand, accompanied only by a scanty growth of *Ammophila arundinacea*, and was the only one he observed.

In making the exhibit Mr. W. Edgar Evans, B.Sc., pointed out that this was a new county record, and referred briefly to previous Scottish records. The first of these was from Colonsay, S. Ebudes (Lightf., "Flor. Scot.," 1777); the second from Leven Links, Fife, 1835 (J. Knapp, Herb. Roy. Bot. Gard. Edin.). He exhibited specimens gathered by Mrs. P. Evans at Leven in 1879, but said the species was now probably extinct here. Later county records were Wigton ("Cyb. Brit.," 1849), Berwickshire ("Trans. Bot. Soc. Edin.," 1870), Dumfries, Kirkcudbright and Mid Ebudes.

Mr. R. L. HARROW showed the following plants in flower from the Royal Botanic Garden:—

Caralluma adscendens, Carpolyza spiralis, Cuscuta reflexa, Escallonia exoniensis, E. langleyensis, E. macrantha, E. punctata, E. Philippiana × *punctata* (raised at Royal Botanic Garden, Edinburgh, 1907), *Oryza sativa*, var. *atropurpurea, Phænocoma prolifera*, var. *Barnesii, Pitcairnia Roezlii, Polygonum equisetifolium.*

Mr. D. M'GLASHEN showed *Ranunculus arvensis* as an alien from the Edinburgh district.

On behalf of Mr. E. M. HOLMES, F.L.S., the President exhibited herbarium specimens of *Origanum majoranoides*, Willd., which had been received from Mr. W. Bevan, Acting

Director of Agriculture, Cyprus, and from Professor W. R. Dunstan, Director of the Imperial Institute, London. The oil of origanum manufactured in Cyprus had been traced to this plant, which possessed some botanical interest. The plant had been lost sight of for a long time, and was clearly described by Willdenow in the "Species Plantarum," vol. iii. p. 137. It is mentioned in Morison's "Pl. Hist.," vol. iii. p. 359, under the name *Majorana hortensis odorata perennis*, and was evidently known as a garden plant over two hundred years ago. It was remarkable that so distinct a plant should have gone out of cultivation, and that its name should be given in books as a synonym of the ordinary garden Marjoram, *Origanum Majorana*, Linn., which was an annual, whereas the Cyprus plant was perennial. The essential oil distilled from the plant had been examined in the Chemical Research Laboratory of the Imperial Institute, and was found to contain 82·5 per cent. of a phenol which had been identified as carvacrol, this being a higher percentage than that yielded by oil distilled from most species of origanum used in the manufacture of the commercial oil.

On behalf of Mr. E. M. Holmes, F.L.S., the President also exhibited the seeds of *Sapium verum*, Hemsl., which yields the "Virger" rubber of New Granada.

MEETING OF THE SOCIETY,

December 12, 1907.

J. RUTHERFORD HILL, Esq., President, in the Chair.

The President said the death on Sunday, 8th inst., at the Royal Palace at Stockholm, of Oscar II., King of Sweden, removed the only foreign royal name from their List of Fellows. He became a Fellow of the Society in December 1877. The late king occupied a distinguished place in science, art, poetry and literature, to all of which he not only made personal contributions, but promoted them by all the influence of his exalted station. Among his own people he was more like a father than a king. Mixing freely with them, and by personal interviews with public officials and private individuals, he endeavoured to get at the mind and understand the aspirations of the nation, and he conscientiously placed all his varied talents at the service of his subjects. On one occasion Bonnet, the botanist, was collecting algæ on the shore near Stockholm when he met another man similarly employed. The two got into conversation and found they had a mutual interest in botanical science. Ultimately Bonnet accepted an invitation to luncheon with the stranger, and expressed surprise when he conducted him to the royal palace. The stranger somewhat apologetically explained that that was the only place given him to live in. It was King Oscar himself whose invitation the astonished Bonnet had accepted, and the whole incident beautifully illustrated the unassuming modesty and graciousness of the cultured and peace-loving monarch and patron of natural science whose death they now sorrowfully recorded.

Professor JOHN BRETLAND FARMER was elected an Honorary British Fellow.

The following were elected Resident Fellows :—

Mr. GEORGE FORREST, Mr. W. BALFOUR GOURLAY, Mr. J. FREDK. JEFFREY, A. L. PEARSON, M.A., B.Sc., and GEORGE W. SCARTH, M.A.

The following were elected Non-Resident Fellows:—

J. W. Bews, M.A., B.Sc., and Matt. Y. Orr, B.Sc.

The following communication was read:—

On the Root Cortex of *Vellozia equisetoides*, Baker. By Rev. James Waterston, M.A., B.Sc., B.D., with exhibition of living plant and photographs.

Mr. James Fraser exhibited specimens of the following alien grasses found by him in the neighbourhood of Edinburgh, all of which are new records for Britain, viz.:—

Elymus canadensis, Linn., a native of North America; *Phalaris angusta*, Nees, a native of the Western States of South America; and *Bromus marginatus*, Nees, a native of Washington, Oregon, Nevada, and other parts of the Western United States, which has also been found as a casual on wool-waste heaps in Maine. When grown in cultivated soil this plant seemed to agree very closely with Shear's *B. marginatus* var. *latior*.

On behalf of Mr. E. M. Holmes, F.L.S., the President exhibited living roots of an undetermined species of *Kæmpferia* known as "Sherungulu" by the natives of the tropical Northern Zoutspansberg, Transvaal. The root was said to be fragrant when dried, and it had been suggested that it might be of use for perfumes.

On behalf of Mr. E. M. Holmes, F.L.S., the President exhibited a herbarium specimen of *Acokanthera venenata*, Don. The plant is used in South Africa as an arrow poison, the bark being pounded by the bushmen between stones, and a decoction made and boiled to an extract in which the arrow tips are dipped. The plant was one of three or four so-called species, differing chiefly in length of flowers and leaves, and occurring all down the Great Rift valley from Arabia to the Cape of Good Hope. The Northern forms are *A. Schimperi* and *A. Deflersii*, and the Southern *A. venenata* and *A. spectabilis*. The plants owe their poisonous effects to a glucoside Ouabaïn, which when taken into the stomach is not poisonous, but when injected into the blood is one of the most powerful poisons known, one-sixty-fourth of a grain being sufficient to kill a man.

On behalf of Mr. PETER FENTON, the President exhibited the fruit of *Pithecoctenium echinatum* and the seed of *Mucuna urens* from St. Helena, the seed of *Entada scandens* from India, and *Bertholletia excelsa* from South America. The *Pithecoctenium* was described as a new species which does not appear in the "Index Kewensis." It was first described by Karl Schumann.

In Professor Bayley Balfour's absence Mr. H. F. TAGG, F.L.S., exhibited a portrait of Mr. Wm. M'Nab, at one time chief of the gardening staff of the Royal Botanic Garden, and an original Fellow of the Society. The portrait, prepared from a calotype in the possession of Miss M'Nab, a grand-daughter of Mr. M'Nab, will appear, with an account of Mr. M'Nab's life, in "Notes from the Royal Botanic Garden."

Dr. A. W. BORTHWICK showed specimens of a gooseberry shoot disease, caused by *Coniothyrium* sp.

Mr. HARRY F. TAGG, F.L.S., exhibited a specimen of a gooseberry bush which had been killed by the attack of a root fungus, *Agaricus melleus*, Vahl.

The specimen, the exhibitor explained, was one of several secured during a visit to Kent, where of recent years the losses to growers occasioned by the ravages of this parasite have assumed considerable proportions. In the plantation from which the specimen was taken large patches of gooseberry bushes attacked by the fungus were observed, and it was estimated in this one plantation alone over a thousand plants were affected.

It was pointed out that when once the mycelium of the fungus had established itself in the roots and stool of a tree, nothing could be done to save it, and plants so affected ought certainly to be destroyed.

The difficulties of combating fungal diseases of this kind, where the mycelium of the parasite is able to spread from tree to tree through the soil, and the necessity of taking active measures by destroying the affected plants when the disease first appears, were commented on.

The Rev. James Waterston, M.A., B.Sc., B.D., showed specimens of the Jumping Bean, the movements of which are caused by *Carpocapsa saltitans* in the fruits of *Sebastiania* spp.

Mr. R. L. Harrow showed the following plants from the Royal Botanic Garden :—*Aphelandra aurantiaca*, var. *Roezlii*, *Calanthe Veitchii*, *C. vestita*, *Ceratopetalum gummiferum*, *Hydrangea quercifolia*, *Maxillaria grandiflora*, *Nerine Bowdenii*, *N. candida*, *Reinwardtia tetragyna*, *R. trigyna*.

MEETING OF THE SOCIETY,

January 9, 1908.

J. RUTHERFORD HILL, Esq., President, in the Chair.

The TREASURER, Mr. RICHARD BROWN, C.A., submitted the following Statement of Accounts for the Session 1906–1907:—

INCOME.

Annual Subscriptions for 1906–1907	£39	0	0
Do. Arrears	1	10	0
Transactions sold	3	10	0
Subscriptions to Illustration Fund	3	0	0
Interest on Deposits in Bank	4	10	9
Excess of Expenditure over Income	2	6	11
	£53	17	8

EXPENDITURE.

Printing (including Transactions for 1906–1907, £30, 17s. 8d.)	£43	7	2
Rooms for Meetings, Tea, etc.	6	10	0
Stationery, Postages, Carriages, etc.	3	15	6
Fire Insurance on Books, etc.	0	5	0
	£53	17	8

STATE OF FUNDS.

Amount of Funds at close of Session 1905–1906				£143	19	2
Deduct—Decrease during Session 1906–1907, as above				2	6	11
Funds as at close of Session 1906–1907				£141	12	3
Being:—Sum in Current Account with Union Bank of Scotland Ltd.	£39	2	0			
Sums in Deposit Receipt with do.	144	10	9			
Due by Treasurer	1	6	8			
	£184	19	5			
Less—Printing Accounts outstanding	43	7	2			
As above				141	12	3

Note.—Subscriptions in arrear, 1905-1906, 15s.; 1906-1907, £6, 15s.

On the motion of the PRESIDENT a cordial vote of thanks was tendered to the TREASURER, and to the AUDITOR, Mr. R. C. MILLAR, C.A.

The following was elected a Resident Fellow:—

Mr. D. W. Thomson.

The following communications were read:—

Potamogeton pensylvanicus, Cham. et Schlecht., introduced to England. By Arthur Bennett, F.L.S.

So far as I know no authenticated case of the introduction to the British Isles is known of a species of *Potamogeton*, and elsewhere we have no knowledge of such, the supposed case of *P. crispus* to N. America[1] having proved to be an error; though there is evidence that *crispus* has been introduced from the east coast of the United States to Arizona, suggested by the late Dr. Morong as due to the agency of birds.

What seems to be an undoubted case is the finding of the above well-known N. American species by Miss Vigurs in a canal at Salterhebble Bridge, near Halifax, Yorkshire, in July 1907. Her brother, Dr. Vigurs of Newquay, Cornwall, kindly sent me three sheets so collected, and added, "I can make nothing of the pondweed."

It is a species that has had many names. By the earlier American botanists—Michaux, Pursh, Rafinesque, etc.—it was called *natans var.* 6, *fluitans*, *heterophyllus*, etc., and no definite name came to be accepted until Professor Tuckerman described it very fully under the name of *P. Claytonii* in the "American Journal of Science and Art," ser. 1, xlv. 38, 1843. But many years before this Bernhardi had sent specimens to Wolfgang, who described it as *P. pumilus* in Roemer and Schultes' "Syst. Mant.," iii. 354, (1827). At about the same time, but really earlier in that year (in April), Chamisso and Schlechtendal in their monograph of the genus in "Linnæa," ii. (1827), described a *P. pensylvanicus* from Philadelphia which Willdenow had in his herbarium. Tuckerman when in Europe saw these specimens at Berlin, and initialed them as his *Claytonii*. Still nothing came of this until 1885, when Dr. Eichler (the then Curator) sent me all the specimens of the genus in Willdenow's collection. This and the study of Rafinesque's

[1] Morong, "Mon. N. American *Naiadaceæ*."

paper in the "Medical Repository" of 1808 and 1811, and the "Critical Review" of 1817, led me to try and trace out its real name. There was no doubt Wolfgang's *pumilus* was the plant, as Dr. Lange sent me an original specimen from Bernhardi, and *pensylvanicus* and *Claytonii* were certainly the same. Then Dr. Morong (*l.c.*) adopted the name *P. Nuttalii*, which occurs in the same volume of "Linnæa," but on the page before *pensylvanicus*. He has been followed by Dr. Gräbner in Engler's "Das Pflanzenreich," Heft 31, 1907. Dr. Morong seems not to have noticed Tuckerman's remarks on the figure of the fruit of *Nuttalii* in the "Linnæa." The result of this naming is that *pensylvanicus* is certain, that *Nuttalii* is not, as we have no specimens, so far as known, in any European herbarium. But there is Rafinesque's name of *P. epihydrum*, "Med. Rep.," 2nd Hex. v. 354, 1808. He there says his plant is the same as Michaux's *natans* var. 6, of his 1803 Flora.[1] In the Vienna Herbarium there is a specimen named "*P. natans*, Michaux. In fluv. Virginia. Beyruth." This is *P. Claytonii*. This of course makes it likely that Rafinesque's name may have to be accepted, but no specimens so named by him are known. A specimen from him (no date) in the Delessert Herbarium at Geneva named "*P. fluitans* Auct. Am." is *Claytonii*. It is the only specimen of Rafinesque's that I have seen. And the earlier American botanists (Pursh, Bartram, etc.), named it *P. fluitans*.

In North America it occurs in the British Possessions in Vancouver's Island, British Columbia, Upper and Lower Canada, New Brunswick, Nova Scotia, and Sable Island.

In the United States, Maine (Fernald !), south to Georgia (Glasgow Herb. !), New England ! to Oregon !, Washington Territory ! and California !; in Jamaica ! and Porto Rico !.

It is probable it has been introduced with cotton in some way; it occurs in the States where this is grown—*i.e.* Virginia !, Carolina !, Georgia !, Tennessee !, Louisiana !, etc.

I have asked the author of the "Flora of Halifax," Mr. Crump, to investigate the spot next summer, and make a complete list of the plants with which it is associated. Miss Vigurs names the following as having been observed by her: *Potamogeton crispus*, Linn., *Elodea*, a *Ceratophyllum*. *Glyceria aquatica* and *Alisma Plantago* were growing with or near it.

[1] "Fl. Boreali Americana," 2 vols., 1803.

The Flora of Prince Charles Foreland, Spitsbergen. By R. N. Rudmose Brown, B.Sc. (Communicated by the Secretary.)

In the summer of 1906 the Prince of Monaco landed an expedition under Dr. W. S. Bruce on the little-known island of Prince Charles Foreland, the most westerly island of the archipelago of Spitsbergen. Six weeks in July and August were passed ashore, and though the work of the expedition was in the main restricted to surveying, a small collection of plants was made. In 1907 Dr. Bruce again went to Prince Charles Foreland and spent the whole summer from June to September on the island. A further collection of plants was made, containing several species not included in the previous year's collections. Dr. W. S. Bruce kindly asked me to undertake the description of these two collections, and they form the subject of the present paper.

Previous to Dr. Bruce's exploration of Prince Charles Foreland our knowledge of the island was very meagre. The Swedish Spitsbergen expedition of 1898 under Dr. A. G. Nathorst landed on the island in July of that year, and collected 29 species of flowering plants. Anterior to this date no species had been recorded from the whole island with the two exceptions of *Chrysosplenium alternifolium* and *Draba leptophylla*. Dr. Bruce's collections contain a total of 55 species of vascular plants. It must be remembered that the flora of the whole Spitsbergen archipelago as now known includes barely 200 species of vascular plants. The collections lack several common species well known from Spitsbergen, but surveying expeditions, as I have mentioned was the case with Dr. Bruce's, have few opportunities and little time available for systematic collecting. Such gaps therefore as exist in these collections in all probability will be filled on a future occasion. Three species found on the Foreland by Drs. Andersson and Hesselman in 1898, namely, *Cardamine bellidifolia*, *Sagina nivalis*, and *Saxifraga hieraciifolia*, do not occur in Dr. Bruce's collections. These bring the total number of species known from Prince Charles Foreland up to 58. The Foreland specimens include no species not known from other parts of Spitsbergen, and the flora is entirely a European one, containing no characteristically American elements. It might have been expected that certain American forms from Greenland would have been found on this island, since it is the most westerly outlier of the European arctic regions; but it is not the case, and in all probability the Greenland Sea sharply divides American and European arctic regions biologically as well as topographically. The flora of the Foreland therefore presents no aspects of great interest, unless it be the entire absence of this American element.

A few brief notes as to the nature of the soil and the physical environment may be of interest. The island is some fifty-five miles long by six broad, and is separated from the mainland of Spitsbergen by a narrow sound varying from eight to two miles in breadth. The interior is very mountainous, rising to a height of 3850 feet in Mount Monaco, but there are extensive stretches of level ground towards the south end, and to some extent also at the north-east. Many of the valleys are filled with glaciers, particularly on the east coast, but only on that coast do some of them reach the sea; the northern and southern parts of the island are unglaciated. A raised beach of half a mile to two miles in breadth almost encircles the Foreland and is clear of snow from June until September, except in the most sheltered spots. The west coast has a far more luxuriant vegetation than the east coast, which is often barren, but, Dr. Bruce says, "even on the west coast there are sterile parts, and one not unfrequently passes abruptly from the flowery region into a veritable desert." Peat bogs are not uncommon, and they support a rich vegetation. At the foot of many of the hills a talus occurs, on the upper and more level parts of which vegetation is relatively abundant, particularly with a southerly or westerly exposure. This is no doubt largely due to the increased fertility of the soil in such spots where birds' nesting-places are always to be found, but certainly other contributing factors are the more direct insulation and the tendency of the soil to be drained of its cold water and thus to become more physiologically suitable for root absorption to take place.

The rapidity with which Arctic plants complete their reproductive processes in the short summer is well known, and Dr. Bruce notes the fact that on Middle Edinburgh Isle a week after the thick snow had disappeared *Saxifraga oppositifolia* was in full bloom. This is the earliest species to flower in the Foreland, while *Cardamine pratensis* is the latest, being in full flower at the end of August and beginning of September. In early September, when the first falls of snow take place, many plants are still in flower, though fruiting is then general. *Saxifraga aizoides*, *Potentilla emarginata*, and *Cardamine pratensis* were all gathered in flower at this time, and "grasses in fine condition showed their delicate heads through the snow."

My thanks are due to Professor J. W. H. Trail, F.R.S., for much valuable help; and I must also express my indebtedness to Dr. C. H. Ostenfeld, especially in reference to the species of *Poa* and certain other grasses, to Dr. H. Dahlstedt for his opinion on a species of *Taraxacum*, and to Professor I. Bayley Balfour, F.R.S., for facilities in the herbarium of the Royal Botanic Garden, Edinburgh. Dr. W. S. Bruce, who entrusted the collections to me, has earned my further obligations by the excellent state of the specimens and the many valuable notes he took in regard to them.

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O. GELERT, "Notes on Arctic Plants," *Botanisk Tidsskrift*, xxi. 3. Copenhagen, 1898.

W. S. BRUCE, "Prince Charles Foreland," *Scottish Geographical Magazine*, xxiii. 1907, p. 141.

THORILD WULFF, *Botanische Beobachtungen aus Spitzbergen*. Lund, 1902.

RANUNCULACEÆ.

Ranunculus Pallasii, Schlecht. Several specimens from swampy places on the west coast towards the north: in full flower in August.

Ranunculus hyperboreus, Rottb. In very wet places near Vogel Hook and at Cape Cold.

Ranunculus pygmaeus, Wahlenb. A few specimens from the north end of the Foreland. It is apparently not common, but being very inconspicuous might easily be overlooked.

Ranunculus nivalis, Linn. On plains at south end of the Foreland; in full flower in August.

Ranunculus sulphureus, Sol. (*R. altaicus*, Laxm.). One of the common species. Specimens from Cape Cold and from near Vogel Hook. It grows luxuriantly in places to a height of over 15 inches, particularly on a mossy or peaty soil. Smaller specimens approach very closely to the last species.

Papaveraceæ.

Papaver radicatum, Rottb. (*P. nudicaule*, Linn.). A common species, often of luxuriant growth. Near Vogel Hook and on plains at south end of Foreland.

Cruciferæ.

Cardamine pratensis, Linn. A species represented by specimens from various places on the west coast. In full flower in August and September, the latest of any species on the Foreland.

Draba. In determining the species of this very variable genus I have followed Gelert, who reduces the Arctic forms to ten species, of which five are found in Spitsbergen.

Draba alpina, Linn. Specimens from Cape Cold and vicinity, and from near Vogel Hook. In flower in July; in fruit in August.

Draba alpina, Linn., var. A much smaller, densely cæspitose form, with short and slender flower stalks. A little south of Vogel Hook on the west coast.

Draba hirta, Linn. Near Vogel Hook; in flower in July.

Draba arctica, J. Vahl. "From talus at foot of 1050 feet hill" at the southern end of the central range. In full flower in July.

Cochlearia officinalis, Linn., var. *greenlandica*, Gelert. On west coast; in flower and fruit in July.

Cochlearia officinalis, Linn., var. *oblongifolia*, Gelert. Near Vogel Hook; in flower and commencing to fruit towards the end of July.

Caryophyllaceæ.

Silene acaulis, Linn. A very common species growing vigorously. Both white and purple varieties occur. Shores of Antarctic's Bay and near Vogel Hook. Mostly on rather dry and stony ground.

Melandryum apetalum (Linn.), Fenzl (*Wahlbergella apetala*, Fr.). On south-west coast; in full flower during July and August.

Cerastium alpinum, Linn. Very common. Specimens from Cape Cold and vicinity and the northern part of the west coast. Flowering almost over by the middle of August.

Cerastium Edmondstonii (Wats.), Murb. and Ostenfeld (*C. arcticum*, Lange). From near Vogel Hook.

Cerastium Edmondstonii, var. *cæspitosum*, Malmgr. Below Mount Monaco, west coast; in full flower in July.

Stellaria longipes, Goldie. North-west coast and plains at south end of Foreland and Cape Cold.

Stellaria humifusa, Rottb. A single specimen of this very common Arctic plant from near Vogel Hook.

Alsine biflora (Linn.), Wahlenb. "Talus at foot of 1050 feet hill" at southern end of central range.

ROSACEÆ.

Dryas octopetala, Linn. Very common; the ground at "Camp 3" near the north end of the island was carpeted with this species. From various places, particularly towards north and south ends. In flower in July and August.

Potentilla emarginata, Pursh (*P. fragiformis*, Willd., forma *parviflora*, Trautv.). On west coast, north and south of Cape Cold. Beginning to fruit in July and August.

SAXIFRAGACEÆ.

Saxifraga nivalis, Linn. Near Vogel Hook and at Cape Cold. Flowering almost over towards the end of August. Among the specimens is one of a very short, stunted form from Cape Cold, smaller in all respects than the typical *S. nivalis*.

Saxifraga stellaris, Linn., var. *comosa*, Wahlenb. Three specimens from the shores of Peter Winter Bay on the east coast of the Foreland.

Saxifraga oppositifolia, Linn. Probably the commonest plant on the Foreland, growing luxuriantly and covering large areas. All along the west coast, flowering plentifully in June and July; in full seed in the beginning of September. Abundant on the Middle Edinburgh Isle.

Saxifraga Hirculus, Linn. With its bright sulphur-yellow flowers one of the most conspicuous of Spitsbergen plants Very common on drier ground, and in full bloom in August. Specimens from the north-west coast, Cape Cold and vicinity, and the southern plain. Particularly abundant about Cape Cold.

Saxifraga aizoides, Linn. Various places on the west coast from near Vogel Hook to Cape Cold. In flower as late as 7th September.

Saxifraga cernua, Linn. The normal form of this species in Arctic regions has the terminal flower buds developed, and flowers freely. Cape Cold, shores of Antarctic's Bay and vicinity, and north-western shores of Foreland. In full flower in July and August. The collection contains a single specimen from near Vogel Hook resembling the British alpine form with drooping, imperfectly developed flowers.

Saxifraga rivularis, Linn. Plentiful in wet places. North-west coast from Vogel Hook southwards.

Saxifraga cæspitosa, Linn. Western shores from Vogel Hook southwards, and in the vicinity of Antarctic's Bay. In full bloom in July; fruiting in August.

Chrysosplenium alternifolium, Linn., var. *tetrandrum*, N. Lund. Common in wetter places North-west shores of Foreland and about Cape Cold.

Crassulaceæ.

Rhodiola rosea, Linn. (*Sedum Rhodiola*, DC.). A single very stunted specimen from "talus at foot of 1050 feet hill" at the southern end of central range.

Compositæ.

Petasites frigidus (Linn.), Fr., Cape Cold. Apparently a rather rare plant on the Foreland.

Taraxacum arcticum (Trautv.), Dahlst. (*T. phymatocarpum*, J. Vahl). Below Mount Monaco and at Cape Cold. Fruiting in August. Dr. H. Dahlstedt very kindly gave me the benefit of his opinion on this species.

CAMPANULACEÆ.

Campanula uniflora, Linn. Three specimens from Cape Cold.

SCROPHULARINEÆ.

Pedicularis hirsuta, Linn. "Talus of 1050 feet hill" at southern end of central range and on north-west shore. In flower in July; in fruit in August.

POLYGONACEÆ.

Polygonum viviparum, Linn. Generally stunted and low growing, this species occasionally assumes a more luxuriant form. Near Vogel Hook, below Mount Monaco, and along the shore southward.

Oxyria digyna, Hill. Luxuriant specimens in profuse flower (July and August) from near Vogel Hook.

SALICINEÆ.

Salix polaris, Wahlenb. Common. Specimens from near Vogel Hook and the shores of Antarctic's Bay.

JUNCACEÆ.

Juncus biglumis, Linn. On shore below Mount Monaco.

Luzula arcuata, Sw. Peter Winter Bay on east coast and near Vogel Hook.

Luzula arcuata, Sw., var. *hyperborea*, R. Br. At north end of Foreland, and at Cape Cold and vicinity.

Luzula nivalis, Beurl. North-west shores of Foreland.

GRAMINEÆ.

Alopecurus alpinus, Sw. Common. From Vogel Hook to Cape Cold.

Phippsia algida (Sol.), R. Br. Vogel Hook and vicinity.

Aira alpina, Linn., forma *vivipara*. Very common; north coast and west coast, southward to Mount Monaco.

Trisetum subspicatum (Linn.), Beauv. Cape Cold.

Arctophila fulva (Trin.), Rupr. (*A. effusa*, Lge.), forma *depauperata*, Nath. (*A. Malmgreni* (Ands.), And. and

Hessel.). Marshy ground on west coast near "500 feet hill."

Poa pratensis, Linn. Near Vogel Hook.

Poa pratensis, Linn. forma. North-west coast.

Poa pratensis, Linn., var. *colpodea* (Th. Fr.), Gelert and Ostenfeld. West coast near Vogel Hook and below Mount Monaco.

Poa cenisia, All. Common on west coast generally, and at Black Hill at north end of Foreland.

Poa alpina, L. forma *vivipara*. West coast.

Dupontia Fischeri, R. Br. West coast from Cape Cold to near Vogel Hook. A pseudoviviparous form from Cape Cold.

Glyceria maritima (Huds.), Wahlenb., forma *reptans* (Laestad), Gelert and Ostenfeld (*G. vilfoidea* (Anders.), Th. Fr.). A mere fragment from the north-east coast, which Dr. C. H. Ostenfeld assures me belongs to this species.

Glyceria angustata (R. Br.), Fr. Common; west coast in the vicinity of Mount Monaco.

Festuca rubra, Linn., var. *arenaria* (Osb.) Lge. Apparently common. Cape Cold and north-west coast; also at Peter Winter Bay on the east coast.

FILICES.

Cystopteris fragilis (Linn.), Bernh., forma *dentata*, Hook. Cape Cold.

Cystopteris fragilis (Linn.), Bernh. var. A variety with pinnæ obtuse, pinnulæ more diffuse and obtuse; growing among grass at Cape Cold.

EQUISETACEÆ.

Equisetum arvense, Linn., forma *alpestre*, Wahlenb. From "talus at foot of 1050 feet hill." Specimens without fertile stems.

LYCOPODIACEÆ.

Lycopodium Selago, Linn. Several well-developed specimens from Cape Cold.

NOTE ON A SCOTS PINE TREE OF GREAT DIMENSIONS IN CO. CORK.[1] By Sir DYCE DUCKWORTH, M.D., LL.D.

This grand specimen I found in a dense wood near Castletownshead, Co. Cork, overhanging the harbour in a well-sheltered position quite 100 feet above the sea. It measured at the base 12 feet in girth; 6 feet up, where large branches began to come off, 13 feet 10 inches. It appeared not less than 120 feet in height, with many large branches.

The soil was shallow on shale rock, and much ivy had invested it, although the ivy was dead in many places, resisted by the strenuous vitality of this monarch. Ferns grew in the forks of it, and a small ash tree had grown from the largest of these. I have warned Madame C. de Bunsen, the proprietor of the property, to have the tree cleared and better tended. I believe it must be at least two hundred years old, and it is possibly the largest, or one of the largest, in Ireland.

MR. GEORGE FORREST exhibited a selection of new and remarkable species of *Primula* from N.W. Yunnan and S.E. Tibet, and submitted the following note:—

The most interesting species shown are *P. vinciflora*, Franch., *Delavayi*, Franch., and *Franchetii*, Pax, comprising, as they do, three out of the four species contained in the remarkable section *Omphalogramma*. The section takes its name from the round and flattened form of the seed, which one might easily mistake at first glance for that of a monocotyledon.

Monsieur Franchet, who identified the bulk of the collections made by Père Delavay and other members of the French Roman Catholic Mission in the same district from which the specimens exhibited came, was so struck by their distinct appearance that he formed a sub-genus of them, still retained as a section of the genus *Primula*.

It is interesting to note that the only other known species contained in that section is *P. Elwesiana* from the Sikkim-Himalaya. The flora of the extension of the Himalaya mountains, from that point until their entrance into Yunnan, has up to date been untapped, but almost certainly, once

[1] For measurements of large Scots pine trees in Scotland see Dr. David Christison in "Trans. Bot. Soc. Edin.," xix. (1893), p. 508.

the country becomes more opened up, we shall have other and perhaps more beautiful species added to those mentioned.

Mr. JAMES FRASER exhibited specimens of two casual grasses recently found by him at Leith, both new records for Britain, viz.: *Hordeum chilense*, Brongn. (*H. secalinum*, var. *chilense*, Desv.), a native of South America, a continent from which we get very few alien plants; and a young *Phleum* which Professor Hackel thinks is probably a young form of *Phleum exaratum*, Hochst., a native of Asia Minor and very closely allied to *P. græcum*, Boiss. and Heldr.

Mr. R. L. HARROW showed the following plants in flower from the Royal Botanic Garden:—*Acacia Balfouriana*, *Aloe ciliaris*, *Bulbophyllum comosum*, *Clematis grewiæflora*, *Clerodendron splendens*, *Coleus thyrsoideus*, *Cyphomandra betacea*, *Dædalacanthus nervosus*, *Lycaste Skinneri*, var. *alba*, *L. Skinneri*, var. *rubella*, *Veltheimia glauca*.

MEETING OF THE SOCIETY,

February 13, 1908.

J. Rutherford Hill, Esq., President, in the Chair.

Miss Ida M. Hayward was elected a Lady Member.

Mr. Peter Fenton was elected a Resident Fellow.

The following communications were read :—

Excursion of the Scottish Alpine Botanical Club to Killin, 1907. By Mr. Alexander Cowan.

The members left Edinburgh on the afternoon of 29th July for Killin, where, as usual, they made the Bridge of Lochay Hotel their headquarters during the meeting.

Although the Club was here only two years before, in 1905, the weather was then so wet as to almost entirely prevent systematic botanising, and for this reason it was felt by the Executive Committee that an early return visit to such a good centre would be agreeable to the members, and this was proved by the fact that twelve of them intimated their intention of being present at the meeting. Two, unfortunately, were prevented at the last moment from attending, but the number present, viz. ten, was larger than had attended for several years. The whole of the accommodation in the hotel had been secured beforehand, and although one or two of the members had for various reasons to leave before the end of the meeting, a very pleasant and, from a botanical point of view, satisfactory week was spent. The weather, fortunately, was very favourable, which the members may congratulate themselves on, considering the abnormally wet summer we have experienced.

On Tuesday, 30th July, it was decided to drive up the Lochay Valley and botanise on Beinn Haesgarnich and Creag Mhor. There was a strong breeze, and the day was an excellent one for climbing. Four of the members of the party spent the day on Creag Mhor, while the remaining six climbed Beinn Haesgarnich by various routes, all reaching the top, where the President's health was duly proposed and honoured. The great find of the day was *Carex ustulata*, of which a considerable quantity was seen in fine flower on Beinn Haesgarnich. In addition to this, the following plants were found on this mountain:—*Asplenium viride*, *Bartsia alpina*, *Botrychium Lunaria*, *Carex capillaris*, *C. curta*, *C. dioica*, *C. pauciflora*, *C. pulla*, *C. ustulata*, *C. rigida*, *Cerastium alpinum*, *Cherleria sedoides*, *Cochlearia alpina*, *Epilobium alpinum*, *Geum rivale*, *Gnaphalium supinum*, *Habenaria albida*, *Pseud-athyrium alpestre*, *Rubus saxatilis*, *Salix herbacea*, *Saxifraga nivalis*, *S. hypnoides*, *S. stellaris*, *Splachnum sphæricum*, *Thalictrum alpinum*, *Tofieldia palustris*, *Trollius europæus*, *Utricularia intermedia*, *Vaccinium uliginosum*, *Viola lutea* var. *amœna*, *Viola palustris*. *Meum athamanticum* was found in the valley.

On Creag Mhor the following plants were found:—*Bartsia alpina*, *Botrychium Lunaria*, *Cerastium alpinum*, *Draba incana*, *Dryas octopetala*, *Gentiana campestris* var. *alba*, *Gnaphalium supinum*, *Habenaria albida*, *Potentilla salisburgensis*, *Pseud-athyrium alpestre*, *Salix reticulata*, *S. herbacea*, *Saussurea alpina*, *Saxifraga hypnoides*, *S. stellaris*, *Thalictrum alpinum*, *Trollius europæus*, *Vaccinium uliginosum*.

On Wednesday, 31st July, the majority of the members spent the day on Cam a Chreag and Meall nan Tarmachan. The day was very fine and clear. The best find made was *Woodsia hyperborea*, which was found by no less than three members of the party, in addition to which a double-flowered form of *Ranunculus acris* was found, also the following:—*Carex atrata*, *C. curta*, *C. flava*, *C. pauciflora*, *Cerastium alpinum*, *Cochlearia officinalis* var. *groenlandica*, *Draba incana*, *Epilobium alpinum*, *E. alsinefolium*, *Festuca vivipara*, *Geum rivale*, *Polystichum aculeatum*, *P. Lonchitis*, *Potentilla salisburgensis*, *Ranunculus acris* (double form), *Rubus saxatilis*, *Salix reticulata*, *S. herbacea*, *Saxifraga hypnoides*, *S. nivalis*, *S. stellaris*, *Tofieldia palustris*, *Trollius europæus*, *Vaccinium uliginosum*, *Veronica saxatilis*, *Viola palustris*, *Woodsia hyperborea*.

Two members of the party, wishing to take things easily, spent the day on the Auchmore side of Loch Tay, where, among the thousands of ferns growing there on the roadside, some interesting varieties were found, such as *Lastrea mon-*

tana with variegated fronds and one or two forms yet to be tried and named, together with some varieties of *Athyrium f.f.* and *Cystopteris fragilis* var. *polydactyla*. *Orchis maculata* was found in great beauty and luxuriance in a marsh by the side of the road. *Carex pallescens* and *Scutellaria galericulata* were also found. Another member angling on Loch Tay brought home a basket of fine trout.

On Thursday, the 1st of August, the party made an early start in order to climb Beinn Lawers. The day was fine though dull. Three of the party commenced the ascent at the burn in order to visit the Corrie. Here *Myosotis alpestris* was found in great quantity and in fine flower, showing that in spite of the numerous plants taken by botanists, a continuous supply is evidently kept up on the lower ledges by means of seed falling from plants on the higher and inaccessible portions of the rock. In addition to this, *Arenaria rubella* was also gathered. The following plants were found in the Corrie and by the burn side:—*Adoxa Moschatellina*, *Arenaria rubella*, *Chrysosplenium alternifolium*, *C. oppositifolium*, *Draba alpina*, *D. incana*, *Gentiana campestris*, *Gymnadenia conopsea*, *Habenaria viridis*, *Myosotis alpestris*, *M. sylvatica*, *Salix reticulata*, *S. herbacea*, *Saxifraga cernua* (in flower), *Veronica saxatilis*.

The members of the party who made the ascent from the hotel found the following plants:—*Arenaria rubella*, *Carex atrata*, *C. capillaris*, *C. curta*, *C. ovalis*, *Cerastium alpinum*, *C. trigynum*, *Cherleria sedoides*, *Cornus suecica*, *Epilobium alpinum*, *Epilobium alsinefolium*, *Juncus biglumis*, *Saussurea alpina*, *Saxifraga cernua*.

All the members reached the top in safety, where they duly drank to the health of the President, who was present. A strong wind was blowing, but though the day was dull no rain fell, and a fair view was obtained of various well-known mountains. The whole of the party made the return journey to the hotel past Loch-na-Chat, and in the Corrie on the north side of the mountain considerable time was spent looking for *Carex ustulata*, but unfortunately none of the members were lucky enough to find a plant.

All were more or less tired after the long day on the mountain, and on reaching the hotel, its comforts of various kinds were much in request and duly appreciated.

On Friday, 2nd August, the members drove about five miles up the Lochay Valley, and walked home, botanising on the way. *Orchis maculata* was found in great abundance all along the side of the road, many plants with pure white flowers being seen. *Gymnadenia conopsea*, *Habenaria chlorantha* were also found in fair quantity, as well as *Campanula latifolia*, *Epilobium angustifolium* and *Trollius europæus.* Some rain fell late in the afternoon of this day, but not until the members had almost reached the hotel, so that they had the pleasant experience of four consecutive days' botanising without once getting wet.

On the whole a very successful meeting was spent; nearly all the well-known rare alpine plants growing in this district being found, the finding of *Carex ustulata* on Beinn Haesgarnich, though not on Beinn Lawers as well, more than compensating for other disappointments. The members returned home on the morning of Saturday 3rd of August.

Before sitting down, I would like to refer for a moment to the Report, read a year ago, of the Club's visit to Connemara in 1906. As some of you may recollect, the principal object of holding the meeting in that district was the rediscovery, if possible, of *Erica Stuarti*, originally found there by the late Dr. Stuart during a previous meeting of the Club many years before, but the members had to leave without, as they thought, having obtained a plant.

It is most interesting to be able to record, however, that a plant gathered by one of the members as *Erica Mackayana* has proved on cultivation to be true *Erica Stuarti,* it having flowered last summer. I may add that none of the plants of *Erica Mackayana* were in flower—they could only be distinguished by their foliage.

The Mosses and Hepatics of Prince Charles Foreland, Spitsbergen. By Dr. J. Hagen, Trondhjem. Communicated by the Secretary.

The collections described in this paper were made by Dr. W. S. Bruce, during his exploration of Prince Charles Foreland, the most westerly island of the Spitsbergen Archipelago, in the summers of 1906 and 1907. The material entrusted to me consisted of eighteen envelopes containing unprepared mosses and liverworts, fourteen of them gathered on the 4th and 23rd to 27th August 1906, and four of them in 1907. Though the collection is rather a small one, it presents nevertheless some features of interest particularly in regard to the habit of the plants, some of them being stunted and woven together into compact, almost woody tufts, as for instance *Dicranum elongatum* and *Jungermannia minuta.* Others appear even at this high latitude in loose cushions growing in a luxuriance not surpassed by plants from much more southern regions, and this is the case even in species by no means characteristic of the Arctic zone, as for instance *Oncophorus Wahlenbergii* and *Aulacomnium palustre.* It is well known that this difference in growth depends not only upon the nature of the species but to a far greater extent upon external influences: an exposed, dry, or weather-beaten situation favours the formation of hard tufts, while a sheltered position allows the plants to develop freely.

High latitudes also give their impress to the vegetation in another way: almost all the mosses and hepatics are found in a barren state. The short summer and the low temperatures are not favourable to the maturation of sexual organs, and in the present collection only *Oncophorus Wahlenbergii* is found with fruits; even this species is only in the first stage of fructification, and it is doubtful if it reaches maturity. In the same way, only one hepatic, *Jungermannia minuta*, has developed perianths. *Hypnum revolutum* has male flowers and *Hypnum uncinatum* both male and female but no sign of fructification, a condition which is also met with in the higher mountains of Norway. Another effect of the severe conditions is seen in the tufts of mosses rarely being pure but generally containing a mixture of a number of species. In some cases this intimate mingling of species is very remarkable to one who only knows them from their habits in more southern latitudes and in more favourable circumstances.

The collection contains nineteen species of mosses and four of hepatics. Among the mosses one new variety occurs, *Hypnum uncinatum*, Hedw., var. *fœneum*, while *Dicranum spadiceum* is a new record for Spitsbergen.

Mosses.

Oncophorus Wahlenbergii, Brid., var. *Homanni*, Boeck.—A cushion 4 to 4·5 cm. in height, with leaves more than 4 mm. long and with some young fruit stalks.

Dicranum molle, Wils.—Growing in cushions, sometimes intermingled with the preceding.

Dicranum spadiceum, Zett.—Shoots occur in cushions of *D. elongatum*. As far as I know, this species has not been previously recorded from Spitsbergen, though it is known from other parts of the Arctic regions and also from Finmark, Siberia and East Greenland.

Dicranum elongatum, Schleich.—Common: in some cases forming the bulk of tufts, in other cases mixed with various species.

Dicranum grœnlandicum, Brid.—A small tuft from "Talus at foot of 1050 ft. hill" at the southern end of the central range.

Ditrichum flexicaule (Schleich.), Hampe.—In a tuft together with *Dicranum spadiceum* and *D. elongatum* evidently growing on earthy soil.

Rhacomitrium lanuginosum (Ehrh.).—Growing sparingly in a tuft of several species from Cape Cold.

Webera commutata, Schimp.—A few shoots among *Dicranum grœnlandicum*.

Bryum crispulum, Hampe.—Occurring in cushions of *Hypnum uncinatum*.

Mnium affine, Bland., var. *integrifolium*, Wils.—Only a few shoots among other mosses near Vogel Hook.

Cinclidium subrotundum, Lindb.—Growing sparingly in tufts of *Oncophorus Wahlenbergii*.

Aulacomnium palustre (L.), Schwägr.—Luxuriant specimens up to 9 cm. in height. Cape Cold and north-west coast.

Var. *polycephalum* (Brid.), Bry. Eur. A tall, loosely cohering tuft from Cape Cold.

Timmia austriaca, Hedw.—Some shoots among *Dicranum elongatum* from Cape Cold.

Polytrichum alpinum (L.), var. *brevifolium* (R. Br.), Brid. —Occurs sparingly among *Dicranum spadiceum* and *D. elongatum*.

Brachythecium udum, Hag.—An Arctic species previously known from various localities in the higher mountains of Norway. On Prince Charles Foreland it occurs in a smaller form markedly decumbent, in very loose tufts, or creeping in single individuals among grasses and other higher plants in moist sheltered places. Near Vogel Hook.

Hypnum uncinatum, Hedw.—Occurs in cushions, singly, or mixed with other mosses. Two forms are found, one of which corresponds to var. *abbreviatum*, Bry. Eur. The other is hitherto undescribed, though known from the shores of northern Norway, where it is abundant, but has previously been confounded with var. *orthothecioides* (Lindb.).

Var. *fœneum*, n. var. In *cæspititibus luteis, laxis, decumbentibus, raro suberectis vigens, longa/longissima, simplex; folia valde hamata, longe cuspidata; fructus rari.* It is easily distinguished from var. *orthothecioides* by the long falcate secund leaves. North-west coast near Vogel Hook.

Hypnum revolutum, Mitt.—Male plants in a mixed tuft from Vogel Hook.

Hypnum stramineum, Dicks.—A large tuft of only this species, and another in which other species also occur. Almost the typical form. Vicinity of Vogel Hook.

Hypnum sarmentosum, Wahlenb.—Found in tufts with other species and also by itself. A single cushion, containing only this species, is hardly more than 2 cm. high, and is glossy with yellow and brown colouring. It contains plants varying in size, some of them approaching the type of the species, but the majority of them short, broad, and with less leaves, almost agreeing with var. *arcticum* (C. Jens.), from which they differ however in the leaves of the branches being sharply pointed. But great importance cannot be attached to this difference since specimens from Red Bay, gathered by Malmgren, in other characters agreeing with the Foreland plants, show on one and the same branch both obtuse and pointed leaves. The Foreland specimens may therefore be referred to the above variety, which it may be more correct to name var. *pumilum*, Milde (Bryol. Siles., p. 369), since this seems, from the description, to be the same as var. *arcticum*.

Hepaticæ.

Jungermannia quinquedentata, Huds.—Some shoots intermingled with *Dicranum grœnlandicum*.

Jungermannia Flœrkei, *Web.* et *Mohr.*—Occurs sparingly in a tuft of the following species.

Jungermannia minuta, Crantz.—Common: in compact hard tufts, with a profusion of perianths.

Blepharostoma trichophyllum (L.), Dum.—Occurs sparingly in company with the last species.

On the Prothallus of Lepidodendron Veltheimianum.

By Wm. T. Gordon, M.A., B.Sc. (*Carnegie Research Scholar in Geology, Edinburgh University*). Communicated by the Secretary. (Plate VII.)

In the Carboniferous Epoch the lycopod alliance formed one of the dominant groups of plants, and contained not merely small forms with a habit similar to the modern representatives of the group, but also large arborescent forms. With such great differences in the vegetative parts we should expect corresponding differences in the reproductive strobili which these plants produced. In *Lepidocarpon*, *Miadesmia* and *Spencerites* we see such specialisation in a marked degree, the seed-like form of the first two showing adaptation to drier conditions than lycopods now grow in. Others show a closer approach to *Selaginella* in the organisation of their strobili, though they are still far removed from that genus. In general the sexual processes are the last to be altered by changing conditions, so the gametophyte stage ought to show affinities with modern forms rather than the sporophyte stage. Unfortunately few gametophytes are ever obtained, and so this method of discussing affinities is limited. When, however, the prothallus develops within a spore wall, either permanently or until fertilisation takes place, there is a better chance for its preservation, and in *Lepidodendron Veltheimianum* we get an example of such preservation.

In the Burntisland limestone blocks, strobili of a lycopodiaceous nature occur in fair abundance, but so far none have been met with in actual tissue connection with stems. Professor Williamson referred these strobili to the *Lepidodendron* common in the same blocks (viz. *Lepidodendron Veltheimianum*) on the ground of their association (Williamson, 1872). Messrs. Kidston and Binnie, after research on megaspores occurring in the Carboniferous strata, have come to the same conclusion. The probabilities are, then, that these strobili were the fructifications of *Lepidodendron Veltheimianum*, and as this prothallus is in a megaspore identical with those occurring in the heterosporous strobili mentioned above, I have referred it to that species. The strobili bear microsporangia in the apical part and megasporangia towards the base. The megaspores have a thick reddish-brown coat covered by knobbed spines, while three ear-like lobes of the spore wall can be seen at the apex of the spore. In the specimen figured there are two of the processes referred to, and at these two places the wall shows a certain amount of splitting, so that the protuberances are at least partly due to rupturing of the spore coat to expose the archegonia Most of these megaspores (which occur in great abundance throughout the blocks) have no tissue inside them, and, when we consider how delicate prothalloid tissue is, this is not surprising. Sometimes, however, they are filled with scattered or broken-up cells, and occasionally with a continuous cellular tissue. In the last case it is justifiable to consider it as a prothallus.

In the specimen figured the plane of section is almost radial longitudinal. It passes through the area enclosed by the three lobes, and which is presumably the apex of the megaspore, and there we should expect to see archegonia if they were present. While I cannot definitely say this is the case, there is at least a cap of small-celled tissue comparable with the archegonial tissue of *Selaginella*. Probably the specimen was not quite mature, for there is no distinct gap in the spore wall at the ear-like lobes, and this immaturity may explain the absence of archegonia. The rest of the prothalloid tissue is of larger-celled parenchyma, the line of demarcation being quite distinct though not constituting a diaphragm. This small-celled archegonial tissue at the apex of a larger-celled prothallus is essentially similar in *Selaginella*, while the splitting of the spore coat along three directions is also shown in that genus. Hence the occurrence of similar tissue in similar position in the megaspore of *Lepidodendron Veltheimianum* leads to the conclusion that the prothallus in that species was similar to that in *Selaginella*. As other Carboniferous *Lepidodendra* had probably a similar development, we may safely say that the gametophyte generation in some *Lepidodendra* was similar to that of *Selaginella*.

EXPLANATION OF PLATE VII.

Figure of megaspore containing prothallus. × 48. Gordon collection, No. 158. *a*, *a*, ear-like lobes of spore wall; *b*, cluster of knobbed spines all curled up together; *c*, small-celled archegonial tissue; *d*, large-celled prothalloid tissue on the apex of which *c* is situated.

Dr. A. W. Borthwick showed some Disease-causing Micro-fungi.

Dr. R. Stewart MacDougall showed a section of oak with galleries of *Cossus ligniperda*.

Mr. J. Morrison, M.A., exhibited the fruit of *Cariniana pyriformis*.

Mr. R. L. Harrow showed the following plants in flower from the Royal Botanic Garden:—*Amasonia calycina*, *Bryophyllum crenatum*, *Caladenia carnea*, var. *alba*, *Corylopsis pauciflora*, *Crassula hemisphaerica*, *Dendrobium Cordelia rosea*, *Gomesia foliosa*, *Hakea acicularis*, *Hamamelis arborea*, *H. japonica*, var. *Zuccariniana*, *Iris alata*, *Lindenbergia grandiflora*, *Odontoglossum maculatum*, *Primula* × *digenea*, *P. Palinuri*.

Megaspore of *Lepidodendron Veltheimianum.*

Wm. T. Gordon.

MEETING OF THE SOCIETY,

March 12, 1908.

J. RUTHERFORD HILL, Esq., President, in the Chair.

Mr. J. N. ZUTSHI was elected a Non-Resident Fellow.

The following communication was read:—

LUMINOSITY IN PLANTS. By Miss BERTHA CHANDLER, M.A. Communicated by Dr. A. W. BORTHWICK.

The subject of luminosity in plants is an interesting one, from the very obscurity in which the subject is still wrapped. Comparatively speaking, not much research has been done in connection with the subject, and the cause and significance of this phenomenon in the majority of plants still remains a mystery. Investigations that have been carried out, however, have revealed much that is interesting.

First of all considering the facts, and then the theories, we come first to the occurrence of this phenomenon in the higher plants.

The so-called luminosity of the flowering plants does not really belong to this class of phenomena, but is possibly due to St. Elmo's fire, a species of electrical phenomenon depending on the condition of the atmosphere. But the cases observed were formerly explained as luminosity, and are interesting historically. The daughter of Linnæus is said to have been the first to remark the light issuing from a flowering plant. She noticed luminous radiations being emitted from a group of nasturtiums (*Tropæolum majus*). Other observers, too, have remarked the same phenomenon, and, curiously enough, almost without exception, in yellow, orange, and occasionally in red flowers, such for example as the sunflower (*Helianthus*)—garden marigold (*Calendula*)—two species of *Tagetes*, which the French call Rose d'Inde and Œillet d'Inde. Dr. Phipson has called attention to this curious fact, that in almost all the cases noted of phosphorescence, not only in the plant world, but even in the animal and mineral kingdoms, whether we take into consideration the colour of the light produced or the substance which shines, yellow and orange tints seem to predominate, and appear in some way connected with the phenomenon. Professor Haggern, the Swedish naturalist, studied the question of luminosity in flowering plants very carefully. He observed the phenomenon more or less marked in the common marigold, garden nasturtium, the orange lily, and the French and African marigold. Thinking that the phenomena might be due to phosphorescent insects, he examined the flowers with the microscope, but no such organisms were found. The rapidity of the flash, however, led him to believe that the phenomenon was due to electricity, the pollen, when freed from the anthers, being electrified and then alighting on the petals, from which the light was emitted.

The Swedish botanist, M. Fries, also observed the phenomenon of luminosity in the poppy. Thinking his eyes deceived him, he called others, and without an exception all remarked the phenomenon. One can scarcely believe that the case observed and others similar were optical illusions, as Pfeffer suggests they might have been; but that these phenomena are in some way connected with the condition of the atmosphere and with electricity is undoubted, since all the phenomena observed took place on warm, sultry evenings.

According to Mornay and Martius, the latex of certain *Euphorbias* is phosphorescent. Pfeffer suggests that this is due to oxidatory photo-chemical changes on exposure to the air, or perhaps that the latex is infected with luminous bacteria. Evidently the phenomenon has not been thoroughly worked out, but research in this direction would be interesting.

Another interesting case of luminosity in higher plants is that of the potato. It is said that in a state of decomposition it emits a bright light. The cause is most probably identical with that of luminous decaying wood, the luminosity of which is due to fungi. The fact of the luminosity of decomposing potatoes was remarked by an officer on guard at Strasburg, who thought the barracks were on fire in consequence of the light emitted from a cellar full of potatoes.

Though the facts are interesting, not really much importance can be attached to the so-called luminosity of higher plants. It is among the lower plants, especially among the fungi and bacteria, that the phenomenon is more striking.

A little moss, *Schistostega osmundacea*, the protonema of which gives forth a faint emerald-green light, was supposed formerly to be luminous, but it has since been clearly shown that the phenomenon is one of reflected light. Leaving this plant, therefore, out of the question, also the wonderful iridescence of many sea-weeds, Professor Molisch says that phosphorescence in the plant world may be said to be confined to the fungi—that is to say, bacteria and mycelial fungi.

Let us first consider fungi. Many agarics exhibit the phenomenon of luminosity. *Agaricus melleus* is one which is most commonly met with, perhaps, but there are other species, *e.g.* *A. olearius*, growing at the foot of olive trees in Italy, *A. noctilucens*, *Gardneri*, etc. M. Delille and Fabre and Gardner have studied these agarics in some detail Another fungus which is luminous, common in dark, damp mines, is *Rhizomorpha subterranea*. The effect of the light in the mines is said to be very pretty, but nowhere perhaps is it more beautiful than in the mines of Hesse in N. Germany.

The phosphorescence of decaying wood has been shown to be due to the presence of fungi. Perhaps the latest work in this direction has been done by Professor Molisch of Prague. He also states that he found decaying leaves quite luminous, *e.g.* those of oak and beech The luminosity is not always due to the same cause. There is a byssoid fungus which is said to be commonly found on old willows—*Thelephora cœrulea*, so called from the blue colour of the mature plant. *Xylaria hypoxylon* is also responsible for the phenomenon. Bockman has shown that dampness is necessary for the luminosity of decayed wood, and made many interesting experiments in connection with the subject.

To pass on to the luminosity of bacteria: considerable work has been done in this connection, especially in late years, by Molisch and by Beyerinck. The former has investigated the cause of phosphorescence in fish and meat, and has shown that the phenomenon (which is of so common a household occurrence, though perhaps luminous meat is not so familiar to us as luminous fish) is due to the presence of bacteria, usually *B. phosphoreum*. These phosphorescent bacteria, according to Fischer, are almost exclusively salt-water forms, and hence the readiness with which moist fish become luminous. Professor Molisch induced luminosity in meat by leaving it in a solution of salt in a cool place for a few days. A culture of phosphorescent bacteria can be made in a 2·3 per cent. NaCl solution, besides the ordinary salts and peptone, and also some source of carbon, such as sugar, etc.

The same author in his work on Luminosity, has suggested luminous bacteria as a source of illumination. By inoculating glass flasks containing a suitable culture medium with phosphorescent bacteria, he obtained a "bacterial lamp" with which it was quite possible for an observer at a distance of one or two meters to read a thermometer or see the time of a watch. It has been suggested that such a lamp might be used in a powder magazine, or for attracting fish, as the flask might be sealed up and lowered into the water, since dead luminous flounders have been successfully used by fishermen as bait. Professor Molisch says that to R. Dubois is due the invention of this bacterial lamp.

Beyerinck has done much interesting work in connection with phosphorescent bacteria. He has shown that they can be used as an extremely delicate test for oxygen, in the smallest trace of which these bacteria become phosphorescent. He has also used them for detecting the presence of an enzyme.

Let us now briefly consider the theories that have been suggested as an explanation of the phenomenon of luminosity in plants. That luminosity is in some measure connected with respiration is undoubtedly the case, for, generally speaking, if the oxygen supply be cut off, luminosity ceases. That it does not, however, vary directly with respiration is proved by the fact that respiration increases up to a maximum temperature, whereas luminosity ceases above a rather lower optimum temperature. Massee maintains that luminosity is a specific property of the protoplasm and not simply due to oxidation. There seems, however, far more in favour of Pfeffer's view that certain substances are probably produced during the metabolism, or more especially the respiratory katabolism of the cell, the slow oxidation of which gives rise to light, or whose action on other substances also in the cell, gives rise to light. Luminosity, according to this view, therefore, is a chemical production of light, not a specific property of the living protoplasm. Pfeffer's view is closely allied to Dubois' theory for the luminosity of insects and fishes, though no substances, such as luciferin, and luciferase, which is of the nature of an enzyme, have been isolated in the case of plants, as in the case of *Pholas dactylus*.

Of what significance luminosity is to plants it is difficult to say. It may not be of any direct use, except as a means of getting rid of waste products by burning them, so to speak. But since luminosity in fishes and insects seems to possess a significance it seems natural to search for the same in the plant world. Further research may reveal much, however, that is now incomprehensible.

Mr. JAMES WHYTOCK showed a series of cut flowers from Dalkeith Palace Gardens.

Dr. R. STEWART MACDOUGALL exhibited (1) a section of Pier Prop from Felixstowe ruined by *Teredo*; (2) Branch of apple tunnelled by caterpillar of *Zeuzera æsculi*, with caterpillar *in situ* from Essex.

Dr. A. W. BORTHWICK exhibited a series of specimens of trees and shrubs in various stages.

Mr. R. L. HARROW showed the following plants in flower from the Royal Botanic Garden:—*Corydalis bulbosa*, var. *densiflora*, *Galanthus nivalis*, var. *poculiformis*, *Iris histrioides*, *Iris* × *per-sind*, *Iris* × *sind-per*, *Iris reticulata*, var. *Krelagei*, *Iris sophonensis*, *Primula malacoides*, *Ranunculus Ficaria* (with mottled leaves), *Saxifraga apiculata*, *S. Boydii*, *S. Boydii*, *Faldonside* var., *S. juniperifolia*, *S. oppositifolia*, *S. Paulinæ*, *S. Petraschii*, *S. scardica*.

MEETING OF THE SOCIETY,

April 9, 1908.

J. Rutherford Hill, Esq., President, in the Chair.

The following communications were read:—

Trees on the Dawyck Estate. By W. Balfour Gourlay, B.A. (Plates VIII.–XIII.)

The lands of Dalwick or Dawick were held, from the thirteenth to the end of the seventeenth century, by the Veitches, a Norman-French family. In the year 1296 William le Vache signs the Ragman Roll. The name appears in various subsequent charters, Vache changing to Vaitch and finally to Veitch. By the early part of the fifteenth century the Veitches are a leading county family. They suffered much at the hands of their impetuous neighbours the Tweedies of Drummelzier, the two families living normally in a state of feud.

The Veitches were succeeded by the Naesmyths of Posso, in the Manor Valley—a very old county family. James Naesmyth, familiarly known as the Deil o' Dawick, was a lawyer of considerable means, which enabled him to commence the carrying out of improvements about the house and lands, there being great scope for work in this direction. He died in 1706, and was succeeded by his son Sir James Naesmyth of Posso, the first baronet. Sir James followed his father's profession. Of Dawick in his time Pennecuick writes:—

"It is now (1715) in the hands of Sir James Naesmyth of Posso, an eminent lawyer, who has rebuilt the house and garden, and added some more ornamental planting for the beauty of the place. Here in an old orchard did the herons in my time build their nests upon some large pear-trees, whereupon, in the harvest-time, are to be seen much fruit growing, and trouts and eels crawling down the body of these trees. These fish the herons take out of the river Tweed to their nests; and this is the remarkable riddle that they talk so much of—to have flesh, fish and fruit at the same time upon one tree."

(The herons are still at Dawyck, but nest now in some high beeches.) The planting of trees was not encouraged by the rural population about this time; for Pennecuick writes:—

"There are some amongst them that will not . . . . plant trees or hedges, for wronging the undergrowth, and sheltering the birds of the air to destroy their corn."

The first baronet died in 1720, and was succeeded by his son Sir James (second baronet)—a noted botanist and pupil of Linnæus. To him we owe the introduction to Dawyck of oaks, horse-chestnuts, sycamores, larches, silver firs and other fine trees. He died in 1779, and during the following 120 years Dawick remained with the Naesmyth family.

In the hands of the present owner sylviculture is not being neglected.

For a number of years *Dawyck* has been spelt with a *y*.

Dawyck House stands a little over 600 feet above sea-level, in a part of Tweeddale which is recognised as being one of the coldest regions in Scotland. The annual rainfall is about 42 inches.

The common larch (*Larix europæa*) was introduced into Great Britain at an early date, being first mentioned as a rare tree in Parkinson's *Paradisus* published in 1629. It was not until 1725 that the larch was introduced into Scotland, a number of specimens being raised from seed and planted at Dawyck in that year. The *Dunkeld* larches were not planted till 1738. The surviving larches of 1725 are not as large trees as one might expect, considering their age, but are of weather-beaten appearance.

The silver fir (*Abies pectinata*) grows well at Dawyck. A row of these trees was planted in 1735 at an altitude of 700 feet. A number survive. The roots of others, long since departed, may still be observed. The largest of these trees is 115 feet high and 15 feet 9 inches round the base. From the valley below, the silver firs may be seen towering above the tall beeches of the Upper Terrace—a most impressive spectacle. Many of the branches have a tendency to grow out at right angles to the trunk and then turn up. Such branches are very liable to damage by storm.

Two venerable horse-chestnuts growing near Dawyck House are said to be the first of their species planted in Scotland. These grand old trees are showing signs of decay, and it is fortunate that they stand in a sheltered position. Their leaves change colour very early in the autumn, and present a glorious gradation of reds and yellows, while the younger trees of their kind are still green. The trees were probably planted about 1730. A small stream (the Scrape Burn) flows past the house. On its right bank stood an avenue of horse-chestnuts, of which only a few specimens now remain. Sir Walter Scott used to visit Dawyck to walk down this avenue.

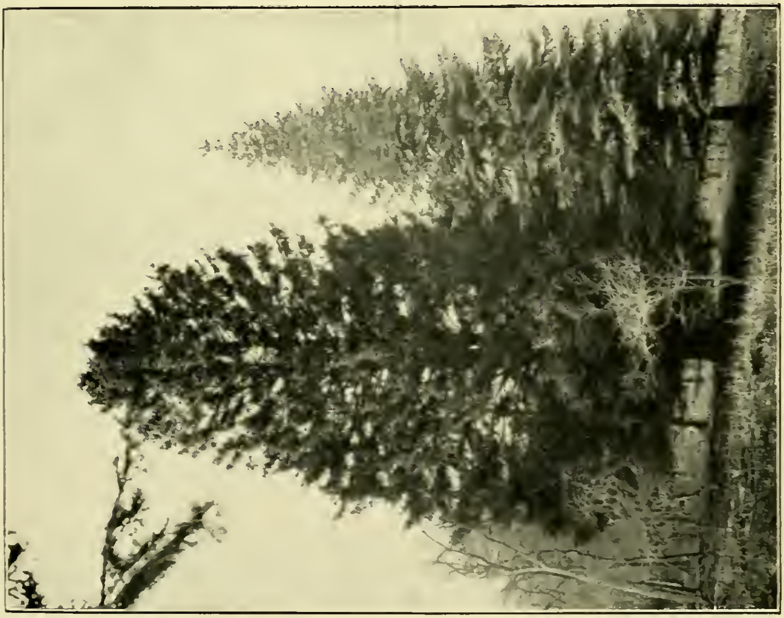
The drive to the old Dawick House still exists as a cart track. A part of it is lined by English elms planted about the middle of the seventeenth century. These, however, are poor trees.

Beech grows well in the valley, but makes slow progress on higher ground. A fastigiate beech near the house is interesting rather than beautiful. A lime avenue dates from about 1730. Oaks, ashes, and sycamores grow to a fair size, but the few Spanish chestnuts are poor trees. There are many fastigiate oaks in the grounds. *Quercus rubra* grows in the park as well as does our native oak, but is apt to be damaged by snow in autumn before the leaves have fallen.

Conifers in great variety grow in the grounds near the house. Among them we find :—the common larch, Douglas fir and Lebanon cedar ; also *Picea excelsa*, *Abies pectinata*, *A. nobilis*, *A. grandis*, *A. concolor*, *A. Nordmanniana*, *A. Pinsapo*, *Picea Menziesii*, *P. nigra*, *Pinus sylvestris*, *P. Laricio*, *P. Cembra* and *P. montana*, Lawson cypress in several varieties, *Thujopsis borealis*, *Sequoia gigantea*, *Araucaria imbricata*, and a number of varieties of yew.

About 1300 acres of land at Dawyck is wooded, but much of this is of little value as timber, being covered with birch and mountain ash. There are some fine larch woods approaching maturity. The young larch plantations are affected by disease, but Japanese larch of ten years old, planted in strips, is healthy and should prove valuable. Douglas fir grows well in sheltered places. Grown among hardwoods, the tops stand out and are apt to be damaged by wind. They should do

Sequoia gigantea.



Picea excelsa and *Abies Nordmanniana.*

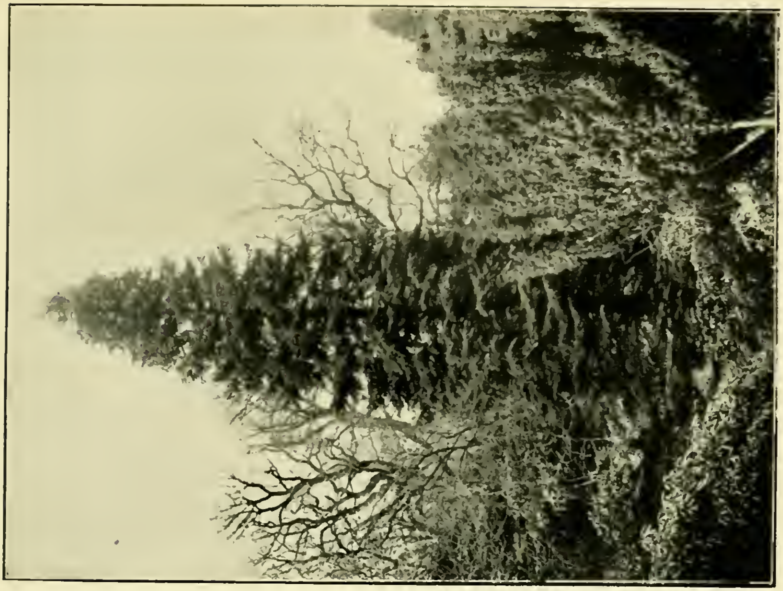
W. Balfour Gourlay.

A.

B.

A.—*Picea nigra* cut down, showing natural layering. B.—*Pinus Cembra.*

W. Balfour Gourlay.

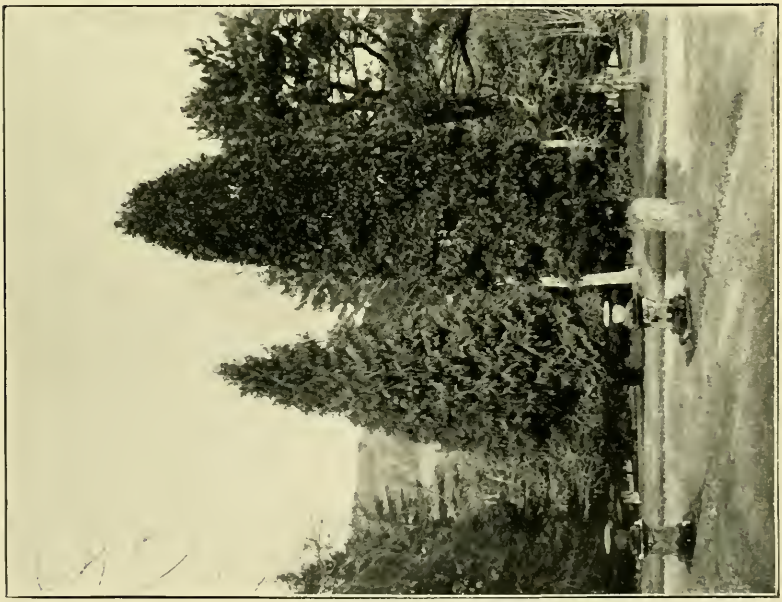


Abies Nordmanniana.

Abies concolor.

W. Balfour Gourlay.

Cupressus Lawsoniana.



Cupressus nootkatensis and *C. Lawsoniana.*

W. Balfour Gourlay.

Larch planted in 1725.

Remnant of an old larch planted 1725.

W. Balfour Gourlay.

Two horse-chestnuts, said to be the first planted in Scotland.

Oak tree near house.

W. Balfour Gourlay.

well grown by themselves. A large Douglas fir of about forty years old has a circumference of 11 ft. 9 ins. five feet above the ground. Scots pine is disappointing. Possibly the soil is too rich. Coming from the high Alps the Cembra pine might be expected to do well, but its growth, except in the grounds near the house, is exceedingly slow and unsatisfactory. The mountain pine grows luxuriantly, but is a useless tree and forms impenetrable thickets. There are several varieties, differing in habit of growth, length and colour of needles

The young plantations of a few years ago consist chiefly of the ordinary European larch, but disease has broken out in places. Japanese larch and Douglas fir have been planted more recently with Menzies spruce in damp places. Experiments are being made with various pines and larches, while *Thuja gigantea*, Lawson cypress and *Thujopsis borealis*, also *Pinus ponderosa*, *P. Murrayana*, *P. resinosa*, *P. monticola*, and *P. densiflora* are to be grown for timber. Of hardwoods which it is hoped may do well as timber trees, *Fraxinus oregona*, *Betula occidentalis*, *Betula lutea* and *Betula papyrifera* are perhaps the most interesting.

Dr. R. Stewart MacDougall showed (1) a fine specimen of fructification of *Merulius lachrymans*; (2) specimens of alder and birch distorted by Honeysuckle; (3) a Lance and Long-Range Jet for Spraying.

The President showed a commercial sample of English-grown Ergot of Rye.

Mr. James Grieve exhibited two Seedling Cypripediums, also specimen of Ash showing natural graft.

Mr. R. L. Harrow showed the following plants in flower from the Royal Botanic Garden:—*Androsace pyrenaica*, *Arabis Billardieri*, var. *rosea*, *Brexia madagascariensis*, *Dendrobium Victoria-Reginæ*, *Draba diversifolia*, *Hæmanthus Cabræ*, *Lobelia affinis*, *Ornithogalum thyrsoides*, *Rhododendron Schlippenbachii*, *Saxifraga Burseriana*, var. *major*, *Saxifraga Ferdinandi-Coburgi*, *Shortia galacifolia*, *Soldanella alpina*, var. *pyrolæfolia*, *Tetratheca pilosa*.

MEETING OF THE SOCIETY,

May 14, 1908.

J. Rutherford Hill, Esq., President, in the Chair.

The following communications were read :—

Cases of Abnormal Germination in Seeds of Peganum Harmala. By J. W. Bews, M.A., B.Sc. (Plate XIV.)

The seeds of *Peganum Harmala* contain a high percentage of two alkaloids, Harmine and Harmaline.

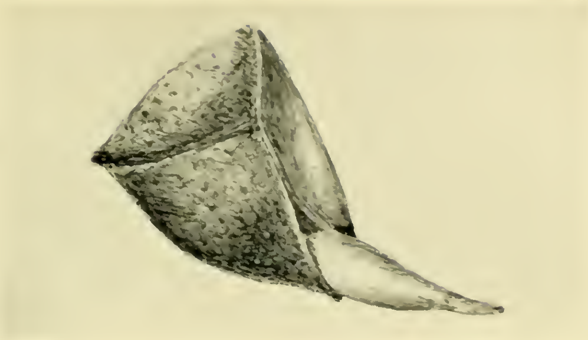
While investigating the behaviour of these alkaloids during germination, I had occasion to germinate large numbers of the seeds. They were germinated under somewhat artificial conditions, being spread out on moist blotting-paper in a germinator which was kept at a temperature of about 30° C.

The seeds of this plant are roughly tetragonal in shape. The seed coat consists of two layers of large cells, and it is in the inner layer of the seed coat that the alkaloids occur.

There is a considerable amount of endosperm in the seed, and in the centre the embryo lies, the cotyledons also being of considerable size. An interesting fact concerning the embryo and endosperm is the peculiar fluorescence shown, especially when the section is mounted in glycerine.

Altogether several thousand seeds were germinated. In the majority of cases they germinated in a perfectly normal way, the radicle appearing first at the micropyle (fig. 1).

In about 4 or 5 per cent. of the cases, however, the cotyledons appeared first at the end opposite the micropyle, having burst their way through the seed coat, leaving the rest of the embryo inside the seed (fig. 2). In these cases the growing radicle must have been unable to force its way through the micropyle and the increasing pressure must have forced the cotyledons through at the other end. In one or two cases, however, it was noted that radicle and coty-



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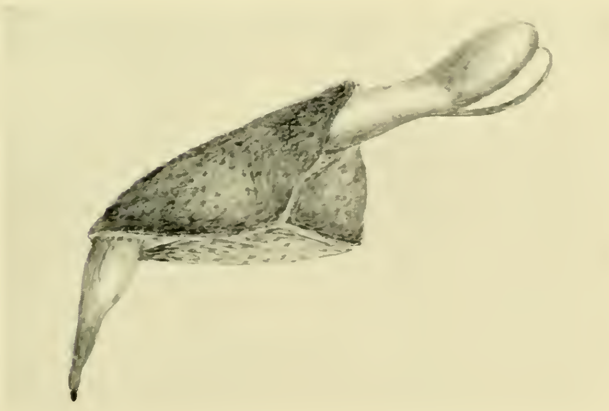

3.

Germination of seeds of *Peganum Harmala*.

Bews.

ledons appeared almost simultaneously, the radicle growing out as usual from the micropyle, the cotyledons appearing at the opposite end (fig. 3).

It must be borne in mind of course that the germination of these seeds took place under perfectly abnormal conditions. It is not at all safe to assume that, if they had been germinated in soil, they would have behaved in this abnormal way. At the same time it is extremely likely that, if they had been germinated in soil, and if these abnormal cases had really occurred under such conditions, they would never have been noticed. It is very improbable that such seedlings could ever become fixed in the soil, or indeed survive long enough for the cotyledons to appear above ground.

The Use of Arsenic in Horticulture. By J. Rutherford Hill, Ph. C.

Recently I was consulted as to what could have caused the death of some domestic fowls on an estate in the south of Scotland. It was complained that the fowls were perfectly well one day and found dead the next without any apparent explanation. On inquiry it was found that the fowls frequented a piece of ground which had been treated with arsenical weedkiller fully six months previously. The weedkiller contained equal quantities of arsenious oxide and sodium hydrate. The weeds were apparently completely killed at the time, but there is now upon the ground a strong and vigorous growth of grasses, mosses, and various weeds.

The season had been unusually wet, and on chemical examination it was found the alkali had been entirely washed away and the soil had resumed its normal faintly acid condition. On looking for arsenic a very different state of affairs was found. A little earth treated with diluted hydrochloric acid gave by Reinsch's, Gutzeit's, and the hydrogen sulphide tests, abundant evidence of arsenic in the soil, and this clearly solved the mystery attending the death of the domestic fowls, who had been picking up gravel from the arsenic-laden pathway.

This example is typical of many similar cases which have come under my notice in different parts of the country, and illustrates one of the dangers attending the use of arsenic in horticulture.

It seems perfectly evident that though the arsenic when put upon the ground is held in solution by the addition of an alkali, it is not washed away as the alkali is, but remains fixed in the soil so as to be dangerous for a lengthened period. In one case hens were poisoned by arsenic from a pathway two years after it had been treated with arsenical weedkiller. I have not definitely ascertained in what form the arsenic exists in the soil. Very possibly the alkaline solution may be neutralised by the humic or other acids in the soil. This particular soil contains a distinct percentage of iron, and there are indications that the arsenic has probably formed a compound with the iron which is insoluble in water. However that may be, the important point is that it is present in quantity sufficient to render it highly dangerous.

Another no less important point is that the presence of the arsenic in such quantity appears to have no effect at all in preventing or retarding the growth of the weeds. From experiments I have made, I find that weeds are speedily and completely killed by watering them with a solution of any alkaline carbonate, chloride, or hydrate. Common salt and washing soda effectually kill weeds. The addition of arsenic does not appear to add any value to the remedy. Certain classes of plants, such as the maritime Chenopodiaceæ, are less easily killed by common salt, and I have been told it is less efficacious in such places as the Orkney and Shetland Islands, where the whole vegetation has become acclimatised to a saline environment.

An aqueous solution of arsenic applied to weeds in dry weather is itself fatal to the exposed parts, but generally fails to kill the roots, and arsenic in the soil does not prevent the growth of plants. Its use in weedkiller seems founded on an impression that it will be more permanent in clearing out weeds than other applications. But arsenic, *per se*, does not appear to have any special virtue, and it is so dangerous to handle that it would be no loss to horticulture and a distinct gain to the community to have its use in this particular form prohibited by some legislation like the Poisoned Flesh and Poisoned Grain Prohibition Acts of 1863 and 1864.

The serious dangers attending the use of arsenic in horticulture have begun to give rise to an important problem in other countries than our own. That this is so is indicated by such statements as the following in *The Lancet* (15th February 1908, p. 527):—

"At a meeting of the Academy of Medicine, Paris, held on 28th January, M. Cazeneuve called the attention of his audience to a situation which has become extremely alarming. Within the last two or three years enormous quantities of arsenic have been used in agricultural operations. The employment of this poison by the vinegrowers is no new thing in France, for it was suggested some twelve years ago as a means of combating insect pests, but its use has greatly increased in recent years. By far the greater part of the arsenic employed comes from a Spanish mining district. In 1901 this district supplied 120 tons of arsenical ores, while in 1905 the quantity necessary for agricultural needs had risen to 4810 tons. Arsenic is not only employed in viticulture but also used for diseases of olives, and various instances of fatal poisoning have occurred in animals that have fed under the olive trees. At the conclusion of his address M. Cazeneuve asked the Academy to point out the dangers which might arise from the indiscriminate use of arsenic."

Enormous quantities of arsenic are used in many countries in connection with fruit-growing and other horticultural and agricultural operations. No one would for a moment object to such uses of a virulent poison if it is indispensable, but there is reason to believe that it is used much too freely and without sufficient discrimination.

The whole question of the uses of arsenic in horticulture is deserving of scientific investigation by someone equipped with adequate botanical and chemical knowledge, and anyone who takes the matter up will render good service to practical agriculturists and horticulturists. I commend this suggestion to the Fellows of this Society.

Mr. W CALDWELL CRAWFORD, M.A., showed a specimen of a Myxomycete, *Reticularia Lycoperdon*, found in a garden at Colinton Road.

Dr. A. W. BORTHWICK exhibited young larch plants attacked by *Hylobius abietis*.

Mr. PETER FENTON showed specimens of *Fontinalis antipyretica* grown indoors and out, and drew attention to its suitability as an aquarium plant.

Mr. FENTON thereafter exhibited a pod of *Afzelia quanzensis* from the vicinity of Victoria Falls, Rhodesia, and a seed of *Phytelephas macrocarpa.*

Mr. R. L. HARROW showed the following plants in flower from the Royal Botanic Garden:—*Arctotis acaulis, Aster Bellidiastrum, Daphne Genkwa, Phlox* × *verna, Polemonium humile*, var. *pulchellum, Primula Forrestii, Pyrethrum Kotschyi, Ranunculus Thora, Saxifraga luteo-viridis.*

MEETING OF THE SOCIETY,

June 11, 1908.

J. Rutherford Hill, Esq., President, in the Chair.

Dr. R. Stewart MacDougall showed specimens of *Testacella haliotidea*, a carnivorous slug from Buckinghamshire. The slugs of the genus *Testacella* can be recognised by their having a rudimentary external shell at the tail end of the foot. *T. haliotidea*, Drap., measures when full grown from 3½ to 4 inches. It lays its eggs singly in the soil. Its food consists of earthworms, millipedes, and other slugs and snails. This species, as well as the other two British species of *Testacella*, is a night feeder.

Dr. MacDougall also showed leaf and bud of vine damaged by *Gryllus domesticus*, the house cricket.

This insect—a dweller near and in the habitations of man—feeds chiefly on sweet stuffs and on moist vegetable matter.

The present case of harm done in a vinery was, as far as he knew, unusual. The crickets were watched and located by lamplight (they hide in the day and come out at night), and the plants (leaf and bud) found next morning with the damage shown in the specimen exhibited.

Mr. James Fraser showed specimens of *Ægilops ventricosa*, Tausch, and *Æ. macrochaeta*, Shuttl. and Huet, found as casuals in the neighbourhood of Edinburgh and not previously recorded for Britain.

Dr. A. W. Borthwick showed plants of *Pseudotsuga Douglasii* attacked by the Pine Weevil (*Hylobius abietis*).

Mr. R. L. Harrow showed a series of plants in flower from the Royal Botanic Garden.

MEETING OF THE SOCIETY.

July 9, 1908.

J. RUTHERFORD HILL, Esq., President, in the Chair.

Mr. CECIL B. CRAMPTON, M.B., C.M., was proposed as a Resident Fellow.

The following communication was read:—

SOME MOSSES AND HEPATICS FROM THE ISLE OF MAY. By WILLIAM EVANS, F.R.S.E.

The object of the present communication is to put on record a few mosses and hepatics which I have at odd times obtained on the Isle of May, at the mouth of the Firth of Forth. The fact of the May being the most seaward as well as the largest of the few islands on the east coast of Scotland, makes it of considerable interest to the biologist, be he botanist or zoologist, and renders a full list of its flora and fauna desirable.

The island has been visited by botanists on various occasions. Patrick Neill landed on it in August 1811, as appears from his note in the "Scots Magazine" at the time. In 1827 Professor J. H. Balfour read a paper on its natural history before the Plinian Society: this paper, I understand, was never published. In the eleventh volume of the "Transactions" of our Society (1873, pp. 390–392) there is a paper by the late John Sadler on the Flora of the Isle of May, in which he gives a list of plants observed there by himself and others on 11th August 1871. Only one moss, however, *Schistidium maritimum*, is recorded; and it is mentioned that "one Jungermanniaceous plant was found but the species remained undetermined." Then, in the Society's "Transactions" for 1884 (Vol. XVI. pp. 115–121) we have a paper by Mr. J. Rattray on the "Phanerogams and Higher Cryptogams" of the island.

The chief feature of this second paper is the list of Algæ. The mosses given are:—*Schistidium maritimum, Orthotrichum* (sp. ?), *Hypnum chrysophyllum*, *H. confertum*, and *H. prælongum*; and there is a solitary liverwort, namely, *Fegatella conica*. A few Fungi, collected on the May last autumn by Misses Baxter and Rintoul, have recently been recorded by Mr. A. B. Steele ("Ann. Scot. Nat. Hist.," 1908, p. 58).

Except for a visit of ten days in September 1885, for the purpose of observing birds on migration, my only opportunities of collecting on the Isle of May have been during the short time allowed on shore from the excursion steamers. On several of these occasions I made a point of securing any Bryophytes that came under my notice, and the specimens thus obtained, together with a few kindly sent to me in April last by Mr. Ross, the lighthouse superintendent, furnish the following list of eighteen mosses and seven hepatics.

Two of the species recorded by Mr. Rattray, namely, *Hypnum* (*Eurhynchium*) *confertum* and *H. chrysophyllum*, have not been met with by me.

Mosses.

Polytrichum juniperinum, Willd.—A few rather small barren plants, April 1908.

Dicranella heteromalla (Dill.), Schimp.—Gathered in September 1885, August 1897, etc. A fine patch, covered with ripe capsules, received from Mr. Ross in April last.

Fissidens viridulus (Swartz), Wahl.—I found a little of this small moss in the barren state on 4th August 1904.

Grimmia maritima, Turn. (*Schistidium maritimum* of the lists of Sadler and Rattray).—Common, and fruiting freely on the low rocks on the east side of the island; September 1879, September 1885, July 1897, etc.

Grimmia Stirtoni, Schimp.—A few small tufts on rocks, 15th July 1897.

Trichostomum flavovirens, Bruch.—September 1885 and August 1897.

Ulota phyllantha, Brid.—In the same situations as *Grimmia maritima*; September 1885 and July 1897: barren as usual. Perhaps this is the *Orthotrichum* referred to in Rattray's list.

Physcomitrium pyriforme (L.), Brid.—A fruiting patch of this moss was found by my father in September 1879, and I gathered it again in September 1885.

Webera nutans (Schreb.), Hedw. ?—A *Webera* coming into fruit, April 1908, is probably this common species, but without fully formed capsules one cannot be quite certain.

Bryum inclinatum (Sw.), Bland. ?—August 1904; "probably *inclinatum*, but impossible to say certainly in absence of fruit" (Dixon, *in lit.*). On other occasions I have gathered a similar plant on the island, but always in the barren state.

Bryum alpinum, Huds.—September 1885, a little, and 15th June 1899; barren. On the latter occasion a pretty form, approaching var. *viride* in the colouring and the lax areolation, was growing in luxuriant cushions around a spring.

Mnium hornum, L.—September 1885, July and September 1897 and April 1908; small, as a rule, and barren.

Brachythecium rutabulum (L.), B. and S.—September 1885 and April 1908; scarce and, like the other *Hypnaceæ*, barren.

Brachythecium velutinum (L.), B. and S.—September 1885 and August 1897, a little.

Eurhynchium prælongum (L.), B. and S. (*Hypnum prælongum* of Rattray's list).—September 1885 and July and August 1897, a small form; April 1908, more luxuriant and better developed.

Eurhynchium myosuroides (L.), Schimp.—September 1885 and April 1908; "a large form approaching my var. *brachythecioides*" (Dixon, *in lit.*).

Hypnum cupressiforme, L.—September 1885 and April 1908; all var. *ericetorum* or near it.

Hylocomium squarrosum (L.), B. and S.—September 1885, a very little.

HEPATICS.

Conocephalum conicum (L.), Dum.—Under the name of *Fegatella conica* this well-known liverwort was recorded from the island by Rattray in 1884, and I observed it there in September 1885; further, Mr. Ross has sent me an ample but barren specimen in April this year.

Lophozia ventricosa (Dicks.), Dum.—There is a specimen of this among my September 1885 gatherings, and it is also among those received in April last.

Cephalozia bicuspidata (L.), Dum.—Specimens of this and the next two species were found growing among *Dicranella heteromalla* and *Mnium hornum* received in April. The *Cephalozia* was in fructification.

Kantia Trichomanis (L.), Gray.—A very little, April 1908.

Lepidozia reptans (L.), Dum.—April 1908.

Frullania Tamarisci (L.), Dum.—Mixed with *Brachythecium rutabulum*, September 1885.

Frullania germana, Tayl.—A good sized specimen gathered in September 1879 is in my herbarium.

The Musci have been submitted to Mr. H. N. Dixon, and the Hepaticæ to Mr. S. M. Macvicar, for whose "Census" the *Frullania germana* has furnished the only record (*v.* c. 85) of the species from the east of Scotland.

The chief points of interest are the occurrence of *Bryum alpinum* and *Frullania germana*, the one being rarely found at a low level in the east of Scotland,[1] and the other what is called an "Atlantic" or west coast species. The record of *Fissidens viridulus*—a little-known plant in this district—and *Grimmia Stirtoni*, are also worthy of notice.

There are, no doubt, more species of Bryophyta than the above to be found on the island, but the conditions evidently do not favour the presence of this form of vegetation. It can hardly be owing to any lack of moisture in the atmosphere, but probably want of shelter, an unsuitable soil, and absence of marshy ground, are among the adverse circumstances. Departure from type, it will be noted, is a feature of several of the mosses obtained, and comparatively few were found in fruit.

Mr. PETER FENTON exhibited a series of fruits and seeds from the Bahamas.

Mr. JAMES FRASER showed living plants of *Carrichtera Vella*, *Polypogon monspeliensis* and *P. maritimus* from Leith Docks.

[1] Howie records *Bryum alpinum* from Norman's Law in Fife, and on this side of the Forth it occurs sparingly on Traprain Law and the Dalmahoy Hills.

Mr. R. L. Harrow showed the following plants in flower from the Royal Botanic Garden: — *Anemone Regeliana*, *Asperula hirta*, *Aster himalaicus*, *Campanula Allionii*, *C. Allionii*, var. *hirsuta*, *Crepis aurea*, *Ixiolirion brachyantherum*, *Myosotis alpestris*, *Primula Bulleyana*, *P. pinnatifida*, *Saxifraga Macnabiana*

Presidential Address, November 1907.

By the kindness of the Assistant Secretary, I am able to submit the following state of the Roll of the Society:—

Honorary Fellows: Royal 1, British 5, Foreign 25. Ordinary Fellows: Resident 108, Non-Resident 43. Corresponding Members 61; Associates 9; Lady Members 6. Total, 258.

During the past year the membership of the Society has been strengthened by the addition of—

Ordinary Fellows: Resident 5. Total, 5.

During the same period 2 Ordinary Fellows have resigned, and we have lost by death:—Ordinary Fellows: Resident 6, Non-Resident 1, Corresponding Members 2. Total, 11.

William Peter Drummond.

William Peter Drummond was the youngest and last surviving son of the well-known seedsman, Peter Drummond of Stirling. He was born at Stirling in 1838. He and his brother George came to Edinburgh and started the business of Drummond Brothers, nurserymen and seedsmen, with a warehouse in George Street and nurseries at Longfield, on ground which has now been feued. He became a Fellow of the Society in 1858. On retiring from business a good many years ago, he went to America, and remained there for some years. Returning to Scotland a few years ago, he resumed attendance at meetings of the Society when health permitted. He died at his residence, 8 Wardie Road, Edinburgh, on 18th December 1906, aged 68 years. He is survived by a widow and a son, Peter E. Drummond, who is a member of the engineering staff at the Gordon Memorial College, Khartoum, Egypt.

William Loudon.

William Loudon was born at Musselburgh in 1830, and educated at Edinburgh Academy and Edinburgh University. In 1854 he went out to India in connection with the Revenue Survey, and in 1860 he was appointed Administrator-General of Bombay, an office which he held till his retiral in 1879, when he came to reside in Edinburgh. He took a great interest in Indian plants, and his beautiful garden on Malabar Hill, Bombay, was well known and greatly admired. He possessed also a fine series of paintings of Indian plants, which he was always delighted to show to his friends. As indicating his keen interest in botany, it may be mentioned that on his return to Edinburgh he attended the lectures of the late Professor Dickson. His connection with the plants of India was curiously illustrated by a query which appeared some time ago in "Notes and Queries" as to the origin of the name "Willie Loudon," which had been applied by the natives to an Indian plant. Sir George Birdwood answered the query by suggesting that probably it had some reference to William Loudon of Bombay. He was also interested in geology. He became a Fellow of the Society in 1889. For some years he had resided at York Road, North Berwick, where he died on 27th January 1907, in his 77th year.

Percival Colin Waite.

Percival Colin Waite, son of Percival John Waite, a London merchant, was born in London in 1859, and was educated at Amesbury in Wilts and at Harrow. A constitutional delicacy, which became apparent while he was a schoolboy, incapacitated him for following any profession. Having attended some lectures on botany by Professor Patrick Geddes at Heriot-Watt College, Edinburgh, he became greatly interested in the study, and took the bronze medal for the year. He then undertook some work at Kew Gardens in photographing plants at the request of Professor Geddes. Thereafter he proceeded to the University of Montpelier in France, where he studied botany under Professor Flahault. After travelling some time abroad he returned to Scotland, and for a few years acted as Demonstrator in Botany under Professor Geddes at University College, Dundee. Here he had as a colleague Dr. A. J. Herbertson of Oxford, and here also he met Dr. Bruce, the Arctic traveller. Through his intimacy with Dr. Herbertson he became greatly interested in meteorology. I am indebted to Dr. Herbertson for the following interesting particulars:—

"In late years Mr. Waite collaborated with me in studies of the rainfall of Australia and of Africa. He had completed tables, which I had begun, of the rainfall of both continents up to 1900, and in the case of Africa even later, as far as the data permitted. The map of Africa, based on this work, was shown at the British Association meeting in South Africa, but it was not published, as we could not get data for the Congo Independent State, although we repeatedly wrote for it. The Australian rainfall results have not been published, because some of the data had not come to hand at the time of his death. I hope to publish the tables, maps, and an account of them in 1909 in our joint names. Mr. Waite was particularly good at tabulating statistics and in discovering irregularities which necessitated more minute inquiry. It will be a very great loss not to have his knowledge to guide me in dealing with the tables he left. What impressed all who were fortunate enough to gain Mr. Waite's friendship was his lovableness, his consideration for others, and his wonderful pluck and patience in doing steady work in spite of his physical weakness. For months his medical adviser would not allow him to do any work at all. But as soon as he received permission to work, even if it were only for an hour a day, he turned to his task again. He was a wonderful example of what can be done by patience and perseverance under very adverse circumstances."

To one of his most intimate friends, Mr. F. J. Wardale of Shrewton, Wilts, I am indebted for the following:—

"Mr. Waite largely assisted Dr. Herbertson in the preliminary investigations for his great work on 'The Distribution of the Rainfall over the Land,' as well as in his preparation of notes for his lectures on his visit to South Africa: and Dr. Buchan in much of the work for the meteorological volume of Bartholomew's 'Physical Atlas.' He also investigated the relations between the Sun-spot Periods and the rise and fall of the Nile, and wrote a monograph on the subject. But perhaps his most important work in this science was done for Dr. H. R. Mill in the preparation of his Annual Rainfall Maps of the British Isles from 1893 to 1905. This work, involving the laying down on the map on a scale of 20 miles to the inch of the records for each year from between 3000 to 4000 stations, exercised to the utmost Mr. Waite's high qualities for such work, and Dr. Mill pays a warm tribute to his care and neatness in 'British Rainfall,' 1906, page 10."

Mr. Waite's intelligence and capacity for careful detail work enabled him to render valuable assistance to Dr. Bruce and Mr. Mossman in tabulating meteorological observations of the Scottish National Antarctic Expedition, and also in working out the results of physical investigations of the sea. His interest in meteorology became greater than his earlier taste for botany, but he continued an active Fellow of the Botanical Society, and was a member of the Council at the time of his death. Of a singularly modest and retiring disposition, he was greatly beloved by those who knew him because of his kindliness and readiness to help in every way to the utmost of his ability. He rendered invaluable service to the Society as a member of the Publication Committee by the assiduity and care with which he supervised the printing of the "Transactions." Though physically weak he was fond of work, and was fully occupied up to the last. After an attack of influenza blood-poisoning supervened, and he died on 13th February 1907, at the early age of 48 years, to the great regret of his many friends.

Sir Thomas Hanbury, K.C.V.O. (The Marquess Hanbury.)

Thomas Hanbury was the third son of Daniel Bell Hanbury, of the firm of Allen & Hanbury, pharmaceutical chemists, London, and was born at Clapham, London, on 21st June 1832. He was educated at the Society of Friends' School at Croydon, and at the age of seventeen entered the office of a firm of tea-brokers in Mincing Lane. At the early age of twenty-one, with three other young men, he founded the firm of Hanbury & Co., East India merchants, at Shanghai, and from 1852 to 1872 he lived the life of a merchant in China, with brief furloughs in 1858 and 1866.

In Shanghai he did valuable work as a member of the Municipal Council, especially in supervising the laying-out and planting of the public gardens and the Bund. He also did great service during the critical period of the Taiping rebellion, and it was said of him that "more than any Englishman of his time he gained the confidence and affection of the Chinese business community." He had in every respect a most successful career, and prospered greatly in business. His residence in China enabled him to be of immense service to botany, and also to pharmacognosy. Being an enthusiastic botanist and very warmly interested in the work of his brother, Daniel Hanbury, he was able to supply him with authentic material for his researches into the botanical sources and natural history of substances used in medicine. During a holiday in Europe in 1867 he visited Mentone with his brother Daniel, and, chancing to visit the promontory of Mortola on the Italian side of the frontier, he was charmed with the horticultural possibilities and natural beauty of the Palazzo Orengo, which stood in ruins among olive groves and vine terraces. He at once purchased the house and grounds, intending, in conjunction with his brother, to lay out a botanic garden for the experimental cultivation of medicinal plants. Owing to Daniel's absorption in other work up to his early death in 1875 this original scheme was never realised, but the gardens of La Mortola, under the care of Sir Thomas Hanbury, became one of the wonders of the world.

In 1868 he married Katharine Adam Pease, daughter of Thomas Pease, of Westbury-on-Trym, Bristol. After two years in Shanghai, where their eldest son was born, they returned finally to Europe, making the Palazzo Orengo their winter home, and ultimately their usual domicile. The garden soon became famous for the luxuriance of its tropical plants and rarities. A catalogue, published in 1889, contains about 3600 species, and that number has been added to by the introduction of further species of scientific or economic value. Sir Thomas Hanbury greatly enriched the botanical collections at Kew by presenting interesting growing plants and seeds. He also sent many specimens to the Museum, and valuable gifts of books and paintings to the Library. He also presented to the Museum of the Pharmaceutical

Society, of which he was an honorary member, the unique collection of "materia medica" gathered by his brother Daniel, and to the Society's Library a valuable set of books relating to them. He was an active member of the Royal Horticultural Society of England, and in 1903 purchased the famous garden, 60 acres in extent, of Mr. G. F. Wilson, at Wisley in Surrey, and presented it to the Society. In the land of his adoption he was greatly beloved and esteemed because of his many benefactions. He founded and maintained schools for boys and girls, built a Botanical Institute and presented it to the University at Genoa, a library for the ancient Approsian Library at Ventimiglia, a hall and library for English winter visitors at Alassio, a drinking-fountain in the town of Mentone in memory of the Queen Victoria Diamond Jubilee in 1897, and provided funds to establish a public garden at Ventimiglia. In recognition of his generous services to Italian education, he was made first a Cavalier, then a Commendatore of the Order of the Crown of Italy, Commendatore of the Order of SS. Maurizio and Lazzaro, and ultimately he was awarded a gold medal as a benefactor of public instruction. In 1901 King Edward created him a Knight Commander of the Royal Victorian Order. Among the many distinguished personages who visited the Palazzo Orengo and its famous garden were Queen Victoria in 1882, the King (then Prince of Wales), along with the Grand Duke Michael of Russia, in 1898, and in the same year her Majesty the Empress Frederick. The Poet Laureate, Sir Alfred Austin, referring to a visit he paid, speaks of the helpful kindliness of Sir Thomas Hanbury and the refined, unostentatious hospitality in which Lady Hanbury assisted him with such quiet and simple graciousness. This was the testimony of all the many visitors to La Mortola. The garden was thrown open two days every week, and often as many as 400 and 500 people would visit it in an afternoon. Visitors were charged an entrance fee, which went to support the hospital at Ventimiglia. Pneumonia, following an attack of influenza, cut him off on 9th March 1907, at the age of 74. He became a Corresponding Member of the Botanical Society in 1902, and was also a Fellow of the Linnean Society. He was a generous friend of the poor, and striking testimony to the general esteem in which he was held was manifested in the concourse of about 7000 people who joined in the funeral procession.

Alexander Buchan, LL.D., F.R.SS. L. and E.

Alexander Buchan was born at Kinnesswood, Kinross-shire, in 1829. From the parish school he came to the Free Church Normal School in Edinburgh, and there and at the University he pursued his studies to qualify for the teaching profession. At the University he took a high place in his classes, and graduated M.A. In 1848 he was appointed schoolmaster at Banchory, and thereafter at Blackford, and lastly at Dunkeld. For twelve years he continued teaching and was very successful, but an affection of the throat became so embarrassing that he had reluctantly to abandon the teaching profession. He had always had a great love for botanical studies, and particularly for field botany, and these he kept up during his residence in the country. This bore fruit in the first paper he contributed to the Botanical Society of Edinburgh, which was a "List of Plants observed in the neighbourhood of Blackford, Perthshire," and is published in the "Transactions" for 1858. In that year he was one of a notable party of botanists who accompanied Professor J. H. Balfour and his students in a famous expedition to the Alps of Switzerland. His love for field botany remained to the end a source of keen enjoyment to him. He had early taken a keen interest in the science of meteorology, and his compulsory retiral from the teaching profession proved the turning-point in what became a highly distinguished career. This happened at a time of great activity and rapid advance in the evolution of the new science of meteorology. In Edinburgh, men like Thomas Stevenson, Milne Home, and Sir Arthur Mitchell had laid the foundation of the Scottish Meteorological Society, which was destined to become a focus for collecting observations from all parts of Scotland and a controlling centre for one of the most completely organised and equipped networks of volunteer meteorological stations to be found in any country. In the year 1860 he abandoned school teaching, and in the same year he was called to Edinburgh as Secretary of the Scottish Meteorological Society, with whose great work his name is so indissolubly associated during the long period of forty-seven years. He possessed a remarkable memory, a marvellous faculty for handling great masses of figures, and a penetrating insight into the meaning and significance of statistical returns collected from widely separated stations. These qualities enabled him to be largely instrumental in securing the general acceptance of Buys Ballot's principle of the relation of wind to air pressure. Variations in atmospheric pressure at given points, and the fact that the direction of the wind was connected with the relative distribution of pressure, were well known before his time, and had been systematised to the extent of definitely marked lines of equal pressure, or "isobars," for several countries. But it required the patience, genius, and rare statistical skill of Alexander Buchan to co-ordinate the enormous masses of statistics gathered together from all parts of the world. This he did in his paper on "The Mean Pressure of the Atmosphere and the Prevailing Winds over the Globe," published in the "Transactions of the Royal Society of Edinburgh" in 1869. To us who are so familiar with the daily results of meteorological observations it is difficult to believe that Alexander Buchan was the first to trace the course of a "depression" across the Atlantic. This gigantic and epoch-making achievement embodied in the previous paper raised him at once to a position of acknowledged pre-eminence as a meteorologist in Europe and America, and he retained this high reputation to the last. It was enhanced by his "Handy Book of Meteorology," published in 1867, and his "Introductory Text-book of Meteorology," in 1871. He was fittingly chosen to examine the meteorological observations of the "Challenger" Expedition, and the results of many years' labour thereon were embodied in the two monographs, "Atmospheric Circulation," published in 1889, and "Oceanic Circulation," in 1895. He was profoundly interested in the high-level meteorological station on Ben Nevis erected by the Royal Societies of London and Edinburgh, and was keenly disappointed when it had to be closed for want of adequate financial support. The study, co-ordination, and elucidation of the accumulated observations at this station occupied most of his time in later years, and had not been completed at the time of his death. He held strongly that these observations were not only of high scientific interest but also of considerable practical utility, and worth all the cost of being continued. The practical value of his meteorological studies was well illustrated in some striking papers on "The Relations of Weather and Health," written in conjunction with Sir Arthur Mitchell. In 1899 Bartholomew published an "Atlas of Pictorial Meteorology," compiled by Dr. Buchan with the assistance of Dr. A. J. Herbertson, and this represents very distinctively the particular form of meteorological research and the method of recording and depicting it with which his name is associated. He was an honorary LL D. of Glasgow University, and it is not easy to understand why his own Alma Mater did not recognise his worth. He was also a Fellow of the Royal Societies of London and Edinburgh, and from 1878 to 1906 he acted as Curator of the Library of the latter. He was also an Honorary Fellow of many British and foreign learned societies. In 1876 he was awarded the Makdougall-Brisbane prize, and in 1893 the Gunning Prize, of the Royal Society of Edinburgh. And in 1902 he was the first to receive the Symons medal of the Royal Meteorological Society of London. In 1864 he became a Fellow of the Botanical Society of Edinburgh, and in 1871 he filled the office of President, giving a Presidential Address on "Climate and Weather in Relation to the Distribution of Plants." For twenty-five years he was a frequent contributor to the Society's proceedings, as will be seen by the following list:—

LIST OF CONTRIBUTIONS TO THE BOTANICAL SOCIETY BY Dr. ALEXANDER BUCHAN, 1858–1883.

"List of Plants observed in the neighbourhood of Blackford, Perthshire." Transactions, vol. v., 1858, p. 162.

"Notice of a Tree found in a Peat Moss in the Island of Shapinshay, Orkney." Transactions, vol. viii., 1866, p. 399.

Presidential Address—"Climate and Weather in Relation to the Distribution of Plants." Transactions, vol. xi., 1873, p. 261.

"On the Practical Application of Meteorology to the Improvement of Climate." Transactions, vol. xi., 1873, p. 85.

"On Seedling Ash Trees Destroyed by Frost." Transactions, vol. xii., 1876, p. 49.

"The Bearing of Meteorological Records on a Supposed Change of Climate in Scotland." Transactions, vol. xii., 1876, p. 280.

"On the Flowering of Spring Plants." Transactions, vol. xii., 1876, p. 441.

Introductory Address as Vice-President in 1876. Transactions, vol. xiii., 1879, p. 1.

"On the Weather of the Winter of 1878–79." Appendix cix. Transactions, vol. xiii., 1879.

"On Low Night Temperatures in Relation to Slight Inequalities of Surface." Transactions, vol. xiii., 1879, p. 48.

"List of Plants for Observing the Influence of the Sea on Vegetation." Transactions, vol. xiii., 1879; Appendix xii.

"Remarks on the Recent Weather." Transactions, vol. xiv., 1883; Appendix lxiii.

Introductory Address as Vice-President, 1881. Transactions, vol. xiv., 1883, p. 263.

"Various Remarks." Transactions, vol xiv., 1883; Appendix xxi., liv., cv.

"The Climate of the Hungarian Mountains in its Relation to the Hungarian Oak." Transactions, vol. xiv., 1883; Appendix cx.

"Obituary Notice of Sir Robert Christison, Bart." Transactions, vol. xiv., 1883.

Mostly all these communications, as will be seen, deal with the relations of his pet study, meteorology, to the science of botany. Dr. Buchan was a man of a singularly unaffected and humble disposition. He was most considerate of others, and always ready to place at their disposal his vast and varied stores of knowledge. His enthusiastic devotion to his work was unabated to the end, when he was attacked by pneumonia and died at the residence of his only son, Dr. A. Hill Buchan, after a few days' illness, on 13th May 1907, exactly seven years after his wife, Sarah, daughter of David Ritchie, Musselburgh, to whom he was married in 1864.

Sir Joseph Fayrer, Bart., K.C.S.I., LL.D., M.D.

Sir Joseph Fayrer, the son of a naval officer, was born at Plymouth on 6th December 1824. His first desire was to be an engineer, and then he thought of the navy, and actually went to sea for a time. Ultimately, however, he resolved to follow the profession of medicine, in which he was destined to earn so much distinction. He studied at the Charing Cross Medical School, London, and graduated M.R.C.S. in 1847. Almost immediately he received a commission in the Royal Navy. He had as a fellow-student Professor Huxley, and it was on the advice of the former that the latter accepted a commission in the Navy, and was appointed to the "Rattlesnake," which had been commissioned to go on an exploring expedition on the coast of Borneo. As is well known, Huxley's experience on this expedition led to the great life-work by which he so enriched biological science and made for himself so illustrious a name. Fayrer had a very remarkable and brilliant career, and his experiences are most interestingly told in his book, "Experiences of my Life," published in 1900. At the outset of his career in the Navy he was present and under fire at the sieges of Palermo and Rome. In 1850 he entered the Bengal Medical Service, and was in active service through the Burmese campaign of 1852. He was political assistant and residency surgeon at Lucknow during the Mutiny, and relates his thrilling experiences at that critical time in the book above mentioned. In somewhat broken health after the Mutiny he returned to England, and came to Edinburgh, where he studied at the University and graduated M.D. in 1859, in which year also he became a non-resident Fellow of the Botanical Society. In August 1858 he was a member, along with Dr. Buchan, of the distinguished company of botanists who accompanied Professor J. H. Balfour and his students to the Alps of Switzerland. Though he was interested in botany, his time was more fully occupied with medical and surgical problems and questions of health and sanitation, and on these topics he published many articles. During his journeys in India he had been deeply impressed by the enormous loss of life caused by the bites of venomous snakes, and this led him to the great work for which he is chiefly remembered in connection with the poisonous snakes of India and the physiological effects of their virus. From 1859–1874 he was Professor of Surgery at the Medical College of Bombay, and accompanied the King, then the Prince of Wales, in his tour through India. Returning to England, he acted as President of the Medical Board of the India Office from 1874–1895, and on his retiral in 1896 he was created a baronet. He was an LL.D. of Edinburgh and St. Andrews, K.C.S.I., and Fellow of many learned societies. He was Honorary Physician to the late Queen Victoria, and Physician Extraordinary to the King. Full of years and honours, which he bore with the most unassuming modesty, he died at his residence, "Belfield," Falmouth, Cornwall, on 21st May 1907, in his 83rd year.

Sir Dietrich Brandis, K.C.I.E., F.R.S.

Dietrich Brandis, the son of Dr. Christian Brandis, Professor of Philosophy in Bonn University, was born at Bonn in April 1824. In his boyhood he accompanied his father to Greece, and remained there for several years. On returning to Germany he was educated at the Universities of Copenhagen, Göttingen, and Bonn, and was appointed Lecturer on Botany at Bonn in 1849. In 1859 he married a daughter of Dr. Marshman of Bengal, father-in-law of General Sir Henry Havelock, and this circumstance opened up for him a highly distinguished career. After the annexation of the province of Pegu, Lower Burma, it became evident to Lord Dalhousie that the wanton destruction of the great teak forests would speedily lead to a complete stoppage of the supply. While he was on the outlook for a suitable man to put in charge of the forests, Sir Henry Havelock suggested his brother-in-law, Dr. Brandis. The outcome was that Brandis reached Calcutta in 1856, and immediately undertook the strenuous but ultimately successfully accomplished task of placing the teak forests under systematic management. The same system was later applied to the teak forests of Upper Burma, so that now the Burmese forests are the chief source of the supply of teak timber for the world, and yield an annual revenue of £200,000. Brandis's next great undertaking was the setting up of the Indian Forest Conservancy Organisation. In early times India appears to have been covered by great forests. For centuries these had been undergoing destruction by the practice of nomadic tribes moving from place to place and firing the forests wherever they went to obtain grass and open places for cultivation. The British occupation immensely accelerated the rate of destruction, and failure to meet the requirements of public works warned administrators that the reckless destruction of trees had been a disastrous mistake. As early as 1855 conservators of forests were appointed in Bombay and Madras, as well as in Burma. In 1862, on the recommendation apparently of a Fellow of this Society and a distinguished pioneer of forest conservancy in India, Dr. Hugh Cleghorn of Stravithie, Lord Dalhousie summoned Dr. Brandis to Simla to consult as to the steps to be taken to more effectually overtake the huge problem with which they were faced. The result was that in 1864 an organised State Department, presided over by Dr. Brandis as Inspector-General of Forests to the Government of India, was established, and a special forest law was passed. There are few things more interesting and instructive than the story of the Indian Forest Department, which has now under administration a forest area of 239,000 square miles, or twice the area of Great Britain and Ireland. The staff consists of 200 English officers and 11,000 native officials, and the revenue has risen from £40,000 in 1864 to £660,000 in 1904. Owing to the unfortunate lack of suitable facilities for practical forestry training in Great Britain, Dr. Brandis obtained permission in 1866 for the training of young British foresters at the French School of Forestry at Nancy and in Germany. In 1885 a British Forest School was instituted at the Royal Indian Engineering College at Coopers Hill, and now there is a forestry school at Oxford. In 1874 Brandis published his "Forest Flora of North-West and Central India," which received the high commendation of Sir Joseph Hooker, and led to Dr. Brandis being elected a Fellow of the Royal Society. He also compiled the first rainfall map of India.

He retired from the Indian Service in 1883, and from 1888 to 1896 superintended the practical instruction of the Coopers Hill forest students in Germany. He also supervised in the same way the forestry training of a number of Americans, who have since established the Government Forest Department which is destined to have a vast influence on forest conservancy in the United States. His services in this connection were specially acknowledged by President Roosevelt, and in a presentation of silver service by the officers of the United States Forestry Department he is spoken of as "the father of forestry in the United States." There can be no doubt it was his privilege to successfully inaugurate the first great scheme of forestry conservancy in the British Empire, and the example is one that might well be followed in all the colonies. It is alleged, for example, that the immense forest wealth of the great Dominion of Canada is in danger of irreparable damage from the reckless destruction of timber trees without any systematic scheme for replanting the depleted areas. With the rapid opening up of the country and the influx of an enormous new population, this danger must inevitably be accentuated. Even in the homeland, experience in India has suggested the desirableness of some such State conservancy, and to-day we see some signs of a practical beginning in that direction. Sir Dietrich Brandis has been a corresponding member of the Botanical Society since 1854, a date prior to his entering on the great work which made him famous. He was made a C.I.E. in 1886, and K.C.I.E in 1887. For eight years before he died he gave himself unremittingly to the production of an exhaustive work, published in 1906, on "The Trees of India," in which he gives detailed descriptions and information regarding the trees, shrubs, woody climbers, bamboos, and palms in the Indian Empire. It has been said that the stimulus of the effort to complete this great task kept him alive, for no sooner had he finished it than he lay down on a sick-bed from which he never rose again. He died at his native town of Bonn on 28th May 1907, at the ripe age of 83 years.

Alexander Somerville, B.Sc., F.L.S.

Alexander Somerville was born at Glasgow in 1842, his father being the well-known Rev. Dr. A. N. Somerville, minister of Anderston Free Church, who became famous because of his great missionary tours to many lands. While still a boy, Alexander Somerville was much interested in entomology, and from the first he was greatly attracted to all branches of natural history. He was educated at Glasgow Academy, and after attending Glasgow University for three years, he entered business and proceeded to Calcutta, where he remained for fifteen years. During this period he seems to have had no leisure to continue the studies and pursuits of his earlier youth. Owing to a breakdown in health he returned to Scotland, and immediately resumed his old pastimes. He also returned to the University, and graduated B.Sc. In his earlier investigations his attention was devoted chiefly to a critical study of the Mollusca of the British Isles, in the course of which he made a most exhaustive examination of the seas and lochs on the West Coast of Scotland from the Clyde area to the Butt of Lewis and Loch Broom. Owing to his expert knowledge of critical species he was appointed one of the referees of the Conchological Society of Great Britain and Ireland for Marine Mollusca. In 1886 he published a "List of British Brachiopoda and Marine Mollusca," which was recognised as the standard by all students till the publication of the Conchological Society's List in 1900.

The work he did in the critical study of the vascular plants of the British Islands, and particularly the topographical distribution of Scottish plants, is of more immediate interest to this Society. To this study he brought all the care and attention to structural detail which he devoted to the Mollusca, and he became a recognised authority in this department, and his opinion was highly valued and frequently sought by workers in the same field, to whom he was at all times most willing to give any help in his power. His topographical researches were chiefly carried on in the West of Scotland, but he visited many other districts where fuller information seemed to be desirable. He spent several weeks in Orkney investigating the flora there. He was for several years President of the Glasgow Natural History Society, three years President of the Conchological Society of Great Britain and Ireland, a strong supporter of the marine station at Millport, and keenly interested in the Scottish Antarctic Expedition. His enthusiasm was contagious; nothing delighted him more than to assist a fellow-worker, and acknowledgments of such help are frequent in scientific publications. The results of his work have been published in the "Transactions of the Glasgow Natural History Society," the "Annals of Scottish Natural History," and the "Journal of the Conchological Society." He became a Fellow of the Linnean Society in 1881, and a Fellow of the Botanical Society of Edinburgh in February 1886, and between 1896 and 1905 made some exceedingly interesting communications to our "Proceedings." These are:—

LIST OF CONTRIBUTIONS TO THE BOTANICAL SOCIETY.

Cystopteris montana in Stirlingshire. Transactions, vol. xx., 1896, p. 285.

Gnaphalium undulatum, Linn., a Cudweed, new to the London Catalogue, from Jersey. Transactions, vol. xx., 1896, p. 345.

Specimen of Goat Moth, Appendix xxxiv. *Carex limosa* and *C. magellanica*, Appendix xxxii. Presentation of Watsonian Vice-Counties, Appendix xxxii. Transactions, vol. xxi., 1900.

Note on the British Distribution of *Glaucium flavum*, Crantz, the Horned Puppy. Transactions, vol. xxii., 1905, p. 13.

Carex divisa, Huds., as a Scottish plant. Transactions, vol. xxii., 1905, p. 305.

On the genus *Polystichum*, Roth (*Aspidium*, Swartz in part), with special reference to *P. angulare*, Presl, and to its distribution in Scotland. Transactions, vol. xxii., 1905, p. 312.

Specimen of *Scirpus triqueter*, Linn., a Bulrush new to the Irish Flora, and discovered in September 1900 by Mr. R. D. O'Brien on the banks of the Shannon, near Limerick. Transactions, vol. xxii., 1905; Appendix iv.

Specimen of *Statice lychnidifolia*, Girard, a Sea Lavendar new to the Channel Islands, and not previously recorded from within the limits of the British Flora. Discovered by Mr. C. R. P. Andrews in Alderney, August 1900. Transactions, vol xxii., 1905; Appendix v.

We had frequent occasion to admire the extreme care with which his herbarium specimens were mounted, a fact which revealed the patient, systematic, and orderly way in which all his investigations were carried out. His kindliness and courtesy endeared him to all, and he impressed us by his unselfish and whole-hearted devotion to furthering the progress of biological science. In a note from Mr. F. C. Crawford, who knew him intimately, he says: "The point that interested him most, and what I shall remember him best by, was his encouragement of young collectors of plants. If I mentioned the name of anyone he was on their track at once. He would write to the young botanists, ask to see their list, and then send them plants. He saw the young collector required encouragement, and he never passed one over. That is where he will be missed, as I know of no one to fill his place in that line. He was of a cheery disposition, and maintained an extensive correspondence with field botanists in all parts of the country."

He has left in manuscript most valuable details of his researches, which are now in possession of his nephew, Rev. G. A. Frank Knight of Perth, by whom, it is understood, they will be published so as to be available for workers in the same field. Latterly failing health prevented Mr. Somerville continuing his excursions, but he still remained keenly interested in the work of others. After some months of suffering he died in Glasgow on 5th June 1907, in his 65th year. He was twice married, and is survived by a widow, two sons, and four daughters.

George Honington Potts.

George Honington Potts was born in London in 1830. He came to Scotland in his youth, and had been in business in Edinburgh as a painter and decorator for many years. He seems to have had a natural taste for the cultivation of plants, and when he lived in Edinburgh, at the end of Potterrow, he grew grapes in his house. Nearly forty years ago he removed to Fettes Mount, Lasswade, Midlothian, where he constructed on a well-watered bank on the east side of the house a rock garden which became famous, and was visited by many botanists and horticulturists. I had the privilege of seeing it in 1872, and again, along with several Fellows and members of the Edinburgh Field Naturalists' Club in 1906, and was struck by the extent to which it had been developed as the years had passed. Mr. Potts had some business relations with Mr. George Maw of Benthall, Kenley, Surrey, the monographer of the genus *Crocus*, and a Fellow of this Society. It was his intercourse with Mr. Maw that induced him to take so much interest in the cultivation of plants. He was specially interested in Saxifrages, Sedums, and Sempervivums, of which he had a large collection. He raised many seedling saxifrages, particularly those of a dwarf habit. One of the best of these was from *Saxifraga muscoides*, and he named it *Saxifraga Lindsayi*, after Mr. Robert Lindsay. His plants were grown all massed together, and though his quick eye often detected a hybrid, he unfortunately was hardly ever able to identify the parents. He became a Fellow of the Society in 1873, and was a frequent exhibitor at the meetings. Some of his more recent exhibits were :—

LIST OF CONTRIBUTIONS TO THE BOTANICAL SOCIETY.

- Specimen of *Saxifraga hypnoides densa* (p. 127).
- Specimen of *Saxifraga Cotyledon* (p. 154).
- Specimen of *Rodgersia podophylla* (p. 154). Transactions, vol. xix., 1893.
- Exhibition of Seedling Saxifrages and Cut Blooms of hybrid Primulas. Transactions, vol. xxi., 1900 ; Appendix vii.
- Exhibition of Saxifrages grown by himself, and of some natural Crosses. Transactions, vol. xxii., 1905 ; Appendix xxvii.

He became a member of the Scottish Alpine Botanical Club in 1876, and during an excursion to Dalwhinnie in

1887 he discovered *Saxifraga aizoides*, var. *aurantiaca*. *Montbretia* or *Tritonia Pottsii*, a South African plant, was found growing in his garden, and he never managed to account for its being there, though it has been suspected that he must have got it from Mr. Maw. It is from this *Montbretia Pottsii* that all the fine and really handsome varieties of *Montbretia* now in cultivation have originated. He raised a very handsome *Dianthus* which is known as "Fettes Mount Pink." During a visit to the Continent about thirty years ago he picked up in Paris a variety of *Sedum brevifolium* which he named *Sedum Pottsii*. He was not a scientific botanist, but an enthusiastic amateur horticulturist with a sharp eye to detect any departure from the normal form in the plants he cultivated. He was a keen angler and chess-player, a genial, good-tempered, and kind-hearted fellow, and an excellent companion on excursions. He died at his residence, Fettes Mount, Lasswade, on 6th June 1907, in his 77th year.

Sir James Hector, M.D., K.C.M.G.

Sir James Hector, F.R.S., F.G.S., F.L.S., was the son of Mr. Alexander Hector, W.S., and was born in Edinburgh in 1834. He was educated at the Edinburgh Academy and the High School. At the age of fourteen years he entered his father's office, and shortly afterwards was apprenticed to the well-known actuary, Mr. James Watson. Having determined to study medicine, he became a student at the University of Edinburgh in 1852, and was a member of Professor J. H. Balfour's class at the Botanic Garden in 1853. He graduated M.D. in 1856. In the following year he was selected by his University for appointment as surgeon and geologist to the Government Expedition under Captain John Palliser to explore the Canadian North-West, which occupied from 1857 to 1860. He received his instructions for this expedition from Sir Roderick Murchison, Director-General of the Geological Survey of Great Britain. The scientific work of the expedition was done chiefly by Sir James, who, with only two companions, took long, arduous journeys on snowshoes in order to collect full information about the country. He penetrated as far as the Rocky

Mountains, where he was the discoverer of five mountain passes, in one of which, Kicking Horse Pass, he was severely kicked in the chest by his horse, and had a narrow escape with his life. This incident is commemorated in the name he gave to the pass. In this expedition his particular department was that of geology, the botany and flora being in the hands of Monsieur Bourgeau, who gathered an immense collection of alpine plants, and whose reports were sent to Sir William Hooker. But in all Hector's geological reports there are most interesting and valuable references to the meteorology and the flora and fauna of the districts explored. His versatility and eminent qualifications for pioneering work are acknowledged by the commander of the expedition, Captain John Palliser, who says in his report to Lord Stanley, M.P., Secretary of State for the Colonies, in October 1858:—

"In addition to being an accomplished naturalist, Dr. Hector is the most accurate mapper of original country I have ever seen, and is now an experienced traveller. By long and severe journeys with dogs and snowshoes last winter, and in connection with his hard trip this autumn, he has laid down the whole north branch of the Saskatchewan, and the south branch from where we met it to the glaciers of its source; and there is no department of the expedition in which he is not competent and willing to assist."

In 1860 he became a non-resident Fellow of the Botanical Society of Edinburgh. He appears to have been attracted to that geologically most interesting land, New Zealand, and in 1863 we find him, in the capacity of geologist to the province of Otago, undertaking an expedition to the then little-known Western Coast of Otago, where he discovered an important low pass through the mountains from the coast at Martin's Bay to Lake Wakatipu. The report of this expedition, published in the "Otago Provincial Government Gazette," and in abstract in the "Journal of the Royal Geographical Society," vol. xxxiv. p. 96, at once drew attention to his eminent fitness to be of service in the development of the colony. Like all his reports, this one is interspersed with valuable and thoroughly scientific observations on the flora and fauna of the regions traversed. In 1865 he was appointed by the Government Director of the Geological

Survey of New Zealand, and occupied this position till his retiral in 1903. His many articles were chiefly published in the "Transactions and Proceedings" of the New Zealand Institute. He was Executive Commissioner for New Zealand to the Sydney International Exhibition of 1879, and in that connection published a handbook of New Zealand, of which a fourth edition was issued in 1886. One chapter of this handbook is devoted to the vegetable and animal products of the islands. In 1889 he edited for a Government Commission an important monograph on the New Zealand flax, *Phormium tenax*, as a fibrous plant, in which the plant, its growth, cultivation, fibre, preparation, properties, and statistics, are exhaustively dealt with.

Sir James Hector was held in high esteem by the public of the colony, and occupied the position of Chancellor of the University of New Zealand. He was made a C.M.G. in 1875, and a K.C.M.G. in 1887. He was also a Fellow of the Royal, the Geological, and the Linnean Societies. In 1868 he married Maria, daughter of Sir D. Munro, M.D. Since 1903 he had lived in retirement at Ratanui, Pentone, Wellington, New Zealand, where he died on 6th November 1907, aged 73 years. His son, Charles Munro Hector of Wellington, graduated at the University of Edinburgh, M.D. with honours in 1898, and B.Sc. in Public Health in 1899.

Afforestation in Scotland.

I have not found it an easy matter to fix on any topic that might appropriately form the subject of a few remarks at the beginning of another session. While looking up some facts in the life-history of Sir Dietrich Brandis I was greatly impressed with the importance and value, from an imperial point of view, of a thoroughly organised and systematic scheme of forest conservancy. It occurred to me that a passing reference to the recent purchase by the Government of the estate of Inverleiver in Argyllshire for purposes of afforestation would be opportune. To the botanist and arboriculturist this is one of the most interesting incidents of the year in Scotland. The necessity for some such step has long been keenly felt, and it has been strenuously advocated by this Society and many other parties for many years.

We shall all, therefore, cordially hail the announcement as the first great step in a national system of afforestation from which results of great value must ultimately be reaped. Immediate results are not to be expected. It is just because work of this nature involves considerable, and probably for a long period unremunerative, expenditure and the financial credit of a State guarantee, that it is essential the experimental work should be undertaken by Government and not by private individuals. The estate extends to some 12,000 acres, but appears to be chiefly unwooded. While it is fitted to be an important object-lesson in many departments of forestry, it nevertheless falls short of what is required in many other respects. It has been pointed out that for adequate forestry demonstration purposes it is essential to have blocks of well-grown timber, and there is nothing of this kind at Inverleiver. The place also is inaccessible from any of the teaching centres. The rainfall of the west coast is normally greatly in excess of the east, and what might suit Inverleiver might be inadvisable in a district with a lower rainfall. While great good would accrue from the systematic afforestation of lands in the Highlands at present yielding probably not more than 3s. per acre, it is pointed out that one great practical problem at the present time is the improvement of existing woods by a scientific system of underplanting. In a valuable letter to the "Scotsman" on 11th November 1907, Lord Balcarres rightly indicates that the treatment and re-stocking of existing woodlands throughout Great Britain, amounting to some 3,000,000 acres, is as great a necessity as the planting of new forests.. It appears to be the general opinion of experienced horticulturists that while the recent purchase is all in the right direction it does not go far enough. I observe with satisfaction that the East of Scotland College of Agriculture has taken steps to acquire an easily accessible piece of wooded land on the Penicuik estate. But it seems to me that to meet the case in a satisfactory manner it ought not to be left to an Institution which, though deserving of all commendation for the energy and success with which it seeks to apply scientific methods to the promotion of the basal industry of the country, can hardly be expected to have the resources necessary to provide a demonstration forest on an adequate scale. We must therefore earnestly hope that the Government will proceed further in the right direction, and that we shall have perhaps a demonstration forest in the South of Scotland where the growth and treatment of hardwoods would receive special attention, and a similar demonstration forest in the Highlands where the growth and treatment of conifers would more fittingly be specialised. Experience in other lands seems to prove that the afforestation of extensive areas in Scotland can be economically carried out. It would incidentally introduce many complementary industries, and might tend largely to solve some of the crying problems associated with rural depopulation and the crowding into cities and towns of the majority of the inhabitants of our land. It has an important bearing also on the pressing problem of coast erosion. What seems desirable is the scientific and systematic application of the advice said to have been given by the old laird to his son: "Be aye stickin' in a tree; it'll be growin' while ye're sleepin'."

Immunity.

Incidentally the projected experimental work at Inverleiver suggests a subject which I had at one time thought of as a suitable topic for an opening address. I refer to the important question of the incidence of disease in plants, and the work that has been done in the direction of selecting individuals that are more or less immune. On the side of what may be called the climatic diseases of plants an important practical question might be the selection of varieties of fruit trees of frost-resisting quality and otherwise adapted to our rigorous Scottish climate. It is perhaps partly the want of such knowledge that accounts for what often seems to me the lesser attention to fruit-growing in Scotland compared to England and other countries In this connection it is interesting to note the work of Dr. William Saunders, who, by crossing the hardier varieties of the apple with the Siberian crab apple, obtained new varieties specially adapted for the higher latitudes of North America. Inverleiver might profitably give opportunity for the practical application of discriminating hybridisation in the production of new varieties of forest trees and of cultivated fruit trees.

At any rate, such work should be undertaken in any national forest department. But a far more important department of plant pathology is that of diseases caused by vegetable or animal parasites, and there will be many opportunities of studying these in a State forest. Any man who could furnish a reliable means of producing a larch tree that would be immune to larch canker would be a national benefactor. In the classic researches of Marshall Ward it was shown that in fungoid diseases of plants the infection or power of resisting infection depends on whether the enzymes and toxins of the attacking fungus were powerful enough to overcome the anti-toxins and other resistant bodies in the plant attacked. By injury or exposure to certain vapours the vitality of otherwise resistant plants may be so reduced as to give the victory to the disease fungus. The growing of great colonies of one plant in crowded areas opens the way to many of the bacterial diseases of which we have the parallel in such diseases of civilisation in man as tuberculosis or cholera. The great problem of plant hygiene, therefore, is to discover those cultural and other conditions which secure races of disease-resisting or immune individuals. To do this and at the same time to secure good cropping varieties, is not always easy. For example, *Vitis riparia* and *Vitis rupestris*, though both resistant to the vine disease, phylloxera, yield very poor grapes. But by crossing *Vitis vinifera*, Millardet with them Mr. Lewton Brain mentions that hybrids have been obtained which resist both phylloxera and mildew. By somewhat similar methods several workers have produced disease-resisting strains of wheat. Of course, when a crop of any kind is attacked, recourse may legitimately be had to any feasible plan for checking the evil. But in this connection I am satisfied that there is far too great a tendency to resort to the indiscriminate use of poisonous insecticides and parasiticides. The use of these powerful substances is always attended with danger, and has, in a large number of cases, led to very disastrous consequences. I am inclined to think their use is unscientific. Instead of a wholesale massacre of the enemy after he has entered the city, it would be more scientific to devise some adequate means for his exclusion, or to surround him with those elements which would render his presence innocuous. There is undoubtedly a great and fruitful field for research on such lines in the department of plant hygiene just as there is in animal hygiene.

Botanical Education.

While looking up the record of some deceased Fellows, I was impressed with the fact that many of the great botanists of the past were members of the medical profession. One cannot but regret that less attention is paid to systematic botany by the medical student of to-day, for many of them receive appointments in foreign lands or distant parts of the empire, and their botanical training fits them to become pioneers of empire and benefactors of science. There is some compensation for this loss in the fact that the value of economic botany and applied science to commercial industries is now more generally recognised, and thus there is no fear of any real diminution in botanical education.

Nature-Knowledge.

Educationists, too, are realising that there has been too much of the mere text-book and the class-room in our system of education in public schools. We must bring the young mind into practical contact with the world of facts in which he lives and moves and has his being. Hence the modern development of nature-teaching. If this is to be properly done it involves a curriculum in biological science for school teachers, and movements are already being made in this direction. There can be little doubt, too, that a taste for botanical studies will be created in the minds of many scholars, and all that must tend to the advantage of botanical science and an increase in the number devoting themselves to its pursuit.

Rural Depopulation and the Housing of the Poor.

One of the greatest and most pressing problems of to-day in Scotland is the depopulation of our rural districts and the massing of the great majority of the people into a few densely crowded areas. The pressure of this problem has given rise to many schemes of social amelioration. One of the most interesting of these to a botanist is that spoken of as the dream of Mr. Ebenezer Howard.

The Garden City.

This modern Utopia, announced only a few years ago, has now taken definite shape as a promising and so far successful object-lesson at the Letchworth estate, near Hitchin, in Hertfordshire. The matter has attracted some attention in Scotland from a proposal to found a second Garden City in connection with the projected Naval Base at Rosyth on the Forth. The object of that movement, which has particular interest for us, is the final clause in the manifesto, namely:—

(*e*) Promoting the erection of sanitary and beautiful dwellings with *adequate space for gardens* and recreation.

Speaking of the problem designed to be solved by the Garden City movement, Earl Grey says:—"What, then, is the evil? It is admitted on all hands that most of the larger cities of England, owing to their ill-regulated and anarchic growth, have become the very cancers of our body politic, and that they are sapping the strength and poisoning the character of the nation. No one who realises that physique and character are the products of environment as well as heredity can fail to regard the suburban excrescences of our smoke-enveloped and air-exhausted towns with feelings short of positive consternation. Streets upon streets of sunless slums with nothing to relieve their squalid and depressing monotony—little provision for recreation beyond that which is supplied by low music-halls and still lower public-houses; boys turned out of school at fourteen years of age, and no organised influence to mould them into honest citizenship at the age at which their characters are most impressionable. These are the evils with which we have to contend, and unless some effective steps are taken to counteract their influence on the character, temperament, and physique of our people, the manhood of our nation must deteriorate, and we shall not be able to retain our present leading position in the world."

Referring to the experience of Mr. Cadbury of Bourneville, he said:—"A worker in the town when he leaves his factory has no place to go to for amusement except the public-house and the music-hall, and his leisure hours are consequently a drain upon his physique and his purse. At Bourneville the artisan finds in his garden that recreation which in the towns he can only obtain in the public-house and the music-hall, with the result that his leisure hours, employed as they are in the cultivation of his garden, add both to his health and the well-being of his family."

Mr. George Cadbury said:—"It is often said that men brought up in towns will not take to a garden. The village of Bourneville is kept entirely independent of the large works adjoining, so that we might try the effects of village life on men who had lived in a town; and it has been truly marvellous to see how men who have been all their lives, perhaps till they were forty or fifty, in a town, take at once kindly to a garden. They seem to enjoy it much more than the country man who has spent all his life in the country. It has been most delightful to see children who have lived all their lives in the great dirty city of Birmingham for the first time see the marvels of Nature: the seed sown in the earth, then—first the blade, and then the ear, and then the full corn in the ear. It is like a miracle to them, and many townsmen make the very best gardeners. I should like you to walk through the streets of Bourneville to-day and see the gardens. Thousands of people come out from Birmingham to see them, and they are kept in many cases by men who have had no education whatever in country life, but nineteen out of twenty of them take to gardening as a duck takes to water. This shows that it is natural for a man to come in contact with the soil."

Mr. W. H. Lever of Port Sunlight fame said:—"He bore testimony, from his experience at Port Sunlight, as Mr. Cadbury had done in respect of Bourneville, to the delight the workpeople took in their gardens. On a late Bank Holiday it was most encouraging to see the bargemen, who were regarded in most places as a rough lot, at work in their gardens with their children round them; as long as they had their gardens to attend to they did not find it necessary to seek amusement away from home."

This scheme opens up a new vista of hope to our teeming millions in great centres of industry, and all lovers of Nature will wish it God-speed.

WHAT ABOUT EDINBURGH?

But what about our ancient cities and towns which cannot be easily adapted to these changed conditions? I will avoid all controversial matter, but one of the admitted difficulties, for example, in the idea of small holdings is that so many town dwellers have lost all taste for country life and ways, and are blind to the beauties of Nature around them. Again, does it not seem mockery to interest a child in plants and flowers who is condemned to live in a house with no garden, and cut off from all opportunity of gratifying the awakened nature-knowledge faculty? I will make bold here to mention a scheme which has been in my mind for many years. We have in Edinburgh itself at this moment two examples of a plan not unlike what I venture to propose.

About 1855 that very remarkable citizen, Mr. John Hope, W.S., conceived the idea of providing small garden plots for respectable working men. He set apart a piece of ground extending to about three acres at the back of Hope Crescent, and stretching from there along to M'Donald Road. This he had laid out in small gardens about 80 or 100 feet square, and separated by hedges. For this work he employed an experienced landscape gardener, Mr. William Gordon, 15 Elm Row, who was retained as superintendent. These he called "The Patriotic Gardens," and they are still in existence. Each tenant pays a rent of from 14s. to £1, 10s. per annum, and holds the tenancy on a fourteen days' notice tenure. One of the conditions is that no alcoholic or excisable liquors are to be brought within the subjects, nor is anyone under the influence thereof to be allowed to enter or remain within the premises. The occupant must cultivate the garden by spade or fork, and the produce is to be for the use of himself and family, and never for sale at a profit. I had the privilege of seeing the gardens two days ago in company with an occupant who is an ironmonger. Born and brought up in Edinburgh, he was totally ignorant of horticulture till he took this garden five years ago. Already he gives evidence of high cultural skill. He has more than forty varieties of chrysanthemum in cultivation, all of which are renewed by cuttings every year. He grows more vegetables of all kinds than he can make use of. In a small greenhouse 12 feet by 7 feet he raised this summer more than 1 cwt. of tomatoes. In another house belonging to a retired working blacksmith I saw some large beautifully-grown chrysanthemums in pots, ready for removal to the Chrysanthemum Show in the Waverley Market. He is a constant prize-taker. Among other owners of gardens I found a retired seaman, a policeman, several postmen, a care-taker, a saddler, a designer, a clothier, a printer, a compositor who has acquired a scientific knowledge of the plants he cultivates, and is a centre of useful information for his neighbours. In one garden, occupied by a collector of taxes, I found a large vinery in which grapes and peaches are grown.

On an adjacent piece of ground there is another series of about twenty similar gardens which were originated about thirty years ago by the late William Young, who was for forty years secretary to the Scottish Horticultural Association. Mr. Young was a shoemaker to trade, but was passionately fond of horticulture, and proved that the maxim "Ne sutor ultra crepidam" is not of universal application. He rented from Messrs. T. Methven & Son a piece of ground behind East London Street, at the east end of Bellevue Park, and laid out a portion of it as small gardens for working men at a rental of £1 each per annum. The area covers about one and a half acres. It is practically a duplicate of the Patriotic Gardens, but not quite so carefully laid out, and the gardens are unhedged. I am informed that there is a keen demand for these garden plots, and more applicants than can be supplied. I cannot detail the many advantages and benefits I was told they secured to the fortunate occupants, whose keen enjoyment of practical gardening was revealed in their smiling faces as I was shown round and introduced to their pet cultures.

It was with genuine regret I learned that the possible purchase of Bellevue Park by the town may result in the disappearance of the East London Street Gardens—surely a very doubtful city improvement. After the death of Mr. Young the gardens were taken over by the Heriot Trust, who seem so far from understanding the spirit of George Heriot, that they are more inclined to create new bursaries by erecting incipient slums than to promote the cause of a Garden City. Whatever happens, let us not reduce but rather expand the area of working-men's garden grounds.

We cannot have all these within the city bounds, but in these days of cheap and easy transit, why should it not be possible to have land sufficiently near the city, say in the direction of Davidson's Mains or Cramond, where every city dweller who has no garden in the town might, if he so wished, have a small plot of land for himself and his family to cultivate? I am persuaded that the idea is practicable, and the results, I feel assured, would bring a vast amelioration of those elements of city life which are the despair of every thoughtful citizen. In the words of Arthur Bennett:—

> "I can see the people crowding from the alleys,
>   And from reeking court and slum,
> To the freshness and the verdure of these valleys—
>   They are singing as they come;
>
> And the nightmare of the old life closes,
>   And the sickness and the heartache melt away,
> As they toil with willing hands amid the roses,
>   Where the rainbow fountains play."

ROLL

OF

THE BOTANICAL SOCIETY OF EDINBURGH.

Corrected to November 1908.

Patron:

HIS MOST GRACIOUS MAJESTY THE KING.

HONORARY FELLOWS.

BRITISH SUBJECTS (LIMITED TO SIX).

Date of Election.

Nov. 1896. BAKER, J. G., F.R.S., F.L.S., 3 *Cumberland Road, Kew.*

Nov. 1888. DYER, Sir WILLIAM TURNER THISELTON, M.A., LL.D., K.C.M.G. C.I.E., F.R.S., *The Ferns, Witcombe, Gloucestershire.*

Dec. 1907. FARMER, J. BRETLAND, M.A., F.R.S., *Professor of Botany, Imperial College of Science and Technology, S. Kensington.*

Jan. 1866. HOOKER, Sir JOSEPH DALTON, M.D., G.C.S.I., C.B., D.C.L. Oxon., LL.D. Cantab., F.R.S., F.L.S., F.G.S., *The Camp, Sunningdale, Berks.*

Mar. 1895. KING, Sir GEORGE, M.B., K.C.I.E., LL.D., F.R.S., F.L.S., *c/o Director, Royal Gardens, Kew*;—*Corresponding Member, April* 1878.

Dec. 1882. OLIVER, DANIEL, LL.D., F.R.S., F.L.S., 10 *Kew Gardens Road, Kew*;—*Non-Resident Fellow, Nov.* 1851.

FOREIGN (LIMITED TO TWENTY-FIVE).

June 1902. BONNIER, GASTON, *Professor of Botany, Paris.*

Mar. 1895. BORNET, Dr. ED., Membre de l'Institut, *Paris*:—*Corresponding Member, June* 1879.

June 1902. BRITTON, NATHANIEL LORD, *Director of the Botanic Garden, New York.*

May 1891. ENGLER, Dr. ADOLF, Geh. Regierungsrath, For.M.L.S., *Professor of Botany in the University, and Director of the Royal Botanic Garden and Museum, Berlin*;—*Corresponding Member, Jan.* 1886.

June 1902. FARLOW, Dr. WILLIAM GILSON, *Professor of Cryptogamic Botany, Harvard, U.S.A.*

Dec. 1892. GOEBEL, Dr. K. F., For.M.L.S., *Professor of Botany in the University, and Director of the Botanic Garden, Münich.*

Nov. 1905. HABERLANDT, Dr. GOTTLIEB, *Professor of Botany in the University, and Director of the Botanic Garden, Graz*;—*Corresponding Member, Jan.* 1886.

Dec. 1885. HILDEBRAND, Dr. F., *Professor of Botany in the University, and Director of the Botanic Garden, Freiburg i. Br.*

Nov. 1905. JANCZEWSKI, RITTER VON GLINKA, Dr. EDUARD, *Professor of Plant Anatomy and Physiology in the University, Cracow*;—*Corresponding Member, Jan.* 1886.

June 1902. LEICHTLIN, MAX, *Baden-Baden*:—*Corresponding Member, Jan.* 1886.

Date of Election.

Mar. 1895. PFEFFER, Dr. WILHELM, Geh. Hofrath, *Professor of Botany, and Director of the Royal Botanic Garden, Leipzig;—Corresponding Member, Jan.* 1886.

Mar. 1895. SARGENT, CHARLES S., *Professor of Arboriculture, and Director of the Arnold Arboretum, Harvard;—Corresponding Member, March* 1878.

Dec. 1885. SCHWENDENER, Dr. S., For.M.L.S., Geh. Regierungsrath, *Professor of Botany in the University, Berlin.*

Dec. 1892. SOLMS-LAUBACH, H. GRAF ZU., For.M.L.S., *Professor of Botany in the University, and Director of the Botanic Garden, Strasburg.*

Nov. 1905. STAHL, Dr. ERNST, *Professor of Botany in the University, and Director of the Botanic Garden, Jena;—Corresponding Member, Mar.* 1895.

Feb. 1876. STRASBURGER, Dr. EDUARD, For.M.R.S., For.M.L.S., Geh. Regierungsrath, *Professor of Botany in the University, and Director of the Botanic Garden, Bonn;—Corresponding Member, Jan.* 1873.

Dec. 1885. TIEGHEM, PHILIPPE VAN, Membre de l'Institut, For.M.L.S., *Professor of Botany, Paris;—Corresponding Member, April* 1877.

June 1902. TIMIRJAZEW, Dr. K. A., *Professor of Botany, Moscow.*

June 1902. TRELEASE, Dr. WILLIAM, *Director of the Botanic Garden, St. Louis, Missouri.*

Mar. 1895. TREUB, Dr. M., *Professor in the School of Agriculture, and Director of the Botanic Garden, Buitenzorg;—Corresponding Member, Jan.* 1886.

June 1902. VÖCHTING, Dr. HERMANN, *Professor of Botany, Tübingen;—Corresponding Member, Mar.* 1895.

Mar. 1895. VRIES, Dr. H. DE, *Professor of Botany in the University, Amsterdam.*

June 1902. WALDHEIM, Dr. ALEXANDER FISCHER VON, *Professor of Botany and Director of the Imperial Botanic Garden, St. Petersburg.*

Dec. 1885. WARMING, Dr. EUGENE, For.M.L.S., *Professor of Botany in the University, and Director of the Botanic Garden, Copenhagen.*

June 1902. WIESNER, Dr. JULIUS, K. k. Hofrath, *Professor of Plant Anatomy and Physiology, Vienna.*

RESIDENT AND NON-RESIDENT FELLOWS.

No distinguishing mark is placed before the name of Resident Fellows who contribute annually and receive Publications.

* *Indicates Resident Fellows who have compounded for Annual Contribution and receive Publications.*

† *Indicates Non-Resident Fellows who have compounded for publications.*

‡ *Indicates Non-Resident Fellows who do not receive Publications.*

Date of Election.

Dec. 1906. Adamson, R. Stephen, B.Sc., 59 *Ladysmith Road.*

Feb. 1905. †Aiken, Rev. J. J. Marshall Lang, B.D., *The Manse, Ayton, Berwickshire.*

Nov. 1884. †Alexander, J. A., 24 *Lawn Crescent, Kew Gardens, London, W.*

April 1902. Alexander, Thomas, 3 *Lovedale Terrace.*

Dec. 1888. †Bailey, Colonel Fred., R.E., 7 *Drummond Place.*

May 1872. *Balfour, I. Bayley, Sc.D., M.D., F.R.S., F.L.S., *King's Botanist, Professor of Botany, and Keeper of the Royal Botanic Garden, Inverleith House.*

Dec. 1863. †Barnes, Henry, M.D., F.R.S.E., 6 *Portland Square, Carlisle.*

Jan. 1905. *Bell, A. C. M., W.S., *East Morningside House.*

Feb. 1857. *Bell, John M., W.S., *East Morningside House.*

May 1891. *Berwick, Thomas, 56 *North Street, St. Andrews.*

Dec. 1907. Bews, J. W., M.A., B.Sc., *Royal Botanic Garden, Edinburgh.*

Dec. 1879. *Bird, George, 33 *Howard Place.*

July 1870. *Black, James Gow, Sc.D., *Professor of Chemistry, University of Otago, New Zealand.*

May 1888. *Bonnar, William, 8 *Spence Street.*

Date of Election.

Jan. 1899. Borthwick, A. W., D.Sc., *Royal Botanic Garden, Edinburgh.*
Dec. 1886. *Bower, F. O., M.A., D.Sc., F.R.S., F.L.S., *Professor of Botany, University of Glasgow*, 1 *St. John's Terrace, Hillhead, Glasgow.*
Jan. 1871. *Boyd, W. B., *of Faldonside, Melrose.*
Feb. 1870. †Bramwell, John M., M.D., 33 *Wimpole Street, London, W.*
Dec. 1890. Brown, Richard, C.A., 23 *St. Andrew Square*,—Treasurer.
Jan. 1902. Bruce, William, B.Sc., *East of Scotland Agricultural College*, 13 *George Square.*
Dec. 1906. Bryce, George, B.Sc., 7 *Shandon Crescent.*
Dec. 1878. *Buchanan, James, *Oswald House, Oswald Road.*
Nov. 1894. Buchan-Hepburn, Bart., Sir A., *Smeaton Hepburn, Prestonkirk.*
Feb. 1882. Caird, Francis M., M.B., C.M., F.R.C.S.Ed., *Professor of Clinical Surgery*, 13 *Charlotte Square*,—Artist.
Nov. 1905. Campbell, Robt., M.A., B.Sc., *Geological Department, University of Edinburgh.*
Dec. 1858. †Carruthers, William, F.R.S., F.L.S., *Central House, Central Hill, London, S.E.*
Dec. 1906. Carter, Humphrey G., *Ramsay Lodge.*
Feb. 1848. Christison, Sir Alexander, Bart., M.D., 40 *Moray Place.*
Mar. 1893. Christison, Lady, 40 *Moray Place.*
April 1848. Christison, David, M.D., 20 *Magdala Crescent.*
June 1873. *Clark, T. Bennet, C.A., *Newmills, Balerno*,—President.
Dec. 1856. †Cleland, John, M.D., F.R.S., *Professor of Anatomy, University of Glasgow.*
May 1861. ‡Coldstream, Wm., B.A., B.Sc., 69 *West Cromwell Road, London, S.W.*
April 1865. †Cooke, M. C., M.A., LL.D., 53 *Castle Road, Kentish Town, London.*
Mar. 1899. *Cowan, Alexander, *Valleyfield, Penicuik.*
Feb. 1870. †Cowan, Charles W., *Dalhousie Castle, Midlothian.*
Jan. 1904. Cowan, M'Taggart, jun., 33 *Drummond Place.*
Mar. 1903. Cowie, William Beaverley, 26 *Clyde Street.*
Dec. 1866. *Craig, Wm., M.D., F.R.C.S.Ed., F.R.S.E., 71 *Bruntsfield Place*,—Honorary Secretary.
Nov. 1908. Crampton, Cecil B., M.B., C.M., *H.M. Geological Survey*, 33 *George Square.*
Feb. 1874. †Crawford, William Caldwell, M.A., 1 *Lockharton Gardens, Colinton Road*,—Honorary Curator.
Nov. 1881. Croom, Sir J. Halliday, M.D., F.R.C.S.Ed., F.R.C.P.Ed., 25 *Charlotte Square.*
Dec. 1902. Cullen, W. J., 10 *Darnaway Street.*
Dec. 1903. Davidson, J. Randolph, M.A., B.Sc., *Schoolhouse, Camelon.*
July 1871. *Davies, Arthur E., Ph.D., F.L.S., *Tweed Bank, West Savile Road.*
Dec. 1892. Day, T. Cuthbert, 36 *Hillside Crescent.*
Jan. 1894. *Dowell, Mrs. A., 13 *Palmerston Place.*
Dec. 1859. †Duckworth, Sir Dyce, M.D., LL.D., 28 *Grosvenor Place, London, S.W.*
Dec. 1865. *Duncanson, J. J. Kirk, M.D., F.R.S.E., 22 *Drumsheugh Gardens.*
Dec. 1869. †Duthie, J. F., B.A., F.L.S., *c/o The Manager, Delhi & London Bank, Ltd.*, 123 *Bishopsgate Street Within, London, E.C.*
Nov. 1885. Elliot, G. F. Scott, M.A., B.Sc., F.L.S., *Newton, Dumfries.*
Feb. 1905. Essed, Eduard, B.Sc., *Forest Botanist to the Government of Dutch Guiana.*
Jan. 1883. *Evans, Arthur H., M.A., 9 *Harvey Road, Cambridge.*
Dec. 1905. *Evans, W. Edgar, B.Sc., 38 *Morningside Park.*
Mar. 1890. Ewart, J. Cossar, M.D., F.R.SS. L. & E., *Professor of Natural History, University of Edinburgh.*
Feb. 1908. Fenton, Peter, 180 *West Regent Street, Glasgow.*
Feb. 1894. Ferguson, R. C. Munro, M.P., *of Raith and Novar, Kirkcaldy.*
Nov. 1861. †Foggo, R. G., 2 *Western Terrace, Murrayfield.*
July 1860. †Fox, Charles H., M.D., 35 *Heriot Row.*
Feb. 1873. *France, Charles S., 13 *Cairnfield Place, Aberdeen.*
Jan. 1906. *Fraser, James, 18 *Park Road, Leith.*
July 1872. *Fraser, John, M.B., C.M., 13 *Heriot Row.*
Dec. 1865. †Fraser, John, M.A., M.D., *Chapel Ash, Wolverhampton.*
Jan. 1903. Fraser, J. C., *Comely Bank Nurseries.*
Mar. 1862. Fraser, Sir Thomas R., M.D., F.R.S., *Professor of Materia Medica*, 13 *Drumsheugh Gardens.*

Date of Election

Mar. 1871. *Gamble, James Sykes, M.A., F.L.S., *High Field, East Liss, Hants.*
Jan. 1881. Geddes, Patrick, F.R.S.E., *Professor of Botany, University College, Dundee.*
May 1874. ‡Geikie, Sir Archibald, LL.D., F.R.SS. L. & E., *Shepherd's Down, Haslemere, Surrey.*
Feb. 1895. Gibb, W. Oliphant, 21 *Royal Terrace.*
Jan. 1887. *Gibson, A. H., 28 *Dalhousie Terrace.*
May 1903. ‡Gilmore, Owen, L.R.C.P., L.R.C.S.E., 49 *Acre Lane, Brixton, London, S. W.*
Dec. 1907. Gourlay, W. Balfour, B.A., 4 *Coates Crescent.*
Jan. 1889. *Grieve, James, *Redbraes Nurseries.*
Dec. 1895. *Grieve, Sommerville, 21 *Queen's Crescent.*
Feb. 1879. *Grieve, Symington, 11 *Lauder Road.*
June 1862. †Haynes, Stanley Lewis, M.D., *Medhurst, Malvern, Worcestershire.*
April 1886. Hill, J. Rutherford, *Secretary, Pharmaceutical Society, York Place.*
May 1867. *Hog, Thomas Alex., *of Newliston, Kirkliston.*
Feb. 1878. †Holmes, E. M., F.L.S., F.R.H.S., *Curator of Museum, Phar. Soc. of Great Britain, Ruthven, Sevenoaks, Kent.*
Dec. 1906. Hunter, John, 39 *Park Road, Trinity.*
July 1905. Inch, John, jun., *Howburn, Biggar.*
Feb. 1891. ‡Jamieson, Thomas, 10 *Belmont Street, Aberdeen.*
Dec. 1907. *Jeffrey, J. Frederick, *Royal Botanic Garden, Edinburgh,*—ASSISTANT SECRETARY.
Mar. 1905. †Joannides, Pericles, B.Sc., *Sporting Club, Ibrahimieh, Alexandria, Egypt.*
May 1877. *Johnston, Henry Halcro, C.B., D.Sc., M.D., F.L.S., *Lieutenant-Colonel R.A.M.C., Orphir House, Orphir, Kirkwall.*
Nov. 1877. Kerr, John Graham, F.R.S.E., *Professor of Zoology, Glasgow University.*
Jan. 1874. *Kirk, Robert, M.D., F.R.C.S. Ed., *Bathgate.*
Feb. 1888. ‡Learmonth, Wm., *Fleetview, Gatehouse of Fleet.*
Feb. 1878. ‡Lennox, David, M.D., F.C.S., *Tayside House, Nethergate, Dundee.*
April 1883. Lindsay, Robert, *Kaimes Lodge, Murrayfield;—Associate, July* 1879.
Jan. 1869. †Livesay, William, M.D., *Sandrock Spring, Chale, Isle of Wight.*
Feb. 1863. †Lowe, George May, M.D., F.R.C.P., *Crescent House, Ryde, Isle of Wight.*
Jan. 1895. MacDougall, R. Stewart, M.A., D.Sc., 13 *Archibald Place.*
Jan. 1881. †Macfarlane, John M., Sc.D., F.R.S.E., *Professor of Botany, University of Philadelphia, U.S.A.*
Dec. 1906. M'Cutcheon, Alexr., 2 *Marchmont Street.*
Feb. 1886. M'Glashan, D., 11 *Corrennie Gardens.*
June 1880. *M'Intosh, W. C., M.D., LL.D., F.R.SS. L. & E., F.L.S., *Professor of Natural History, St Andrews.*
Feb. 1902. Mackenzie, D. F., *Estate Office, Mortonhall.*
June 1850. M'Laren, Hon. Lord, 46 *Moray Place.*
Feb. 1882. M'Murtrie, Rev. John, M.A., D.D., 13 *Inverleith Place.*
June 1897. †Macvicar, Symers M., *Invermoidart, Acharacle, Fort-William.*
Dec. 1896. Mahalanobis, S. C., B.Sc., F.R.S.E., *Presidency College, Calcutta.*
Jan. 1902. Massie, William Hall, *Redbraes House.*
Dec. 1872. †Maw, George, F.L.S., F.G.S., *Benthall, Kenley, Surrey.*
Feb. 1890. *Millar, R. C., C.A., 6 *Regent Terrace,*—AUDITOR.
Mar. 1883. Milne, Alex., 32 *Hanover Street.*
May 1874. Mitchell, Rev. Dr., 14 *Abercromby Place.*
Jan. 1899. Morton, Alex., B.Sc., 21 *Woodburn Terrace.*
July 1878. †Muirhead, George, F.R.S.E., *Gordon Estates Office, Fochabers.*
Dec. 1878. *Norman, Commander Francis M., R.N., *Cheriot House, Berwick-on-Tweed.*
Dec. 1907. †Orr, Matt. Y., B.Sc., *University College, Cardiff.*
April 1883. *Paul, Rev. David, M.A., LL.D., *Carridale, Fountainhall Road,*—FOREIGN SECRETARY.
Dec. 1907. Pearson, A. L., M.A., B.Sc., 50 *Albany Street, Leith.*
Mar. 1874. ‡Pettigrew, J. B., M.D., LL.D., F.R.SS. L. & E., *Professor of Medicine, St Andrews.*

Date of Election.

April 1887. Peyton, Rev. W. W., *Woodgate, Tan-y-Bryn Road, Llandudno, Wales.*
June 1891. †Prain, David, Lieut.-Col., M.D., C.I.E., F.R.SS. L. & E., F.L.S., *Royal Botanic Gardens, Kew.*
June 1893. ‡Pullar, Sir Robert, J.P., F.R.S.E., *Tayside, Perth.*
Dec. 1858. †Ramsbotham, S. H., M.D., *Fairstead, Ripon Road, Harrogate.*
July 1884. *Rattray, John, M.A., B.Sc., F.R.S.E., *Tullyburn Terrace, Glasgow Road, Perth.*
Jan. 1878. *Reid, Jas. R., C.M.G., 11 *Magdala Crescent.*
April 1877. ‡Riddell, Wm. R., B.A., B.Sc. (Hon. Mr Justice), *Osgood Hall, Toronto, Canada.*
Dec. 1869. *Robertson, A. Milne, M.B., C.M., *Hawea, Rodway Road, Roehampton, London, S.W.*
Dec. 1890. Robertson, Robert A., M.A., B.Sc., *Lecturer on Botany, Botanical Department, Bute Medical School, St. Andrews.*
Feb. 1905. *Ross, A. J., M.A., B.Sc., 177 *Dalkeith Road.*
June 1898. Russell, Dr., *Cadham, Markinch.*
Mar. 1902. Sampson, Hugh C., B.Sc., *P.O. Box 855, Pretoria, South Africa.*
Jan. 1906. †Sanderson, Harry, *Eastmount, Galashiels.*
Dec. 1907. Scarth, Geo. W., M.A., *Royal Botanic Garden, Edinburgh.*
Dec. 1887. ‡Scott, J. S., L.S.A., 69 *Clowes Street, West Gorton, Manchester.*
Feb. 1905. Scott, Leonard C., 6 *Leopold Place.*
Feb. 1891. Smith, J. Pentland, M.A., B.Sc., 21 *Oakshaw, Paisley.*
Jan. 1902. *Smith, W. W., M.A., *Royal Botanic Garden, Calcutta.*
Jan. 1890. *Somerville, William, Œc.D., B.Sc., F.R.S.E., *Sibthorpian Professor of Rural Economy,* 121 *Banbury Road, Oxford.*
July 1853. ‡Southwell, Thos., F.Z.S., 10 *The Crescent, Norwich.*
June 1874. Sprague, Thomas Bond, M.A., LL.D., F.R.S.E., 29 *Buckingham Terrace.*
Nov. 1883. †Stabler, George, *Levens, Milnthorpe, Westmoreland.*
Dec. 1892. Stewart, Robert, S.S.C., 7 *East Claremont Street.*
Feb. 1902. Tagg, Harry F., F.L.S., *Royal Botanic Garden, Edinburgh.*
Dec. 1887. Terras, J. A., B.Sc., 40 *Findhorn Place.*
Jan. 1908. Thomson, D. W., 113 *George Street.*
May 1888. *Trail, J. W. H., M.A., M.D., F.R.S., F.L.S., *Professor of Botany, Aberdeen.*
Dec. 1888. Turnbull, Robert, B.Sc., *Board of Agriculture, 4 Upper Merrion Street, Dublin.*
July 1886. †Waddell, Alexander, *of Palace, Jedburgh.*
Dec. 1905. Waterston, Rev. James, B.D., B.Sc., 9 *Woodburn Terrace.*
July 1884. Watson, William, M.D., *The Lea, Corstorphine.*
Feb. 1901. Whytock, James, *Dalkeith Gardens, Dalkeith.*
Dec. 1890. *Wilson, John H., D.Sc., F.R.S.E., *Greenside Place, St. Andrews;—Associate, Nov. 1886.*
May 1863. †Yellowlees, David, M.D., LL.D., 6 *Albert Gate, Dowanhill, Glasgow.*
Jan. 1903. Young, William, *Fairview, Kirkcaldy.*
Mar. 1908. ‡Zutshi, J. N., F.R.H.S., *Assistant Conservator of Forests, Goona, India.*

CORRESPONDING MEMBERS.

Dec. 1905. Adamovic, Lujo, *Professor of Botany, and Director of the Botanic Garden, Belgrade.*
Jan. 1878. Areschoug, Dr. Fredrik Wilhelm Christian, *Emeritus Professor of Botany in the University, Lund.*
Jan. 1878. Ascherson, Dr. Paul, *Royal Herbarium, Berlin.*
Dec. 1905. Bailey, Fredk. Manson, F.L.S., *Colonial Botanist of Queensland, Brisbane.*
Dec. 1905. Barboza, J. Casimiro, *Director of the Botanic Garden, Oporto.*
Dec. 1905. Beijerinck, M. W., *Professor of Bacteriology, Delft.*
Dec. 1881. Bohnensieg, Dr. G. C. W., *Conservator of the Library of the Museum Teyler, Haarlem.*
Dec. 1905. Bolus, Harry, F.L.S., *Cape Town.*
Mar. 1895. Brefeld, Dr. Oscar, Geheimrath Regierungsrath, *Professor of Botany in the University, Breslau.*

Date of Election.

Mar. 1881. Caminhoá, Dr. Joaquim Monteira, *Rio de Janeiro.*
Dec. 1905. Campbell, Dr. Douglas Houghton, *Professor of Botany, Stanford University, California.*
Jan. 1866. Candolle, Casimir de, *Geneva.*
July 1879. Cheeseman, T. F., F.L.S., F.Z.S., *Curator of the Museum, Auckland, New Zealand.*
July 1879. Cleave, Rev. W. O., LL.D., *College House, St. Helier, Jersey.*
Dec. 1905. Cockayne, L., *Ollivier's Road, Christchurch, New Zealand.*
June 1902. Constantin, Dr. J., *Director, Jardin des Plantes, Paris.*
Dec. 1905. Coulter, John Merle, *Professor of Botany, University of Chicago.*
June 1902. Cramer, Dr. Carl Eduard, *Professor of Botany, Zürich.*
Jan. 1878. Eeden, Frederik William van, *Director of the Colonial Museum, Haarlem.*
Mar. 1895. Elfving, Dr. Fredrik, *Professor of Botany in the University, and Director of the Botanic Garden, Helsingfors.*
Dec. 1905. Famintzin, Dr André, *Emeritus Professor of Botany and Director of the Botanical Laboratory of the Imperial Academy of Sciences, St Petersburg.*
Dec. 1905. Fawcett, William, B.Sc., F.L.S., 76 *Shooter's Hill Road, Blackheath, London, S.E.*
Dec. 1905. Flahault, Dr. Charles, *Professor and Director of the Botanical Institute, Montpellier.*
Dec. 1905. Foslie, M., *Curator of the Botanical Department of the Museum, Trondhjem.*
Dec. 1905. Fries, Dr. Theodor Magnus, *Emeritus Professor of Botany at the University, Upsala.*
Dec. 1905. Gravis, Auguste, *Professor at the University and Director of the Botanic Garden, Liége.*
Mar. 1895. Guignard, Léon, Membre de l'Institut, *Professor of Botany, Paris.*
Dec. 1887. Hansen, Dr. Emil Christen, *Director of the Physiological Department of the Carlsberg Laboratory, Copenhagen.*
Dec. 1905. Heinricher, Dr. Emil, *Professor of Botany and Director of the Botanic Garden, Innsbruck.*
May 1891. Henry, Augustine, M.D., *Lecturer on Forestry in the University, Cambridge.*
June 1902. Henriques, Julio A., *Professor of Botany in the University, and Director of the Botanic Garden, Coimbra.*
Dec. 1905. Kjellman, Dr. Frans, *Professor of Botany in the University, and Director of the Botanic Garden, Upsala.*
Jan. 1886. Luerssen, Dr. Christian, *Professor of Botany in the University, and Director of the Botanic Garden, Königsberg.*
June 1902. MacMillan, Conway, *Minnesota.*
Dec. 1905. Macoun, John, M.A., F.L.S., *Dominion Botanist on the Geological Survey, Ottawa.*
June 1902. Maiden, J. H., *Director of the Botanic Garden, Sydney, N.S.W.*
Dec. 1905. Mattirolo, Dr. Oreste, *Professor of Botany in the University, and Director of the Botanic Garden, Torino, Piedmont.*
June 1902. Miyoshi, Manabu, *Professor of Botany in the Imperial University, Tokio.*
Jan. 1873. Millardet, Dr. Alexis, *Professor of Botany in the Faculty of Sciences, Bordeaux.*
Dec. 1905. Miyabe, Dr. Kingo, *Professor of Botany, and Director of the Botanic Garden, Sapporo, Hokkaido, Japan.*
Dec. 1868. Radlkofer, Dr. Ludwig, *Professor of Botany in the University of Münich.*
June 1902. Raunkiär, Christen, *Assistant in the Botanic Garden, Copenhagen.*
Mar. 1881. Rodrigues, Dr. Joas Barbosa, *Director of the Botanic Garden, Rio Janeiro.*
Dec. 1905. Rodway, Leonard, *Government Botanist of Tasmania, Hobart.*
Dec. 1905. Schröter, Dr. Carl, *Professor of Botany, and Director of the Botanical Museum, Zürich.*
Feb. 1876. Sodiro, Luis, *Professor of Botany in the University, Quito, Ecuador.*
Nov. 1888. Scully, W. C., F.L.S., *Cape Town.*
May 1876. Terracciano, Dr. Nicolao, *Director of the Royal Gardens, Caserta, Campania.*
June 1902. Tubeuf, Dr. Carl Freiherr von, Regierungsrath, *Münich.*
Nov. 1888. Tyson, W., *Cape Town.*

Date of Election.

Dec. 1905. Velenovský, Josef, *Professor of Systematic Botany in the Imperial University of Bohemia, Prague.*
Dec. 1905. Vladescu, Dr. Mihail, *Professor of Botany at the University, and Director of the Botanic Garden, Bukarest.*
June 1902. Wettstein, Dr. Richard, Ritter von Westersheim, *Professor of Systematic Botany, and Director of the Botanic Garden and Museum, University, Vienna.*
Dec. 1887. Wildpret, H., *Director of the Botanic Garden, Orotava.*
June 1902. Wille, Dr. Johan Nordal Fischer, *Professor in the University, and Director of the Botanic Garden, Christiania.*
June 1902. Wood, John Medley, A.L.S., *Curator of the Botanic Garden, Durban, Natal.*

ASSOCIATES.

Mar. 1886. Bennett, A., 143 *High Street, Croydon.*
Feb. 1876. Campbell, A., 62 *Marchmont Road.*
Feb. 1871. Evans, William, 38 *Morningside Park.*
April 1906. Fish, D. S., *Secretary, Horticultural Society, Alexandria, Egypt.*
Jan. 1906. Harrow, R. L., *Royal Botanic Garden, Edinburgh.*
Mar. 1886. Landsborough, Rev. D., LL.D., *Kilmarnock.*
June 1891. McAndrew, James, 69 *Spottiswoode Street.*
Dec. 1883. Richardson, Adam D., 6 *Dalkeith Street, Joppa.*
Jan. 1906. Stewart, L., 28 *Rodney Street.*

LADY MEMBERS.

June 1893. Aitken, Mrs. A. P., 38 *Garscube Terrace, Murrayfield.*
April 1893. Balfour, Mrs. Bayley, *Inverleith House.*
April 1902. Grieve, Mrs. Symington, 11 *Lauder Road.*
Feb. 1908. Hayward, Miss Ida M., 7 *Abbotsford Road, Galashiels.*
Mar. 1904. Maxwell, Mrs., *Bangholm Bower, Goldenacre.*
Jan. 1894. Pearson, Miss C. C., 27 *Royal Terrace.*

THE SOCIETY EXCHANGES PUBLICATIONS WITH—

AMERICA.

CANADA.

Disko, Greenland,	Den Danske Arktiske Station.
Halifax, . . .	Department of Agriculture.
	Nova Scotian Institute of Natural Science.
Montreal. . .	Horticultural Society.
	Natural History Society.
Ottawa, . . .	Geological and Natural History Survey of Canada.
	Department of Agriculture.
Toronto. . . .	Canadian Institute.

COSTA RICA.

San José. . .	Instituto Nacional.

MEXICO.

Escuintla, Chiapas,	Director, La Zacualpa Botanical Station.

UNITED STATES.

Ames, Iowa, .	Department of Agriculture.
Auburn, Ala., .	Department of Agriculture.
Austin, Texas. .	Agricultural Experiment Station.
Boston, Mass., .	Massachusetts Horticultural Society.
	Society of Natural History.
Cambridge, Mass.,	Harvard University.
Chicago, Ill., .	University of Chicago.
Cincinnati, Ohio.	Society of Natural History.
	Lloyd Botanical Library.
Colorado Springs, Col.	Colorado College.
Columbia, Mo.,	Library of University of Missouri.
Davenport, Iowa,	Academy of Natural Sciences.
Indianapolis, .	Indiana Academy of Sciences.
Ithaca, N.Y., .	Cornell University.
Madison, Wis.,	Wisconsin Academy of Sciences.
Manhattan, Kansas,	State Agricultural College.
Milwaukee, Wis.,	Public Museum of Milwaukee.
Minneapolis, Minn.,	Botanical Department, University of Minnesota.
New Haven, Conn.,	Academy of Arts and Sciences.
New York, . .	Academy of Sciences.
	American Museum of Natural History.
	Columbia University.
	Torrey Botanical Club.
Philadelphia, .	Academy of Natural Sciences.
	University of Pennsylvania.
Rochester, N.Y.,	Rochester Academy of Sciences.
St. Louis, Missouri,	Botanic Garden.

Berkeley, Calif.,	University of California.
San Francisco, Calif.,	California Academy of Sciences.
Topeka, Kansas,	Academy of Science.
Trenton, N.J., .	Natural History Society.
Washington, .	National Academy of Sciences.
	United States Geological Survey.
	Smithsonian Institution.
	United States Department of Agriculture :—Bureau of Plant Industry—Division of Agrostology ; Division of Botany ; Division of Entomology ; Division of Forestry ; Division of Microscopy ; Division of Pomology ; Division of Soils ; Division of Vegetable Pathology ; National Herbarium ; Office of Experiment Stations.

South America.

Bogota, Rep. of Columbia,	Ministry of Public Works.
Caracas, . . .	Junta central del Aclimatacion.
La Plata, . .	Museo de La Plata, Rep. Argentina.
Monte Video, .	Museo Naçional de Monte Video.
Rio de Janeiro,	Museo Naçional.

WEST INDIES.

Jamaica, . .	Botanical Department.
Trinidad, . .	Royal Botanic Garden.

AFRICA.

Cape Colony, .	Botanical Department.
Durban, Natal,	Botanic Garden.

ASIA.

Calcutta, . .	Indian Museum.
	Royal Botanic Garden.
Ceylon, . . .	Royal Botanic Garden, Peradeniya.
Manila, . . .	Bureau of Science.
Straits Settlements,	Botanic Gardens and Forest Department.
Buitenzorg, . .	Botanic Garden.
Tokio, . . .	Imperial University College of Agriculture.

AUSTRALASIA.

New South Wales.

Sydney, . . .	Department of Agriculture.
	Royal Society of New South Wales.

New Zealand.

Wellington, .	New Zealand Institute.

Queensland.

Brisbane, . .	Department of Agriculture.
	Royal Society of Queensland.

West Australia.

Perth, . . . Department of Agriculture.

Tasmania.

Hobart, . . . Royal Society of Tasmania.

Victoria.

Melbourne. . . Department of Agriculture.
Royal Society of Victoria.

EUROPE.

Austria.

Cracow, . . . Academia Umiejetnósci.
Graz, . . . Naturwissenschaftlicher Verein für Steiermark.
Vienna, . . . Kaiserlich-königliche zoologisch-botanische Gesellschaft.
Naturwissenschaftlicher Verein an der Universität.

Belgium.

Antwerp. . . Vlaamsch nat. en Geneeskundig Congress.
Brussels. . . Académie Royale des Sciences, des Lettres, et des Beaux-Arts de Belgique.
Institut Botanique, Bruxelles.
Société Royale de Botanique de Belgique.
Liége. . . Botanic Garden.

Denmark.

Copenhagen. . Botaniske Forening.

France.

Amiens, . . . Société Linnéenne du Nord de la France.
Cherbourg. . . Société Nationale des Sciences Naturelles et Mathematiques.
Lyons, . . . Société Botanique.
Marseille. . . Faculté des Sciences de Marseille.
Paris. . . Société Botanique de France.
Toulouse. . . Société Française de Botanique.

Germany.

Berlin. . . Botanischer Verein für die Provinz Brandenburg und die angrenzenden Länder.
Bonn, . . . Naturhistorischer Verein der Preussischen Rheinlande, Westfalens, und der Regierung-Bezirks Osnabruck.
Niederrheinische Gesellschaft für Natur- und Heilkunde.
Braunschweig. . Verein für Naturwissenschaft.
Bremen, . . . Naturwissenschaftlicher Verein.
Breslau, . . . Schlesische Gesellschaft für Vaterländische Cultur.
Erlangen. . . Physikalisch-Medicinische Societät.
Frankfort-am-Oder, Naturwissenschaftlicher Verein des Regierungsbezirks.
Frankfort-a-M., Senckenbergische Naturforschende Gesellschaft.
Giessen. . . Oberhessische Gesellschaft für Natur- und Heilkunde.
Halle, . . . Kaiserliche Leopoldinisch-Carolinische Deutsche Akademie der Naturforscher.

Hamburg, . .	Botanische Staatsinstitute.
Kiel, ...	Naturwissenschaftlicher Verein für Schleswig-Holstein.
Königsberg, .	Physikalisch-Oekonomische Gesellschaft.
Münich, . . .	Bayerische Botanische Gesellschaft.
Stuttgart, . .	Verein für Vaterländische Naturkunde.

GREAT BRITAIN AND IRELAND.

Alnwick, . .	Berwickshire Naturalists' Club.
Belfast, . . .	Natural History and Philosophical Society.
Bristol, . . .	Bristol Naturalists' Society.
Buckhurst Hill,	Essex Field Club.
Cambridge, . .	Philosophical Society.
Dublin, . . .	Royal Dublin Society.
Edinburgh, . .	Royal Scottish Arboricultural Society.
	Royal College of Physicians.
	Edinburgh Geological Society.
	Royal Society of Edinburgh.
	Royal Physical Society.
	Royal Scottish Geographical Society.
	Royal Scottish Society of Arts.
	University of Edinburgh.
Glasgow, . . .	Natural History Society.
	Royal Philosophical Society.
	University of Glasgow.
Hull, ...	Yorkshire Naturalists' Union.
Liverpool, . .	Literary and Philosophical Society.
London, . . .	Board of Agriculture.
	Editor of *Gardeners' Chronicle*.
	Linnean Society.
	Editor of *Nature*.
	Pharmaceutical Society of Great Britain.
	Quekett Microscopical Club.
	Royal Gardens, Kew.
	The Royal Society.
	Royal Horticultural Society.
	Royal Microscopical Society.
Manchester, . .	Manchester Literary and Philosophical Society.
Newcastle-upon-Tyne,	Durham College of Science.
	Natural History Society of Northumberland, Durham, and Newcastle-on-Tyne, and the Tyneside Naturalists' Field Club.
Norwich, . .	Norfolk and Norwich Naturalists' Society.
Perth, . . .	Perthshire Society of Natural Science.
Plymouth, . .	Plymouth Institution.
Watford, . .	Hertfordshire Natural History Society and Field Club.

HOLLAND.

Amsterdam,	Koninklijke Akademie van Wettenschappen.
Haarlem, . .	Koloniaal Museum.
	Musée Teyler.
	Nederlandsche Maatschappij ter Bevordering van Nijverheid.
Luxembourg, .	Société Botanique du Grand-duché de Luxembourg.

ITALY.

Florence, . . . Soc. Botanico Italiano.
Rome, . . . Regio Istituto Botanico.

PORTUGAL.

Lisbon, . . . Academia real das Sciencias.

ROUMANIA.

Bucharest, . . Institut Botanique.

RUSSIA.

Helsingfors, . Societas pro Fauna et Flora Fennica.
Kieff, ... Société des Naturalistes.
Moscow, . . . Société impériale des Naturalistes.
St. Petersburg . Hortus botanicus imperialis.
Musée Botanique de l'Académie impériale des Sciences

SCANDINAVIA.

Christiania, . Nyt Magazin.
Lund, . . . Universitas Lundensis.
Stockholm, . . Kongl. Svenska Vetenskaps Akademien.
Sveriges Offentliga Bibliotek.
Upsala, . . . Societas Regia Scientiarum.

SWITZERLAND.

Basel, . . . Schweizerischer Botanischer Gesellschaft.
Berne, . . . Naturforschende Gesellschaft.
Zürich, . . . Naturforschende Gesellschaft.

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PRINTED BY NEILL AND CO., LTD., EDINBURGH.

TRANSACTIONS AND PROCEEDINGS

OF THE

BOTANICAL SOCIETY OF EDINBURGH.

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VOLUME XXIV.

INCLUDING SESSIONS LXXIII.–LXXV.
(1908–1911).

WITH NUMEROUS ILLUSTRATIONS.

EDINBURGH:
PRINTED FOR THE BOTANICAL SOCIETY.
1912.

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PART I.

EDINBURGH:
PRINTED FOR THE BOTANICAL SOCIETY BY
NEILL & CO., LIMITED.

And to be obtained from the SECRETARY OF THE SOCIETY *at the Royal Botanic Garden.*

1909.

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TRANSACTIONS

OF THE

BOTANICAL SOCIETY OF EDINBURGH.

SESSION LXXIII.

Presidential Address, November 1908.

By the kindness of the Assistant Secretary, Mr Jeffrey, I am able to submit the following state of the Roll of the Society:—

Honorary Fellows: British 6, Foreign 25. Ordinary Fellows: Resident 106, Non-Resident, 45. Corresponding Members 60; Associates 9; Lady Members 6. Total, 257.

During the past year the membership of the Society has been strengthened by the addition of:—Honorary British Fellow 1. Ordinary Fellows: Resident 7, Non-Resident 3; Lady Member 1. Total 12.

During the same period 5 Ordinary Fellows have resigned, and we have lost by death:—1 Royal Fellow (Oscar II., King of Sweden). Ordinary Fellows: Resident 5, Non-Resident 1, Corresponding Member 1. Total 8.

Oscar II., King of Sweden.—The death on Sunday, 8th December 1907, at the Royal Palace at Stockholm, of Oscar II., King of Sweden, removed the only foreign royal name from their list of Fellows. The late king ascended the throne on 18th September 1872, and during his whole reign the feud between Sweden and Norway was acute, and ultimately resulted in the declaration of Norwegian independence. In 1899 he abdicated in favour of his son

Gustavus, but in a few months he resumed his kingship. In a position of almost unexampled difficulty he strove to preserve friendly relations between the two nations, and it is generally admitted that his personal intervention secured the avoidance of bloodshed in the revolution by which Sweden and Norway became separate kingdoms. By his actions throughout the long years of difficulty and contention he earned the enviable title of the Peacemaker.

While the late Professor J. Hutton Balfour was on a visit to Sweden, King Oscar made his acquaintance, and their common interest in natural science led to a personal friendship which resulted in King Oscar becoming a Fellow of the Society in 1877. Reference was made to the distinguished place occupied by King Oscar II. in science, art, poetry, and literature when recording his death at the December meeting of the Society in 1907 (see "Transactions," vol. xxiii., part iv., p. 306).

J. K. Milne of Kevock Tower, Lasswade, became a Fellow in 1875, and died some time ago, no notice having reached us till recently.

Frank C. Crawford, who became a Fellow in July 1897, died suddenly at his residence, 19 Royal Terrace, Edinburgh, on 9th February 1908. He was the younger son of Adam Howden Crawford of the Hon. East India Co.'s Service, and was educated at the Edinburgh Academy. After a preliminary training in Edinburgh, he joined the London Stock Exchange, and after about twenty years he retired and came to reside in Edinburgh. He was greatly attracted by the study of natural history, and was a most assiduous collector. He devoted special attention to the genus *Carex*, and an exhaustive work by him on British sedges was in the press at the time of his death. He was at one time President of the Microscopical Society, and took great interest in the work of the Botanical Society, to which he frequently contributed.

The study of British birds was also one of his hobbies, and he possessed a very fine collection. He took great interest also in the study of shells, of which he possessed many beautiful examples. He was of a happy and enthusiastic temperament, and his breezy manner became contagious in any company. Genial and kind-hearted, and a lovable companion, his unexpected death in the very midst of his activities came with a shock of surprise to the many friends by whom he will be greatly missed.

John Archibald, M.D., who became a Fellow in December 1866, died at his residence, "Hazelden," Bournemouth, on 23rd March 1908. He was also a Fellow of the Royal Society of Edinburgh, and a Fellow of the Royal Scottish Society of Arts.

William Sanderson, F.R.S.E., became a Fellow of the Society in 1882 and died at his residence, Talbot House, Ferry Road, Leith, on 4th April 1908. He was an example of a very busy commercial man who found leisure to interest himself in botanical science. He took a special interest in the cultivation of orchids, of which he exhibited some fine examples at meetings of the Society. He was also a Fellow of the Royal Society of Edinburgh, the Royal Scottish Society of Arts, and the Scottish Arboricultural Society.

Georgett Wilson Brown, Victoria, British Columbia, became a non-resident Fellow in 1857. He appears to have become a Fellow at a time when he was brought into touch through lending some botanical drawings or paintings to the Society. For many years no communications had been received from him, and only recently word had been received of his death, which took place in May 1904.

William Paxton became a Fellow in July 1889, and died on 14th June 1907. He took great interest in the propagating of mistletoe, and introduced it in the garden at 11 Lauder Road, Edinburgh, in 1868. He also successfully introduced it at the Dean Cemetery, Edinburgh, and many plants of his introduction still flourish there. He also succeeded in flowering *Lilium giganteum* in the open at Lauder Road. He took a great interest in the cultivation of herbaceous plants, of which he had an intimate and encyclopædic knowledge, and he had gathered a very fine collection.

Professor D. CLOS, M.D., director of the Jardin des Plantes at Tolouse, and correspondent of the section of botany of the Paris Academy of Science, died in September 1908. He had been a corresponding member since 1865.

The President proceeded :—

I must ask you to excuse any formal address on the present occasion, owing to the pressure of official duties. It has been a great honour to me to fill the high office of President, and I desire gratefully to acknowledge the great kindness and consideration which I have uniformly experienced and the very loyal support given to me by the Council. I have especially to acknowledge my indebtedness to Professor Balfour for his unfailing courtesy and help. In my present dilemma I consulted him, and was encouraged to hope that the Society would overlook any shortcoming on my part in failing to give such an address as I should have felt incumbent upon me in ordinary circumstances. I desire also to acknowledge the admirable manner in which the business of the Society has been conducted by the Assistant Secretary, Mr. Jeffrey, from whom I have received invaluable and indispensable assistance.

THE BUCHAN FIELD CLUB AND REGIONAL RESEARCH.

An interesting event took place at Peterhead on the 10th October, the coming of age of the Buchan Field Club, founded in November 1887. It was celebrated by a large meeting in the Music Hall, Peterhead, and was attended by delegates from many learned Societies and other institutions, including the Royal Society of Edinburgh, the Botanical Society of Edinburgh, the Royal Physical Society, the Royal Scottish Geographical Society, the Senatus of the University of Aberdeen, Aberdeen Anatomical and Anthropological Society, the Society of Antiquaries of Scotland, the New Spalding Club, Aberdeen Philosophical Society, Edinburgh Geological Society, and many others.

The Botanical Society was invited to send a representative, and this duty was undertaken by one of our Life Fellows, Mr. Charles S. France of Aberdeen, who discharged his commission with conspicuous ability and to the great satisfaction of the Buchan Field Club.

It has been suggested to me that this event might have a little notice at this first meeting of our Society, and, indeed, it had already occurred to me to say something on the subject as a fitting part of that Presidential address which has been lying heavy on my conscience during the last few weeks.

Having been brought into rather intimate contact with the workers and the work of the Buchan Field Club, I have been greatly impressed by the high and permanent value of the work which the Club has already accomplished.

The objects of the Buchan Field Club are :—

1. The Study of Natural Science and of the Archæology, Folklore, History, and Literature of Buchan.

2. To interest the young in such studies.

3. To co-operate with the managers of the Arbuthnot Museum, Peterhead, for the improvement of that institution, which embraces the following departments :—1. Topography and Folklore; 2. Antiquities; 3. History; 4. Biography and Literature; 5. Geology and Mineralogy; 6. Meteorology; 7. Agriculture and Cattle Rearing; 8. Botany; 9. Zoology.

A glance at the nine portly volumes in which their twenty-one years' labours are recorded is most instructive. There are several notable articles in botanical science, the most conspicuous of which is a very exhaustive paper by Professor Trail of Aberdeen on "The Flora of Buchan: Its Distribution, Origin, and Relation to Man." It is a perfect example of what may be called "regional research," and is a model of what might well be done for other districts of Scotland by local workers.

I observe also that there is in preparation a majority volume in which the accumulated knowledge on all the points that come within the sphere of the Club's operations will be presented in a series of special articles each written by an accomplished expert in that particular department. In the department of natural science I see such names as Sir Arthur Mitchell, Professor Trail, Professor J. A. Thomson, R. N. Rudmose Brown, B.Sc., etc. This is to be written on popular lines, and cannot fail to be deeply interesting and stimulating to local workers as well as suggestive to workers elsewhere.

There are several Clubs of this kind in other parts.

One naturally thinks of the Berwickshire Naturalists' Field Club, which has done splendid work for many years. But there is ample room for more. This subject was touched upon in a most interesting way at the Dublin meeting of the British Association in September last in a paper by Professor H. A. Miers, F.R.S., in which he said. "One of the most useful functions of a body like a local society is to encourage a habit of expressing scientific results in simple and intelligible language that will appeal to the whole society. Indeed, nothing can be better or more useful for the scientific specialist himself than to attempt to explain his own work in simple language to a mixed audience."

In addition to this nothing is more wanted at the present day than books giving simple untechnical accounts of the living work by the worker himself, and this should be done not only in the newer fields of science, the popularisation of which is liable to be overdone, but in the more ordinary work of everyday science, which results in discoveries perhaps equally momentous, but at present buried beyond the reach of the amateur.

The educative work that the local societies can best perform through its members, who, though not children, have unprepared minds, is the encouragement of original research. This could be done, *first*, by inviting the trained and experienced workers to make known to them, through the medium of untechnical language, the beauty and interest of scientific work in the course of its progress, and of scientific discovery in the making: and *secondly*, by providing them with followers who will continue to prosecute, under their guidance, original observations and even experimental research. Enthusiasm has been instilled, and sincere students produced by the University extension movement; let the local societies initiate a new science extension movement by which the barrier between the professional man of science and the amateur, between the expert and the layman, will be broken down.

The Buchan Field Club impresses me as a fine example of a Territorial Association for the promotion of regional research, and their territory becomes a cosmos in the investigation of which the members qualify for work in the wide world anywhere. Mr Haldane's Territorial Army

Scheme was a splendid conception for the development of local patriotism and the association of men in the common aim of maintaining and defending our laws, our liberties, our homes, and our empire. But there are other fields for the development of patriotic action. Why not have a territorial army for regional research, a brotherhood of men of light and leading, for the attainment of a wider culture than is possible to isolated workers, a training and equipment for world-wide service? All honour to the men who give time and labour and thought to studying the art of war, and who are ready, if need be, to shed their blood at the call of duty. But no less honour to the men who give their days, and ofttimes their nights as well, to the building up of that intellectual enlightenment and culture which, after all, are more valuable and more enduring national assets than great armies or a fleet that secures the supremacy of the sea. He who can make two blades of grass grow where formerly there was only one, is a greater benefactor of his nation than the man who designs a ship of war superior to the latest *Dreadnought*. To add to the sum of human knowledge is a higher patriotism than to pile up implements of war. To unlock the treasure-house of nature and reveal the secret glories of the temple of science so that, with a fuller knowledge of his environment, man may better achieve the purpose of human life, is a worthier ambition than to be the inventor or expert manipulator of cunningly devised instruments of death. It was because I felt the Buchan Field Club, which might be widely copied, was such a Territorial Army of Regional Research for the furthering of this patriotic ambition that I, in the absence of any meetings of the Council, sent to them, as your President, by the hands of Mr. C. S. France, a letter of cordial congratulation from this Society on the celebration of their majority.

Note upon some Sea-weeds from the Island of Dominica, British West Indies. By Mr. Symington Grieve.

In January 1906, when in London, before starting upon a trip to the island of Dominica, I was asked by my friend Mr. E. M. Holmes to try and collect some sea-weeds there.

As most of my time was spent in the interior of the island, I unfortunately had little opportunity of visiting the sea-shore. However, once or twice when passing along or near the coast I made an effort to get a few specimens, especially such as were not too large to carry about with me. The result was only a collection of about twenty specimens, but of these, as far as I have been able to discover, none have hitherto been recorded from the island of Dominica. This encouraging fact has made me think it may be worth while recording this small collection. Mr. E. M. Holmes has been good enough to name the specimens, and he says several of them are interesting and rare. I am also indebted to him for the observations appearing in connection with several of the sea-weeds noted, under which appear his initials.

The *Sargassum* weeds will help to illustrate the distribution of that interesting family of sea-weeds, especially those in fructification. I have no doubt that another visit to the island would enable me greatly to add to my collection, as most of the likely places were too far out of the way for me to reach, and I had so much other work on hand.

The notes upon the distribution of the sea-weeds referred to in this list are mostly taken from the "Catalogue of the Marine Algæ of the West Indian Region," by George Murray, Esq., F.L.S., which appeared in the "Journal of Botany" for 1888, pp. 193, 237, 303, 331, 358, and for 1889, pp. 237, 257, 298: also some of my information I owe to De Toni, "Sylloge Algarum."

To Mr. E. M. Holmes, F.L.S., and the authors above mentioned, I desire to tender my best thanks.

ULVACEÆ.

Ulva fasciata, Delile.—Found growing upon rocks on sea-shore, Dominica, B.W.I.: Barbadoes, Dickie; Guadeloupe, Mazé; Gulf of Mexico, Schott.

Geographical distribution.—General in warm seas.

CLADOPHORACEÆ.

Chætomorpha antennina, Kütz.—From small rocks on the shore, North-east Dominica: Guadeloupe, Mazé.

Geographical distribution.—Indian Ocean and South Pacific.

Rhizoclonium arenosum, Kütz.—Found growing upon small outcrops of rock upon the seashore near Roseau, Dominica, B.W.I.

Rhizoclonium arenosum, var. *Occidentalis*, Kütz.—Found growing upon stones on the seashore near Roseau, Dominica, B.W.I.

Note.—This variety differs from the type, chiefly in the lesser diameter of the filaments, usually only half that of the type.—E. M. H.

SARGASSACEÆ.

Sargassum Filipendula, C. Ag.—Found growing upon small rocks upon the sea beach, Dominica, B.W.I.; Gulf of Mexico (*fide* J. G. Agardh); Florida, Melvill.

Sargassum platycarpum, Mont.—Found growing upon small rocks upon the shore, Dominica, B.W.I.; Grenada, Murray; Barbadoes, Dickie; Guadeloupe, Mazé; Martinique, Duperrey; "Ad alias insulas Indiæ Occidentalis" (Mus. Petropolit.), J. G. Ag.

Geographical distribution.—Warm Atlantic.

Sargassum pteropleuron, Grunow.—Found growing upon small rocks upon the sea beach, Dominica, B.W.I.; Bahamas, "Novara"; Florida, Palmer.

Sargassum vulgare, C. Ag.—Found growing upon small stones on the sandy beach, Portsmouth, Dominica, B.W.I.; Grenada, Murray; Barbadoes, Dickie; Guadeloupe, Mazé; Jamaica, Sloane, Chitty; Cuba, R. de la Sagra; Florida, Harvey, Melvill; Bermuda, Kemp, Rein.

Note.—The species of the genus *Sargassum* are almost impossible to determine with certainty in the absence of fructification, from the great similarity of the leaves or frondlets of species which have very different fructification. There is little doubt that extended observation would reveal other species on the shores of these islands, since twenty-five species are enumerated in the "Algues de Guadeloupe" as occurring in that island.—E. M. H.

DICTYOTACEÆ.

Haliseris delicatula, J. Ag.—Found growing on a few small rocks on the sandy beach, Portsmouth, Dominica, B.W.I.; Grenada, Murray; Barbadoes, Dickie; Guadeloupe, Mazé; Cuba, R. de la Sagra; shores of Mexico (*fide* J. G. Agardh).

Geographical distribution.—Brazil.

Note.—From its small size this species is easily overlooked when growing amongst other algæ.—E. M. H.

Dictyota Bartayresiana, Lamour.—Found growing upon stones upon the seashore. Dominica, B.W.I.; Barbadoes, Dickie; Guadeloupe, Mazé; St. Thomas, Young; Danish West Indian Islands, Hohenack (Meeresalgen, Nos. 427, 428); Vera Cruz, Liebman; Florida, Melvill; Bermuda, Kemp; "Challenger."

Note.—This species bears considerable resemblance to several other species, and when sterile is recognised by the acuminate character of the young fronds and their subdivaricate branching.—E. M. H.

GIGARTINACEÆ.

Gymnogongrus tenuis, J. Ag.—Found growing upon rolled stones upon the seashore, Dominica, B.W.I.; Guadeloupe, Mazé; on the shores of the Mexican Republic, Liebman. Agardh gives it as Gulf of Mexico, and on the islands of St. Thomas and Martinique.

Gymnogongrus tenuis, J. Ag., var. *angusta*, J. Ag.—In this variety the branchlets are longer. Found growing on rolled stones upon the seashore, Dominica, B.W.I.

Note.—It is mentioned by Mazé and Schraum as occurring in four localities in Guadeloupe, but it has apparently not been noticed by many algologists, as it is comparatively rare in herbaria.—E. M. H.

Gymnogongrus tenuis, J. Ag., var. *brevifolia*, Holmes.—Growth: Spreading over the surface of rolled stones upon the sea beach. Dominica, B.W.I.

This variety has very short branchlets and does not appear to have been previously noticed.

Note.—The plant is evidently a very variable one, and further observation may show that these varieties are merely forms running one into the other.—E. M. H.

Acanthophora Thierii, Lamour?

Geographical distribution.—It is recorded from the shores of North America, West Indies, Mexico, Brazil, the Nicobar Islands, and Biarritz in Europe.

Note.—The specimen consisted of a fragment mixed with other algæ, and it was not possible to determine the species with certainty.—E. M. H.

Rhodomelaceæ.

Laurencia tuberculosa, J. Ag.—Along with *Gymnogongrus tenuis* found growing upon stones upon the sea beach, Dominica, B.W.I.

Ceramiaceæ.

Ceramium clavulatum, C. Ag. (*Centroceras clavulatum*, Mont.)—Found growing upon rolled stones upon the seashore, Dominica, B.W.I. In Mr. George Murray's list in "Journal of Botany," at page 196, it is mentioned under the name *Centroceras clavulatum*, Ag., but De Toni, in the "Sylloge Algarum," regards Centroceras as a subgeneric group only.

The stations mentioned for this plant are:—Grenada, Murray; Guadeloupe, Mazé; St. Thomas, A. R. Young; Cuba, Hb. Montague; Florida, Harvey, Melvill; Bermuda, Rein, "Challenger."

Note.—It is widely distributed in all the warmer seas, including the Mediterranean.—E. M. H.

Grateloupiaceæ.

Grateloupia Cutleriæ, Kütz.—Found growing upon rolled stones upon the sea beach, Dominica, B.W.I.; Guadeloupe, Mazé.

Geographical distribution.—Chili, Peru.

Grateloupia filicina, C. Ag.—Grenada, Murray; Guadeloupe, Mazé; St. Thomas, A. R. Young; Florida, Harvey.

Note.—Widely distributed in the warmer parts of the Atlantic and Pacific Oceans, and, like many of the species of the genus, variable in size and amount of division of the frond.—E. M. H.

Grateloupia filicina, C. Ag., var. *filiformis*, De Toni.—Found growing upon rocks upon the sea beach, covered at about half tide. Guadeloupe, Mazé; Hohenack (Meeresalgen, No. 380).

Grateloupia prolongata, J. Ag.—Found growing upon low rocks upon the sea beach, covered about half tide. Very near *G. filiformis*, but not distichous: proliferæ from the surface of the frond; Guadeloupe, Mazé.

Geographical distribution.—Pacific and Indian Ocean.

Var. *cauda*, De Toni.

Note.—This differs from the type in its flagelliform branches.—E. M. H.

Grateloupia versicolor, J. Ag.—Found growing upon stones upon the sea beach about half tide, Dominica, B.W.I.

CORALLINACEÆ.

Amphiroa fragilissima, Lamour.—Found growing upon sea-weed from small rocks on the seashore, Dominica, B.W.I.

Geographical distribution. — Grenada, Murray; Guadeloupe, Mazé; Jamaica, Sloane: Florida, Harvey, Melvill, Hooper; Bermuda, "Challenger"; also Mediterranean.

Note.—A brittle species with joints six to ten times, or even to fourteen times, longer than broad, and growing in cushions.—E. M. H.

Amphiroa breviarticulata, Aresch.—Dominica.

Geographical distribution.—West Indies.

Note.—In this species the joints are only two to five times longer than broad, and taper slightly towards the apex.—E. M. H.

EXCURSION OF THE SCOTTISH ALPINE BOTANICAL CLUB TO CRIANLARICH, 1908. By MR. ALEXANDER COWAN.

The members left Edinburgh on Monday, 27th July, for Crianlarich Hotel, Perthshire, which was chosen as the headquarters, owing to the proprietor of the hotel at Tyndrum being unable to guarantee bedroom accommodation. On Tuesday, 28th July, it was hoped to visit Ben Loaigh, but as the mountain was largely enveloped in mist, it was thought better, after the members' experience on Ben Lawers in similar conditions a few years back, to wait for a more favourable day, and it was decided to take the morning train to Arrochar and walk from there along the shore of Loch Lomond to Ardlui, returning thence to Crianlarich by train in the evening. The day, fortunately, turned out very fine, but nothing of any great interest was found either on the roadside, on the shore of the loch, or on the higher ground visited by two of the members.

Carum verticillatum, a plant well known in this locality, was seen in large quantity. Besides this, the following plants were found:—*Blechnum Spicant* var. *anomalum*, *B. Spicant* var. *caudatum*, *Carex laevigata*, *C. pallescens*, *Carum verticillatum*, *Circaea alpina*, *Gnaphalium sylvaticum*, *Hypericum Androsaemum*, *Lastrea aemula*, *Lythrum Salicaria*, *Lysimachia vulgaris*, *Polystichum aculeatum*, *Sanicula europaea*, *Scutellaria galericulata*. Leaves of *Quercus pedunculata* were gathered, one $10\frac{3}{4} \times 5\frac{5}{8}$, another $7 \times 6\frac{1}{8}$ ins.

As the morning of Wednesday, 29th July, was fine, it was decided to visit Ben Loaigh. The members accordingly left Crianlarich by the 10.5 train and alighted at Glen Lochy crossing, where it had been arranged that the train should stop specially for the convenience of the members, though this was about a mile short of the most convenient point on the line from which the ascent of the mountain could be made. The members spent the whole of the day on the various ledges of rock to the north of the mountain. Time did not permit of anyone getting so far as the corrie, or even as far as the best-known station for *Kobresia caricina*, and unfortunately no trace of this plant could be seen on the northern slopes of the mountain. The members, however, were fortunate in finding *Cystopteris montana* in considerable quantity on several ledges of the rocks, and a plant of the holly fern—*Polystichum Lonchitis*—was found with all its fronds crested, doubtless a seedling either from the plant originally found there many years ago by Dr. Craig during a visit of the Club, or a seedling from a crested plant still growing on some inaccessible part of the rocks. As the railway authorities would not stop the evening train at Lochy crossing to pick up the members, the only alternative was for them to drive back to Tyndrum, and this entailed an early departure from the mountain. The day had fortunately kept fine, but as the members were walking homewards rain commenced to fall and continued without ceasing until they reached Tyndrum railway station, where the members were kept waiting a considerable time in their damp clothes, owing to the train being very late; fortunately, however, no one was any the worse of the unpleasant experience. The following plants were found:—*Arabis petræa, Carduus heterophyllus* at 2000 feet, *Carex atrata, C. capillaris, C. dioica, C. flava, C. pallescens, C. pauciflora, C. pilulifera, C. pulicaris, C. pulla, C. rigida, C. vaginata, Cystopteris montana, Dryas octopetala, Galium boreale, Geum rivale, Habenaria viridis, Juncus biglumis, J. castaneus, J. trifidus, J. triglumis, Salix herbacea, S. Myrsinites, Saussurea alpina, Saxifraga aizoides, S. hypnoides, S. nivalis, S. oppositifolia, S. stellaris, Tofieldia palustris, Trollius europæus, Polystichum Lonchitis,* also *P. Lonchitis* var. *cristatum.*

One member of the party, who only arrived on Tuesday, found *Utricularia minor* in Loch Dochart. On Thursday the 30th July the members spent the day on Cruach Ardran. A considerable amount of time was spent in looking for *Carex irrigua*, as it was understood to have been found here by a late member of the Club some years ago, but no trace of it was seen. The ground was well stocked with sheep, and most of the herbage was well eaten down. The day was fine and misty alternately, the mist usually being accompanied by a wetting rain, and the wind was very cold. No plant of any special note was found, though numerous well-known plants were gathered, as the following list shows:—*Aira alpina, A. cæspitosa, A. vivipara, Asplenium viride, Carex binervis, C. dioica* (male and female), *C. pallescens, C. panicea, C. pilulifera, C. rigida, C. stellulata,* very abundant *Epilobium alpinum, Festuca ovina, F. vivipara, Galium boreale, Gnaphalium supinum, Juncus trifidus, J. triglumis, Lastræa dilatata* var. *laciniata, Lastræa montana* var. *truncata, Loiseleuria procumbens, Lycopodium alpinum, L. annotinum, L. clavatum, Orchis latifolia* var. *incarnata, Polystichum Lonchitis, Pseudathyrium alpestre, Rubus Chamæmorus, R. saxatilis, Saxifraga aizoides, S. hypnoides, S. nivalis, S. oppositifolia, S. stellaris, Trollius europæus, Vaccinium uliginosum. Rumex sanguineus* was also found near Loch Dochart.

On Friday, 31st July, three of the members decided to again visit Ben Loaigh in order to botanise on the north-eastern slopes of the mountain, which the members were unable to reach owing to want of time two days previously. They therefore drove from Crianlarich as far as Coinish farm, from which they walked a distance to the corrie of about three miles. They were all of opinion that this was much the easiest way to reach the mountain, as there is a path the whole way from Tyndrum to within a mile of the corrie; and no doubt, if the Club visits this district on a future occasion, ponies could be obtained for the older members to ride on, which would make a day on the mountain very much easier than having to walk to the botanising ground from the road at Glen Lochy and back there again at night. Fortunately, one of the first plants found was *Kobresia caricina*. *Cystopteris montana* was also found, showing that it is largely distributed among the rocks on this mountain. The following plants were also found:—*Allosorus crispus*, *Arabis petræa*, *Bartsia alpina*, *Carex atrata*, *C. capillaris*, *C. dioica*, *C. panicea*, *C. pauciflora*, *C. pilulifera*, *C. pulicaris*, *C. pulla*, *C. rigida*, *Cherleria sedoides*, *Cystopteris fragilis* var. *dentata*, *C. montana*, *Dryas octopetala*, *Epilobium alpinum*, *Galium boreale*, *Hymenophyllum* var. (not ascertained) *Juncus biglumis*, *J. castaneus*, *Kobresia caricina*, *Melampyrum alpinum*, *Polystichum Lonchitis* (two or three varieties), *Pyrola rotundifolia*, *Saxifraga aizoides*, *S. aizoides* var. *aurantiaca*, *S. hypnoides*, *S. oppositifolia*, *S. nivalis*, *S. stellaris*, *Saussurea alpina*, *Silene acaulis*, *Tofieldia palustris*, *Vaccinium uliginosum*. The day was cold and misty, with a strong west wind.

The other members spent the day at Tyndrum, where *Loiseleuria procumbens* was gathered, but as the day was so stormy, fishing on Lochan Bhe was impossible, and it was with great difficulty that a few specimens of the supposed *Scirpus fluitans* were obtained.

The members returned home on Saturday, the 1st of August, having had on the whole a fairly interesting meeting. The weather, though warm in other parts of the country, was extremely cold in the evenings, and there was always continual mist on the higher mountains, accompanied by occasional showers of rain.

NAIAS FLEXILIS, ROSTK ET SCHMIDT, AS A BRITISH PLANT. By ARTHUR BENNETT, F.L.S.

"On October the 11th, 1850, at a meeting of the Botanical Society of London, Mr. D. Oliver, junr. (now Emeritus Professor Oliver, LL.D., F.R.S.), exhibited specimens of *Naias flexilis*, Rostk. et Schmidt, discovered by him in a pond near Roundstone, Connemara, Ireland, in August last."[1] This was afterwards gathered by Mr. A. G. More and others in Lough Cregduff, which was supposed to be Mr. Oliver's station, although the distance did not quite agree.

In September 1877 Mr. A. G. More gathered it in Lough Caragh, S. Kerry, in 15 to 20 feet of water, associated with *Eriocaulon, Isoetes lacustris, Lobelia Dortmanna*, etc.[2]

In August 1885 it was found at Killarney, N. Kerry, by the Rev. E. F. Linton !. Gathered at Glencar 1899 and Killarney by Dr. Scully.

Gathered as lately as 1896 by Mr. Lloyd Praeger in Lough Cregduff.

In Scotland. "First found in Loch Cluny, Drummond-Hay, 1872."[3] But Col. Drummond-Hay notes,[4] on specimens sent by him, "the discovery of this plant by Mr. Sturrock of Blairgowrie in the summer of 1865 (a slip for 1875)." I am not able to explain this discrepancy. Messrs. Robb and Sturrock found it in Loch Cluny (157 feet above sea-level) on 13th August 1875, "growing in water about 5 feet deep, generally along with *Callitriche autumnalis*, L., or a *Chara*, but sometimes in patches by itself."[5]

In Loch Cluny it is associated with *Subularia, Elatine hexandra, Callitriche hamulata* and *autumnalis, Lobelia Dortmanna, Littorella, Utricularia* sp., *Potamogeton natans, lucens* (?), *angustifolius* (*Zizii*), *perfoliatus, prælongus, crispus, pusillus, obtusifolius, heterophyllus, Sparganium minimum* (?), *Nuphar*, three species of aquatic

[1] "Phytol.," iii. (1850), 1088.
[2] "Jour. of Botany," Nov. 1877, p. 350.
[3] "Flora of Perth" (1898).
[4] "Rep. Bot. Ex. Club," 1877–8, p. 10, 1879.
[5] "Scott. Nat.," 199, 1876.

Ranunculi and *Nymphæa*. By the note on the *Utricularia* I should expect it to prove *U. neglecta*.

It was planted in Loch Lindores, Fifeshire, 23rd August 1878 by Dr. B. White and Col. Drummond-Hay. The specimens from Loch Cluny.[1]

Afterwards "found in almost all the chain of lakes between Dunkeld and Blairgowrie."[2]

In Ochtertyre Loch (S.S.E. of Doune), in Perthshire, by Dr. B. White, where it occurred with *Potamogeton lucens, perfoliatus* and *heterophyllus* (Dr. White sp.).

In July 1908 Mr. M. M'Neill of Colonsay, Inner Hebrides, sent me a large box of a gathering with rake, etc., from Loch Fada in that isle. This loch is about 2 miles long and 124 feet above level of sea. Among the specimens I found several small masses of the *Naias*. It was associated with *Ranunculus Drouetii, Elatine hexandra, Callitriche autumnalis* in abundance, *Myriophyllum alterniflorum, Utricularia minor* and *neglecta, Littorella, Sparganium minimum, Juncus supinus* var. *fluitans, Potamogeton heterophyllus, perfoliatus* and *pusillus, Chara aspera* and *fragilis*, and *Nitella opaca*. A later box received from Loch Sgoltaire did not contain the *Naias*, but had *Nitella translucens*, an addition to the island flora. It is probable the *Naias* will be found in other lochs in Western Scotland if they are "dragged." In the "Student's Flora," ed. ii., 1878, Sir J. D. Hooker gives "Skye" as a habitat for the *Naias*. I have not been able to ascertain on what grounds he does so. It is not so given by Dr. Traill in his Scottish Topographical Botany in "Ann. Scott. Nat. History," nor is it marked by Mr. Symers Macvicar in a London catalogue of Skye plants which he kindly sent me.

All the Scottish and Irish specimens I have seen fairly agree with the American plant, but in Lake Ringsjon in Scania, Sweden, occurs the var. *microcarpa*, Nilsson, which is characterised by much smaller fruit. In Europe *flexilis* occurs in Sweden (Scania! and Upland!) in Pomerania, Marchia! Russia, prov. Olenetz and Borussia; Garcke. In N. America it is generally distributed in Canada and the United States, but does not reach the Southern States. In Finland it probably occurs in Lake Onega, but Hjelt, in

[1] "Scott. Nat.," v. (1879), 131.
[2] "Fl. Perth" (1898), p. 313.

his "Flora Fennica" (1895), 521, does not notice the *N. tenuissima*, Al. Braun, which certainly occurs in Finland, nor does Nyman in his "Consp. Fl. Europ." (1882), 685. This was named *N. minor*, All., var. *tenuissima* by Braun in "Jour. of Botany" (1864), 277, but Magnus, in "Beit. Kent. Gat. Najas" (1870) 24, 45, made it a species, and Dr. Rendle in "Trans. Linn. Soc." (Botany), v. (1899), 414, does the same. I have one of the original specimens gathered by Norrlin[1] in the Vesijari-see, but he placed it under *N. fragilis*, Del. = *N. minor*, All. Norrlin[2] gives as a locality for *flexilis* "Savenshji ad Velikaji-guba." This is in 62° 15′ N. lat., at the northern end of Lake Onega.

N. flexilis has occurred in recent beds in a fossil state in Hanover, Holstein, S.W. Norway, Sweden, and E. Finland (Rendle, *l.c.*)

In England in pre-Glacial beds at Pakefield in Suffolk, *N. marina*, L., and *N. minor*, All., have occurred, but Mr. C. Reid[3] does not mention the occurrence of *N. flexilis*.

ATRIPLEX CALOTHECA, FRIES, AS A SCOTTISH SPECIES.

By ARTHUR BENNETT, F.L.S.

For some years I have been expecting to see specimens of the above species from some of the northern counties of Great Britain. But the want of complete specimens with good fruit has compelled me to hesitate in applying the name to many specimens. Fries adapted the name from the *A. hastata*, L., γ *calotheca*, Rafn., "Damn. Fl.," ii. 240, 1796, and published specimens of it in his "Herb. Norm.," viii., No. 84 (1841): describing it in his "Nov. Fl. Suec.," Mant. 3, 164 (1842):—

"*A. calotheca*, herbacea, patulo-ramosa, subprostrata foliis triangulari-sagittatis sinuato-dentatis, supremis interrigimis, floribus terminalibus spicatis, calycibus femineis triangularibus, in dentes acuminatos subulatosve laciniatis." (Fries, *l.c.*)

It has been divided by various authors in various ways,

[1] "Bid. Syd. Tavastlands Flora" (1871), 126.
[2] "Fl. Karl. Onegensis," 1 (1871–4).
[3] "The pre-Glacial Flora of Britain," Jour. Linn. Soc. (Botany), vol. xxxviii. (1908), 211.

Westerlund, author of a critical account[1] of the Swedish Atriplices, did not take up some earlier names, and so confused the synomy. Richter, "Pl. Europ.," ii. 144 (1897) gives—

a. the type.

β. macrotheca, Mog. (1849).

γ. stipitatum, Hartm. (1879)

δ. pedicellatum, Marss. (1869).

ε. parvifolium, Lange (1864, *not* 1886, as Richter gives).

In the latest "Swedish Flora," Neuman and Ahlf., 569 (1901), is given a var. *tenuibracteatum* which seems scarcely different to Westerlund's var. *macrotheca*.

The distribution of the species is:—

Norway (Christiana), Sweden, Denmark, Finland, North Germany, Schlesvig-Holstein, but is not given for the Faroes (Ostenfeld) or Holland (Vuyck).

It is given for six coast provinces of Sweden, but is doubtfully native in Finland.

So far as Scotland is concerned, the following, I believe, will prove to be this species, but are doubtful:—

? Shetland, Beeby, 11th August 1896, No. 1163.

? E. Sutherland, E. L. Marshall sp.

? E. Ross, E. L. Marshall, 20th July 1891, No. 97.

? Wigton, J. M'Andrew sp.

The only specimens I can confidently name are those from the coast of Moidart, Argyllshire, gathered by Mr. Symers Macvicar, and sent to me a few years ago with a series of Atriplices from that and the neighbouring coasts. Remarks on the species will be found in "Ann. Scot. Nat. History," 33, 35, and 119 (1899).

A specimen of *A. littoralis*, L., gathered by Dr. Playfair, "15.9.1874, Abercorn (shore of Forth)," Linlithgow, strongly simulates the var. *longpipes*. Drejer, "Fl. Hafn.," 107 (1838) of *A. calotheca*, and is, I believe, referable to *A. littoralis*, L., var. *γ angustissimus*, Marss., "Fl. Neu-Pommern," 394 (1869), found in Pomerania and Hungary.

The British Atriplices want a careful revision and collation with Continental specimens; it is one of the neglected genera, but requires, above all, good specimens in good fruit.

[1] "Bid. kånn. Sveriges Atriplices Ak. Afl. Lund.," 1861.

AERIAL ROOTS OF ACANTHORHIZA ACULEATA. By Miss BERTHA CHANDLER, M.A., B.Sc. (Plates I. and II.)

The development of aerial roots is by no means an uncommon occurrence among many plants. We find such plants as *Rhizophora*, *Monstera*, *Ficus*, *Dillenia* and others producing these organs under normal conditions: and, indeed, most plants may be induced to form these structures under conditions of excessive heat and moisture.

Acanthorhiza aculeata, a palm, develops quite normally abundant aerial roots. They differ from normal aerial roots in the fact that at a certain stage of their development they lose their root-cap and become metamorphosed into hard woody structures, literally thorns. This curious fact about these roots was noticed as early as 1880 by Dr. Friedrich.[1] His examination was conducted almost entirely from the structural standpoint, for he deals with the development of tissues in these roots as they pass from normal aerial roots to thorns, and he touches very little on the physiology or function of these structures.

There are two specimens of this plant in the palm-house in the Royal Botanic Garden, Edinburgh. A photo of one of these by Mr. R. Adam, is given (Plate I.). These specimens were studied with the permission of the Regius Keeper, and the results of my examination have made it possible for me to revise Dr. Friedrich's paper, and to add a few further notes, together with figures which were not given by that author. He examined specimens in the Botanic Garden, St. Petersburg, and gives as an average length of a root about 10 cm. In the specimens in the Royal Botanic Garden, Edinburgh, some branched roots reach a length of 40–50 cm., though the unbranched roots rarely attain a length of more than 15 cm.

The external appearance of these aerial roots are readily seen from Plate I. They arise usually at the base of the leaves after the leaves have fallen away. The roots are to be seen in the figure developed roughly in rings round the trunk. Often they are developed, however, before this stage, and on tearing down the sheath covering the base of

[1] "Acta Horti Petropolitani," 1880.

the leaf a root can be seen flattened against the trunk. On emerging from the leaf-sheath they become cylindrical in form and branch freely. Some of these flattened roots can be seen in the centre of the figure lower down on the stem.

Three distinct stages may be noticed in the life-history of these aerial roots. The young roots emerge as soft green structures, provided with a root-cap. They lengthen, and the root-cap is loosened, hanging from the tip of the root and easily dislodged by artificial means. This constitutes the second stage in the metamorphosis of these roots. The final stage is reached when the root-cap is lost, and the root becomes completely hardened, forming a thorn.

These stages can all be distinctly seen in the figure. These constitute the changes for unbranched roots, and also for the longer branched roots, the lateral roots of which differ in no respect from the unbranched ones. There are many other aerial roots, however, especially at the base of the tree forming a dense interwoven thicket, which do not harden and become thorns, but, entering the ground, develop as normal roots, and perform much the same function as the prop-roots in *Pandanus*.

The internal features of these aerial roots have been so minutely described that there is very little to add. But a summary may be given of Dr. Friedrich's results, together with one or two interesting points that have been overlooked.

Looking at a longitudinal section of a young aerial root, and comparing it with a typical root-cap, say, for instance, that of barley, the difference will at once be noticed. In the latter case the loose cells are approximately the same size, and there is no differentiation into an outer and an inner root-cap as in the former (see Plate II. fig. 2). "The cells of the outer root-cap," to quote Dr. Friedrich, "are parenchymatous, and arranged in a brick-shaped manner one above the other; their walls are thickened, pitted, and markedly lignified (showing an intensive yellow coloration with aniline sulphate). Between them are distinct intercellular spaces. The inner root-cap is distinguished from the outer by the different shape of its cells, which are smaller, more polyhedric, parenchymatous cells formed by tangential division" (Plate II. figs. 2 and 3).

The epidermis is interesting. The cells are markedly thickened to the outside, at the point where they touch the root-cap, while the other sides of the walls remain unthickened (fig. 3, *a* and *b*). These epidermal cells are concave to the outside, but gradually take on a more regular, flat-shaped form. Owing to the direction in which the epidermal cells lie, a longitudinal section of the root shows a transverse view of the epidermal cells; a transverse section shows a longitudinal view of the cells. A special median section would show the epidermis as a layer quite distinct from the rest of the meristem tissue right to the apex, thus dividing the root-cap from the root itself. The cells of the epidermis increase through radial division, and the thickening of the outer part of the walls can be watched from very early stages upwards.

In the second stage of the life-history of these aerial roots internal changes have also taken place. In a longitudinal section the root-cap is seen to be only slightly adhering to the root (fig. 4). The outer thicker layer has noticeably peeled off in layers, forming the tufted mass round the root, which can easily be detected with the naked eye (fig. 1, *b*). The inner layer, too, gradually loosens from the epidermis, the cells of which become gradually thickened to the outside (fig. 4, *a*).

In the final or thorn stage the metamorphosis is complete; the root-cap, if present at all, is so loose that it is more like a thimble on the root, like the root-pocket of the Lemnaceæ, and can easily be detached, leaving behind a bristle or thorn (fig. 1, *c*). The transverse sections of aerial roots at various stages in their life-history show more distinctly the process of hardening (figs. 5–9). The essential features shown in a transverse section are, the epidermis, the protective sheath (*Schützhülle*), consisting of thick cells (Dr. Friedrich says that he has observed this tissue in no other aerial root, but it is observable to some extent in palm pneumathodes, roots of Bromeliads, etc.), an outer cork tissue, an inner cork tissue with larger cells to the outside, small to the inside, a distinct endodermis, a typically palm vascular system xylem alternating with the phloem, and the pith. Transverse sections of the upper portion of the axis of the thorns show well-marked aerenchyma in the inner cortex. The figures show that as the sections approach the tip of the thorn the wood tissue is considerably increased and the aerenchyma gradually lost (figs. 6, 7, 8). A section near the tip shows practically all hardened tissue except phloem. As Dr. Friedrich puts it, with the whole change of the aerial root into thorns nothing is altered in the anatomical arrangement of the inside tissues; the cells of all the tissues, with the exception of the phloem become thickened and lignified. The flattened bases of some of these aerial roots (fig. 9) exhibit the same essential features as the circular roots themselves, but with a much more marked woody development.

Mention was made of the roots which are found, on tearing down the leaf-sheath, flattening themselves against the trunk. The point is interesting, for they resemble in this respect the intracortical roots of the Bromeliaceæ; for example in *Puya* and *Kingia*. These roots, one will remember, are developed inside the cortex, and on emerging lose their root-cap, a further point of resemblance to a stage in the development of the aerial roots in *Acanthorhiza*. The flattened roots may be simply explained as the pressure of the leaf-sheaths, since on emerging they become cylindrical in form; but the striking resemblance in habit to the intracortical roots of the Bromeliads, and the tendency of the roots to lie parallel with the stem, suggests another cause, that of atavism, that is to say, that the memory of a former habit similar to the roots of the Bromeliads still clings to them.

The interesting point to notice about these aerial roots is their function; there is no doubt that in their early existence they function as pneumathodes or breathing roots, an inference drawn from the presence of much aerenchyma. This function persists even in the thorn stage, where aerenchyma are found at the base of the structures, but with the loss of the root-cap and aerenchyma the function becomes largely that of protection. The fact that many of these roots do not proceed as far as the thorn stage, but on entering the ground develop as normal roots, adds a third function to those already mentioned—one similar to that of the prop-roots of the Pandanaceæ.

EXPLANATION OF PLATES.

PLATE I.

Photo of a specimen of *Acanthorhiza aculeata* at the Royal Botanic Garden, Edinburgh. (By Mr. Robt. Adam.)

PLATE II.

Fig. 1. Various stages in the life-history of aerial roots of *Acanthorhiza aculeata*.
- *a*. youngest stage—root-cap firmly adhering.
- *b*. 2nd stage—root-cap a loose tuft.
- *c*. complete metamorphosis into a thorn.
- *d*. a branched root.
- *e*. an aerial root flattened in its upper portion.

,, 2. L.S. of young aerial root.
- *a*. epidermis (thickened on outer walls).
- *b*. epidermis under the root-cap.
- *c*. inner root-cap.
- *d*. outer root-cap.

,, 3. Enlarged portion of fig. 2. (Lettering as in fig. 2.)

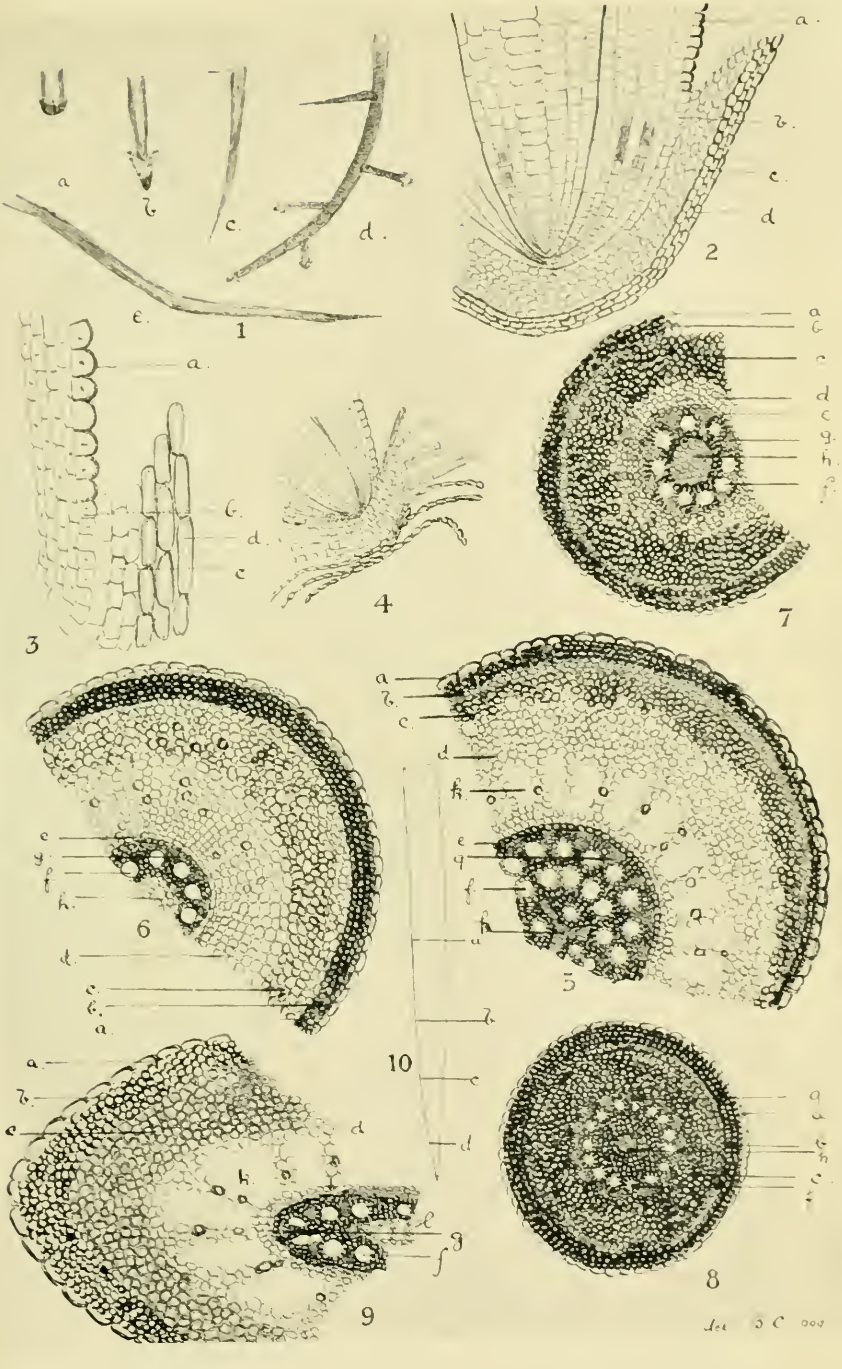
,, 4. L.S. of an older root showing the peeling off of both outer and inner root-caps in layers.

,, 5. T.S. of the axis of a branched aerial root. A T.S. of the axis of an unbranched root (fig. 10, *a*) would be similar.
- *a*. epidermis.
- *b*. protective sheath (*Schützhülle*).
- *c*. outer cortex.
- *d*. inner cortex.
- *e*. endodermis.
- *f*. xylem tracheids.
- *g*. phloem.
- *h*. pith.
- *k*. aerenchyma with thickened cells at intervals.

,, 6, 7, 8 (corresponding to figs. 10, *b*, *c*, *d*). Successive stages across metamorphosed aerial root showing loss of aerenchyma and hardening of tissue. (Lettering as in fig. 5).

,, 9. T.S. across flattened base of aerial root. (Lettering as in fig. 5.)
- *k*. cortical aerenchyma.
- *l*. pith aerenchyma.

Photographed by R. M. Adam.



Miss Bertha Chandler.

Note on the Septa in Root Vessels of Bromeliaceæ. By Rev. James Waterston, B.D., B.Sc. (Plate III.)

In cutting transverse sections of the hypogeal roots of many of the Bromeliaceæ one discovers frequently lignified bars stretching across the lumina of the vasa. These are thickened portions of the terminations of the vascular elements. As these septa—for such they are till the cellulose membrane between the bars has broken down—generally run obliquely to the longitudinal axis of the root, one seldom finds them complete in a section of normal thickness. By taking sections a little thicker than usual one can note the nature of the pattern on the septum. Often this simply reproduces the thickening on the walls of the vasa. A common type, fig. 3, shows a series of parallel bars between which the original membrane has disappeared. Thus the lumen of the vas is at intervals crossed by a series of oblique gratings. Sometimes lignification goes further. The bars may be interconnected, and a somewhat reticulated septum results, fig. 4. Possibly owing to the strain being less, the original membrane may in such cases be preserved intact. Its presence can be demonstrated by staining with a suitable reagent.

Recently, in almost perfectly transverse sections from roots of *Puya* (three spp.), characteristic septa were noted. Their thickening does not copy that on the walls of the vas. It is broad and stout, with few bars on each septum. The original membrane may persist, fig. 1, or may be ruptured, figs. 2, 5. This often takes place irregularly, but in one case (*P. chilensis*) it is very definite. A septum of this sort must exercise a particular, regulative effect on the passage of any fluid through the vas.

Doubtless also, when every trace of the cellulose membrane has gone, the struts of the septum will still be of considerable mechanical importance for the plant. In almost any root that would be the case. But it is an arrangement of special value for the Bromeliads. In this group the vasa are arranged in a peripheral zone round the thickened pith. Proximally they are embedded, it may be for fully two-thirds of their circumference, in a mass of sclerenchyma, outwardly they are bounded by much weaker tissues—protoxylem, soft phloem, and wood parenchyma. The walls thus unequally supported must be better able to resist distortion, owing to the presence at intervals of these strengthening bars.

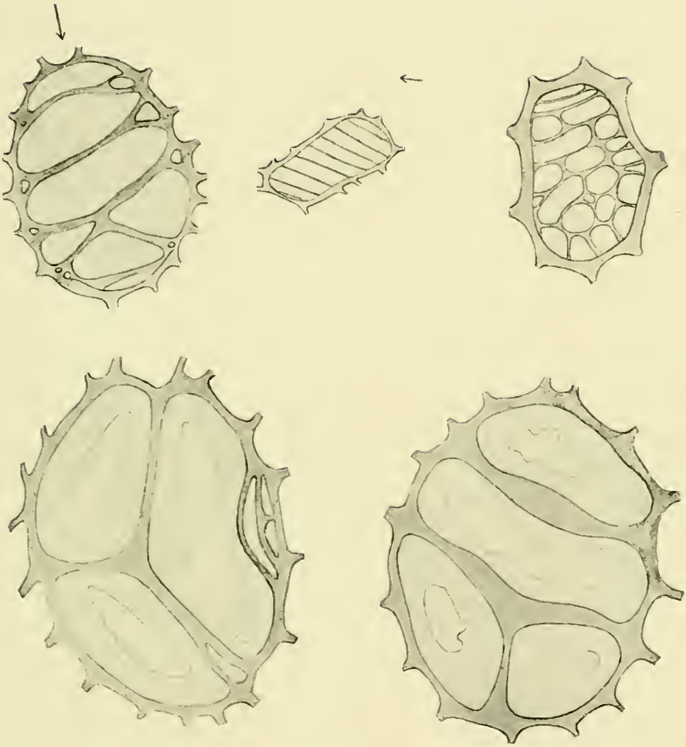
Good preparations of these septa can be obtained by immersing the sections for twenty-four hours in aniline-water-safranin, washing out with weak acid alcohol, and then counterstaining with aqueous methyl blue. If the washing out is checked at the right moment, the red and blue of the bars and septum respectively are pure and their contrast decided.

MORPHOLOGICAL CHANGES INDUCED IN ROOTS OF BROMELIACEÆ BY ATTACK OF HETERODERA SP. By Rev. JAMES WATERSTON, B.D., B.Sc. (Plates IV., V.)

The object of this communication—which cannot claim to be more than a preliminary notice—is to give a short account of changes induced in the various root tissues of the Bromeliaceæ by the presence there of a species of *Heterodera*. A more thorough examination has been made of the parasite's ravages in *Pitcairnia* and *Billbergia*, but, while the following observations were made on species of these genera, the attack is not confined to them.

Heterodera is a genus of the Tylenchidæ, a family of Nematode worms. Tylenchi, the stem-eel worms, are only too well known to agriculturists in Britain and elsewhere from their devastation of cereals. *Heterodera*, first recognised in the early sixties, shares this evil family reputation. *H. schachtii*, Schmdt., *e.g.* causes "beet-sickness," sometimes so severe that one-third of the crop (5) is destroyed. Like Tylenchus it attacks wheat (2), barley, etc. Cabbage (3) has also been injured. *H. radicicola* (4) was found in the Sahara to invade carrots, turnips, beets, tomatoes, the egg-plant (*Solanum Melongena*), onions, and celery.

It would be out of place to describe in detail the anatomy, etc., of *Heterodera*. But one or two points in its structure and life-history may be mentioned for an understanding of its characteristic attack.



1. Pitcairnia cærulea. 3. Puya sp. 4. Tillandsia Lescaillei.
2. Puya chilensis. 5. Puya chilensis.

J. W. *del.*

The worm is well adapted to its specific life conditions (1). Both sexes have a strong mouth-prick, swollen proximally, by which the host's tissues are pierced and fixation there effected. When not exserted the style lies in a buccal groove immediately behind which is situated a bulbous muscular gizzard. This sucks in the juices of the host.

Marked sexual dimorphism occurs. The ♂, which when adult is recognisable by its six-rayed chitinous cap or "calotte," never loses its vermiform facies. But the ♀, which undergoes one ecdysis less than the ♂, and in fact retains its larval skin when adult, is greatly changed after impregnation. The reproductive organs and the alimentary tract become enormously swollen. Ultimately the worm is lemon- or citron-shaped. The genital pore from being lateral is shifted to a distinctly terminal position.

The larvæ of *Heterodera* are free living in the soil. At first they cannot be sexually distinguished. In some respects they resemble the adults, but differ in possessing pointed tails. After a time they attach themselves to the host plant, where the ♀ remains for life, falling off in the end either as an empty skin or as a brood-chamber for the young. The ♂ reaches maturity while attached to the plant. He then leaves it to find the ♀. Just before leaving he has assumed his peculiar head-dress. The larva is destitute of it; so too is the ♀, though in her case a covering of hardened sap simulates the "calotte" of the ♂.

Within the body of the gravid ♀ the embryos develop, and in their escape cause the death of their mother. The young may frequently be observed within a mucilaginous drop at the anal end of the parent. After hatching they make their way to the soil, where the life-cycle (four to five weeks) goes on as before. During the winter the unhatched larvæ of the last brood shelter in the skin of the dead mother.

Heterodera schachtii, Schmdt., does not penetrate at all deeply into the tissues of the plants attacked. *H. radicicola*, and the form of which we are now speaking, on the contrary, live embedded in the host.

With respect to the former, the account of Vuillemin and Legrain (4) is here given without comment. These investigators found at El Oued (Sahara) that the majority of the market-garden plants in cultivation were attacked. But the results were not uniform. Turnips and carrots were injured; beetroot, etc., throve when *Heterodera* was present, but languished in its absence. In the latter case, in fact, only stunted, immature plants could be raised. This fact was at first regarded as a coincidence merely. Histological investigation showed, however, that the worm had brought about a useful modification of the tissues. Vuillemin and Legrain thus regard the association "comme une véritable symbiose." Further, they conclude, *Heterodera*, which in a moist[1] environment makes such havoc among root crops, produces most salutary effects in plants grown among arid desert sands. The injured carrots and turnips already referred to, at an early stage succeed in overcoming the parasite's beneficent action. Hence in their dry surroundings it becomes impossible for them to develop succulent tap roots. *Heterodera* has great resisting power to drought, and can lie dormant for a time. It thus proves a useful ally of the higher vegetation, "dans un milieu dont l'aridité exclut les symbioses cryptogamiques."[2]

The external symptom of the presence of *Heterodèra* was a swelling of the root, spindle-shaped in Monocotyledons, round more or less in Dicotoyledons. Transverse sections showed the following state of affairs:—In the vicinity of the worm, certain of the elements, both in the primary and in the secondary wood, were transformed at an early stage into greatly swollen "utricles."[3] These bladder-like formations had collenchymatous walls with numerous water passages. The original cell had undergone division, without apparently formation of cell walls, till each "utricle" contained a multinucleated mass of protoplasm

[1] "Dans les serres ou dans les champs des contrées humides."

[2] For in the desert Leguminous plants when sown fail to produce mycodomatia on their roots.

[3] The value of this modification depended entirely on the environ ment. At El Oued the garden soil, to a depth of 50 m., is nothing but sand. Twice a day the soil is liberally watered. Thanks to the structure induced by the parasite's attack, the plants take up sufficient liquid to last them in the interval. Turnips and carrots resist the formation of those giant multinucleated cells. The collenchymatous "utricle" in their case collapses at an early stage, or it is filled by a cell formation in which starch deposits. Thus though the roots may survive owing to their fleshy nature, they never become so succulent as others in which the attack has been successfully established.

rich in reserve nitrogenous matter and without starch. As the structures just described abut on the vasa, they were able to draw water thence, store it for a time, and then pass it on to the thirsty cells around them.

In the Bromeliaceæ the roots frequently show swellings near the tip. But in general the effects of the attack of *Heterodera* can best be seen in fusiform enlargements some distance back. These are inconspicuous until they have split open.[1]

Rupture often takes place in the line of their long axis. The cortex is pierced. Sometimes even the vasa of the central cylinder are laid bare. Occasionally, with a lens, white specks in the innermost recesses of the fissure can be detected. These are, of course, the ♀ *Heterodera* swollen with eggs.

Now, because of the structure of the normal root, these ruptures, setting aside the hypothesis of some mechanical disturbance, challenged investigation. In the Bromeliaceæ the root cortex shows in its middle a sheath of exceedingly hard sclerenchyma (Plate V. fig. 1). Section cutting is often a matter of great difficulty. But wherever these white specks could be made out, the sheath had evidently been pierced by some agent. Transverse sections showed an even more remarkable state of affairs, viz. that the sheath appeared never to have formed at the spots referred to. On one side of the section the thickened libriform sclerenchyma was replaced by a mass of thin-walled cells.

The following is a general account of the changes observed :—

In some extreme cases the whole of the central cylinder with the inner cortex had perished. The root was reduced to a sheath of sclerenchyma surrounded by the dried remains of the outer cortex. Occasionally traces of the piliferous layer could be distinguished. More often every indication of it had vanished.

Where the destructive process had not gone so far the surviving tissues showed more or less disorganisation.

[1] The swellings at the tip have been investigated without, however, yielding any data that cannot better be taken from the second point of attack.

(*a*) The pith, whose cells are, as a rule, wholly lignified, peripherally at least, was scarcely abnormal. The thickening[1] was hardly so pronounced as usual. Its outline might be distorted. It has, however, never been observed to be invaded by the parasite.

(*b*) In the Bromeliaceæ the vasa of the main roots are symmetrically ranged about the pith. *Heterodera* often occurs in the vasa where these are large, as *e.g.*, in *Pitcairnia* spp. In some instances the parasites, dissected out from this position, were found to have attached themselves to the wall next the pith.

Where the worm is established the walls of the vas and those of the neighbouring wood parenchyma remain thin (Plate IV. fig. 5). Sometimes they are found broken down—thus preparing the way for the condition first described.

(*c*) The phloem seems seldom to be invaded. But in the vicinity of an attack it may share in the hypertrophy induced (Plate IV. fig. 2, *ph.*).

(*d*) The protoxylem may afford the parasite lodging and be obliterated. But even if the attack be only near a patch of protoxylem there may be marked increase in the size and number of the elements, *e.g.* a species with normally three small vessels has shown as many as seven or eight (Plate IV. fig. 3).

(*e*) Generally *Heterodera* is found lying in a gall (Plate V. figs. 2, 3), whose long axis is roughly in a plane at right angles to the long axis of the root. Occasionally it may be placed otherwise—even parallel to the root axis. The gall itself is apparently formed from the innermost layer of the inner cortex, the endoderm, and the pericycle. Its walls consist of one or two layers of compressed cells which have been flattened against one another by the growth of the parasite.

Of the creature as found little can be said. Only the ♀ has been noted. Doubtless the ♂ and larvæ will be found when searched for in the soil. The ♀♀ occur commonly

[1] In one instance, however (Pl. IV., fig. 4), the pith consisted almost entirely of parenchyma.

in a large number of Bromeliaceæ in cultivation in the Royal Botanic Garden, Edinburgh. Plants from the Botanic Garden, Glasgow, also show the same attack.

No anatomical details can, as a rule, be made out in these ♀♀. Practically all examined have been in the last stage—nothing more than sacs of eggs or more or less empty skins containing some protoplasmic debris. Occasionally large nuclei may be seen—apparently the last traces of the alimentary canal. A section of the creature's attack in a vas thus often shows merely a clear thick zone lining the cavity. Within there is a film of protoplasmic matter (Plate IV. fig. 5). The clear zone referred to is, of course, the thick and practically unstainable epidermis characteristic of Nematodes.

I do not know of any measurements made in the case of *H. schachtii* and *H. radicicola*. The present attack may be the work of a distinct species or even of more than one species, should the form infesting plants in the Royal Botanic Garden, Edinburgh, prove to be different from that found in Glasgow. The following dimensions may be given :—

	Length.	Breadth.
1. Adult ♀ from *Pitcairnia* sp. (lemon-shaped). Edinburgh .	·588 mm.	·35 mm.
2. Much younger ♀ from *Pitcairnia* sp. (shaped like a Florence flask)	·448 mm.	·168 mm.
(This example began to narrow at a point ·21 mm. from the genital aperture. It there measured ·07 mm. in breadth.)		
3. Eggs of ♀ No. 1, still in the body of the mother . .	·084 mm.	·028 mm.

Satisfactory measurements of the endodermal galls have not yet been obtained for all three dimensions. In a number of sections taken from a root of *Pitcairnia bracteata* (Glasgow Botanic Garden) the length of the gall is ·252 mm. and the breadth ·112 mm.

In a gall from an Edinburgh plant (*P. corallina*) the transverse measurements are ·154 and ·112 mm. respectively. The length cannot be determined.

The worm then, one would imagine, must be under pressure. Apparently, too, it may be folded on itself within the gall, but details are not easily made out.

Changes in the tissue near the gall have now to be described.

Very characteristic are the effects on the endodermis itself. Sometimes all trace of this in the immediate vicinity is lost. But, as a rule, it persists with the radial walls slightly elongated where the cells abut on the point of attack. For some distance on either side of the gall the radial walls of the endoderm are unthickened. Further round the normal thickening reappears. Thus an attacked root in T.S. shows an endodermis consisting on one side of thin parenchyma, on the other are the usual horseshoe-shaped cells (Plate IV. fig. 2).

The pericycle, under the irritation of *Heterodera*, divides tangentially (Plate IV. figs. 2, 3, *p*), and may form a layer three to four cells deep.

The effect on the cortex too is distinct. In T.S. there appears a broad proliferation of thin-walled cells stretching outwards from the endodermis and widening as it goes. This mass of cells must originate from the inner cortex while that is still capable of division. The sheath of sclerenchyma, which forms in Bromeliads a mid-cortical layer, never is found opposite a gall (Plate V. figs. 2–4). *Heterodera* in some way inhibits the deposition of thickening matter on the cell wall. Two advantages in all probability directly follow. There is reduced pressure, while additional moisture may come in from the outside. Further, as rupture takes place latterly in this proliferated region the young *Heteroderæ* find prepared a passage to the soil where the early stage of the life-cycle is passed.

One curious feature of this mass of thin-walled cells is that here and there in it occur isolated elements over which *Heterodera* has had no inhibiting influence (Plate V. fig. 2). They are more or less completely lignified. Where the unthickened tissue joins the sheath there is frequently a gradual transition from such isolated cells to a broad continuous band of sclerenchyma. In other cases the line of demarcation is sharp.

As regards the final result of the attack, it has already been remarked that in extreme cases the entire central portion of the root is killed below the point of the worm's lodgment. In many instances—where the attack has been severe—the cells of the tissue a little above the parasite have been thickened or filled up. But as this condition is frequently observed in old normal roots or where there has been mechanical injury, one can have no confidence in connecting it directly with the presence of *Heterodera*.

In one instance, however, the root had apparently reacted successfully against the worm. T.S. showed a triangular gaping wound reaching almost to the pith. In this space presumably the worm had been situated. Inside the thickened sheath a second, much narrower than the first, had formed. Opposite the wound this new sheath bent inwards, traversing the inner cortex, endodermis, etc., and effectually cutting off the injured area. About one-third of the functional central cylinder was thus salved. In the portion cut off the cells were either lignified or filled with gum, while the soft tissue which had caused the gap seem to have been suberised.

The nature of the tissue made no difference to its fate, cortex, endoderm, pericycle, phloem, and vasa were alike filled up.

There are some interesting points in a comparison of the present attack with that noted by MM. Vuillemin and Legrain. The Bromeliaceæ are epiphytes and xerophytes in tropical America. Their environment, therefore, is in some respects comparable to that of the plants grown at El Oued in the Sahara. In both cases the parasite is internal and causes hypertrophy of the tissues. There is, however, nothing in the cell proliferation noted in the Bromeliads analogous to the "utricles" of V. and L., with their multinuclear protoplasmic contents, which are supposed to benefit the host. So far as the Bromeliaceæ are concerned, it is extremely unlikely that at any time *Heterodera* comes under this beneficent category. Conceivably at the first it may stimulate the root tip to greater activity and cause a more copious water-supply. But for this there is at present no evidence. Everything points to the association of worm and root as one of malignant parasitism.

I have to thank warmly the following gentlemen :—

Professor Bayley Balfour, who has provided every facility for investigating the Bromeliaceæ under his charge in the Royal Botanic Garden, Edinburgh. Mr. L. Stewart has also assisted in many ways. I am indebted also to the Glasgow authorities and to Mr. Rourke, superintendent of the gardens there, for some valuable material.

Mr. W. E. Evans, B.Sc., very kindly made slides from sections illustrating the attack.

To my friend Dr. Ashworth I have been greatly obliged throughout. He has helped me in the identifying of the parasite, in searching for literature, by several discussions, and by the loan of slides of the life-history of *H. schachtii*, Schmdt., which were shown to the Society when this communication was first read.

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EXPLANATION OF PLATES.

PLATE IV.

Fig. 1. T.S. of Normal Bromeliad root, near endodermis. *Billbergia pallidiflora.*

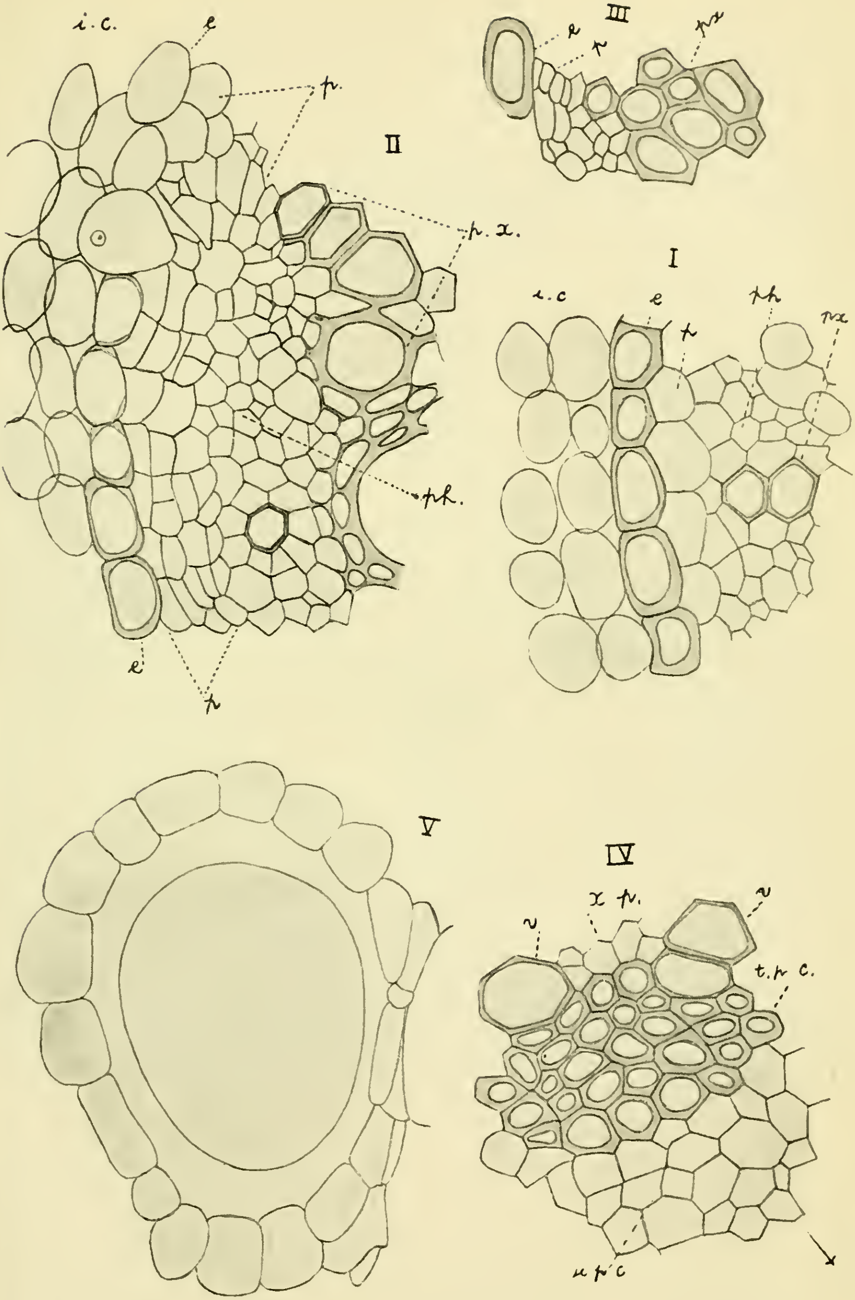
„ 2. T.S. of root (from large vas to inner cortex) near attack of *Heterodera* sp. *B. pallidiflora.*

„ 3. Hypertrophied protoxylem. *B. pallidiflora.*

„ 4. Pith and vasa. Thickening inhibited. *B. Saundersii.*

„ 5. Attacked vas to show parenchymatous walls persistent. *Pitcairnia corallina.*

i.c. inner cortex. *ph.* phloem.
e. endodermis. *p.x.* protoxylem.
p. pericycle. *v.* vas.
t.p.c. thickened pith-cells. *u.p.c.* unthickened pith-cells.
x.p. xylem parenchyma.



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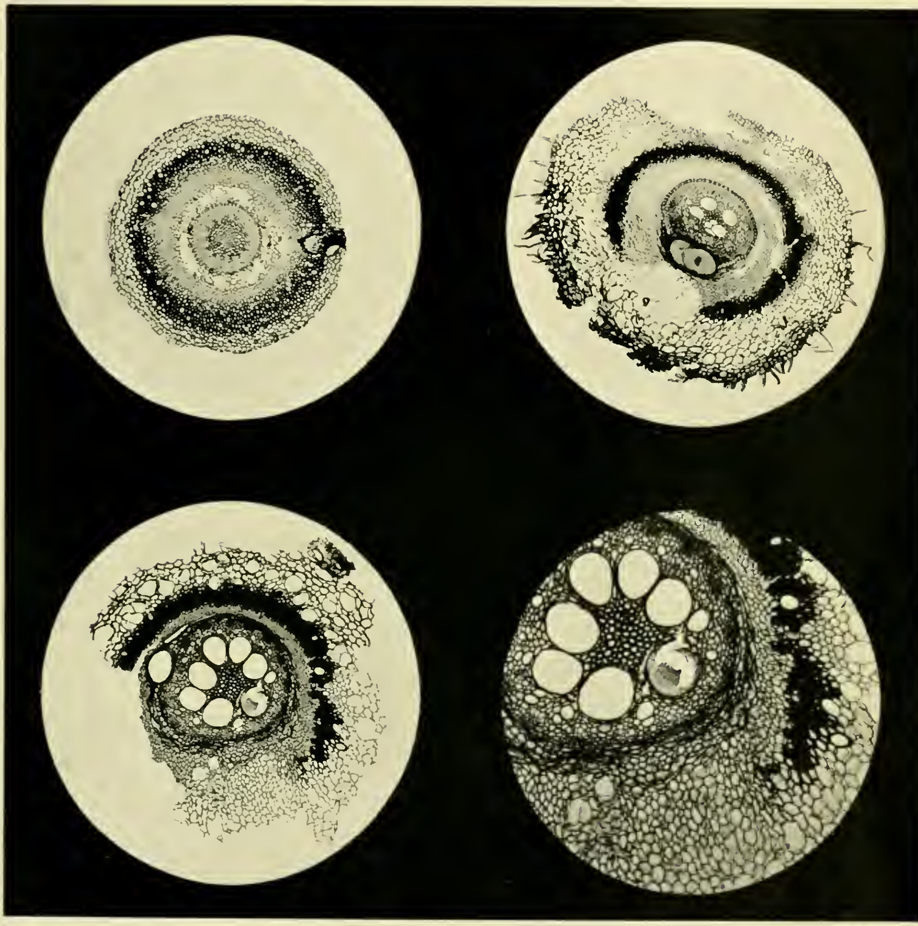

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Photographed by W. Edgar Evans.

PLATE V.

Fig. 1. *Tillandsia dianthoidea.* T.S., a normal root. The lateral thin parts of the cortical sheath are due to the emergence there of secondary roots.
,, 2. *Pitcairnia bracteata. Heterodera* ♀ *in situ* in endodermal gall, apparently slightly doubled. Note the isolated thickened cell.
,, 3. *Pitcairnia corallina*, badly attacked root. The endodermis and vasa have been occupied.
,, 4. The same, more highly magnified.

EXUBERANT LENTICEL FORMATION ON AN OAK SEEDLING. By Miss BERTHA CHANDLER, M.A., B.Sc. (Plate VI.)

At a former meeting of the Botanical Society Mr. Rutherford-Hill showed an oak seedling which had been sown in water, exhibiting, in consequence, abnormally developed lenticels on the roots. The specimen, which was eleven weeks old, was kindly given me by Mr. Rutherford-Hill, with another, seven weeks old. The photographs are from the former, the older specimen, which exhibited these outgrowths to a more marked extent than the latter.

Before examination under the microscope, these structures were thought to be "pneumathodes," but sections showed that they were rather lenticels having no differentiated structure apart from the lateral root which these encircled. The production of abnormal lenticels is very much akin to the artificial production of aerial roots, for the same factor, excess of moisture, favours the development of both structures. Just as pneumathodes can be induced in plants by cultivation under water, so abnormal lenticel formation, caused by the accelerated division of the lenticel initials, can also be induced. The oak seedling figured is an example. Terras,[1] speaking of abnormal lenticels occurring on stems, says that under similar conditions the same thing occurs on roots. The two main factors, the abundance of moisture and the reduction of the pressure owing to the slight resistance of the medium in which the seedling is grown, account for the abnormal development of these

[1] "Trans. Bot. Soc. Edin.," xxii. p. 450.

lenticels. The presence of the water has so accelerated cell division that two or more lenticels have cohered and formed the bell-like sheath around the lateral root.

EXPLANATION OF PLATE.

Fig. 1. Photograph of oak seedling, showing lenticels.

Fig. 2. Same, enlarged. *a,a*, exuberant lenticels ; *b*, lateral rootlet.

Fig. 3. T.S. of root (median section) showing *a*, *a*, lenticels ; *b*, lateral rootlet.

Fig. 4. L.S. showing *a*, *a*, lenticels ; *b*, lateral rootlet.

Fig. 5. T.S. across root showing lenticel cut below a lateral rootlet. *a*, lenticel.

NOTES ON THE FLORA OF THE SCILLY ISLES.

By W. W. SMITH, M.A.

The first detailed account of the flora of the Scilly Isles is given by F. Townsend in the "Journal of Botany," vol. ii., 1864, pp. 102–120, where 348 species are recorded. The next addition is given by M. A. Lawson, 24 species, "Journal of Botany," 1870, vol. viii. pp. 357–358. In vol. xxxi., 1893, pp. 118–120, is a further list by A. Somerville giving 44 more, and in the same volume, pp. 265–267, 64 more, culled by E. D. Marquand from the unpublished papers of Ralfs on the Flora of West Cornwall. Ralfs visited the islands before Townsend, and the above 64 represent those in his original list which were not recorded in the above three communications.

The writer of this note visited the group in August 1906, and the twenty plants mentioned below are, I believe, new records. This makes a total for the islands of 500 species, of which 385 are Dicotyledons, 98 Monocotyledons, and 17 Filices.

Papaver somniferum, L.—Tresco. Occasional.

Crambe maritima, L.—Old Town shore, St. Mary's : Tresco, St. Agnes.

Armoracia rusticana, L.—Tresco.

Brassica tenuifolia, DC.—Tresco. Rare.

Viola tricolor, L.—St. Mary's.

Viola tricolor, L., var. *arvensis*.—St. Mary's, St. Martin's.

Lychnis vespertina, Sibth.—St Agnes. Rare.

Medicago denticulata, Willd.—St. Mary's, Old Grimsby, Tresco.

Epilobium hirsutum, L.—Old Town marshes. Rare.

Carum Petroselinum, Benth.—Hugh Town, Tresco.

Caucalis Anthriscus, Huds.—Hugh Town.

Picris echioides, L.—Roads about the Castle and Hugh Town.

Hieracium umbellatum, L.—St. Mary's.

Vinca major, L.—St. Mary's. No doubt an escape.

Verbascum nigrum, L.—Sandy flats in Tresco.

Symphytum officinale, L.—Hugh Town, St. Martin's. Rare.

Veronica Buxbaumii, Ten.—St. Mary's.

Polygonum maritimum, L.—N. of Tresco.

Iris fœtidissima, L.—Tresco dunes.

Phalaris canariensis, L.—Hugh Town, Tresco.

Most of the above species are probably introductions of late years. Conditions of cultivation have changed much since the trade in early spring flowers was started, and intercourse between the islands and the mainland has greatly improved.

The writer visited all five inhabited islands and a considerable number of the small rocky islets. Most corners were carefully examined and the conclusion come to that these lists represent pretty nearly the total possible in the group.

I am adding a few notes on some previously recorded species to supply localities omitted in previous records.

Glaucium luteum, Scop.—Shores near Hugh Town, Samson, Tresco, Bryher. Common and very luxuriant.

Nasturtium officinale, R. Br.—Not uncommon in the marshes of St Mary's.

Alyssum maritimum, L.—Not uncommon in St. Mary's on the tops of old walls.

Silene maritima, With., is uncommon, but observed in several places on St. Mary's as well as on Samson—not on the shore, but on the cliff some distance from the sea.

Lavatera arborea, L., is very abundant on some of the uninhabited islands such as Mincarlo, and seems to be indigenous.

Trifolium repens, L., var. *Townsendii*, is still abundant in the old locality near the lake in Tresco.

Angelica sylvestris, L., was very luxuriant in marshes in St. Mary's, attaining nine feet.

Anthemis nobilis, L., is very common in the herbage in St. Mary's.

Sonchus arvensis, L.—Tresco, St. Mary's. Forms a conspicuous plant on the cliffs.

Samolus Valerandi, L.—Occasionally on the cliffs where there is slight accumulation of debris.

Plantago Coronopus, L., is very luxuriant on the shores, while *P. maritima* seems to be lacking.

Antirrhinum Orontium, L.—St. Mary's, St. Martin's, St. Agnes, Tresco.

Scrophularia Scorodonia, L.—St. Mary's, St. Martin's, Tresco, Samson, St. Agnes.

Briza minor, L.—Scattered by roadsides in St. Mary's.

Pteris aquilina, L., is the predominant plant in the uncultivated parts of the islands and is very luxuriant.

Here and there in the islands garden plants have established themselves such as species of *Mesembryanthemum*, *Geranium*, *Physalis*, *Muhlenbeckia*, while species of *Veronica*, *Euonymus*, and *Escallonia* form luxuriant hedges. St. Agnes is the reputed locality for *Acanthus mollis*, L. I failed to find it there, but saw two plants on St. Mary's, where in all probability they were escapes from cultivation.

TWEEDSIDE ALIEN PLANTS. By MISS IDA M. HAYWARD.

The Tweed district is specially rich in alien plants—a result due doubtless to the fact that the river and its tributaries flow through so many wool-manufacturing towns. Seeds picked up in their native countries become detached from the wool in the process of washing. A considerable proportion find their way into the river and, ultimately becoming lodged in congenial soil, take root and grow. Thus on deposits of alluvium and banks of shingle natives

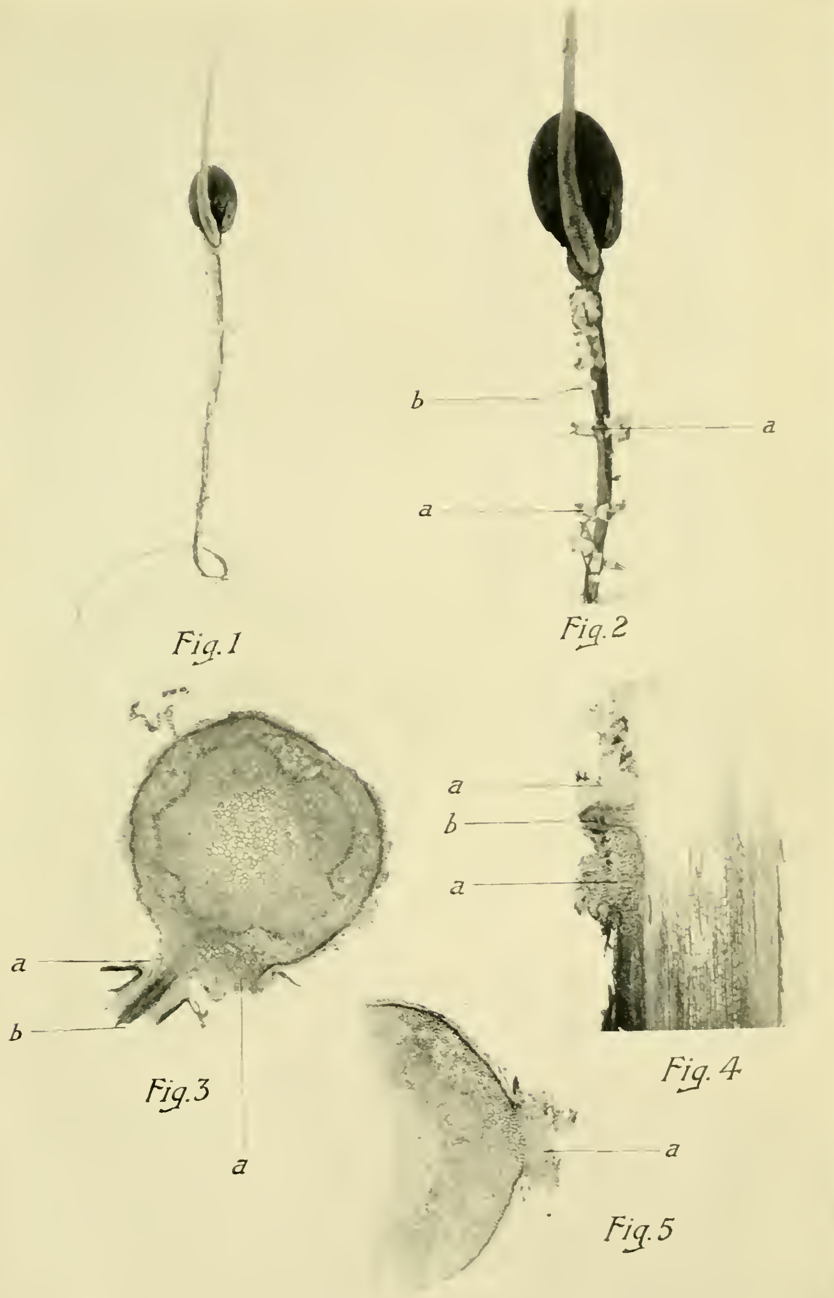


Fig. 1 Fig. 2 Fig. 3 Fig. 4 Fig. 5

Miss Bertha Chandler.

of Australia, New Zealand, and South America flourish together for some distance below the manufacturing towns. In favourable summers like that of last year some of these plants may be selfsown, but as a rule these aliens die down annually and the supply is kept up by the introduction of fresh seed. Possibly some may be naturalised in process of time. In any case it can hardly fail to be of interest to place on record a list of aliens recently found on the banks of the Tweed.

During last year the writer has collected frequently on the banks of the Tweed and its tributaries, on some occasions with the assistance of Mr. James Fraser. In all 139 spp. have been found: 9 are new to Britain—6 having already been exhibited[1] to the Society, while 3 have been noticed by Mr. Fraser in the "Annals of Scot. Nat. Hist.," Jan. 1909, p. 40 ff. The others are included either in Druce's "List of British Plants," or in Dunn's "Alien Flora of Great Britain."

Below there is given a list of some previous notices of alien plants from Tweedside:—

1829. "Flora of Berwick-on-Tweed." Dr. Geo. Johnston. Includes 6 of the spp. now recorded.
1869. "Proc. Berwick Nat. Club." Stuart. 14 from Tweed and Gala.
1872. *Ibid.* "Tweedside Plants of Recent Introduction." Brotherston. (18.)
1876 *Ibid.* Rev. Jas. Farquharson, M.A., in "List of Flowering Plants and Ferns observed in Selkirkshire," gives 8 aliens.
1902. "Lauder and Lauderdale." Thomson. In the list of plants by Kelly and Shaw are 16 aliens.
1903. "Trans. Bot. Soc. Edin." Trail refers to 25 species.
1905. "Ann. Scot. Nat. Hist." Druce notes 5 near Melrose.

Of course the same plants figure often more than once in the above lists. After making all deductions, one finds that 68 of the species now enumerated have not been previously recorded from "Tweed."

For the identification of *Atriplex spongiosa*, F. von Muell, I am indebted to Professor Bayley Balfour, F.R.S., F.L.S. My best thanks are also due to Mr. James Fraser, who has gone over the ground with me on several occasions. I have also to thank the authorities of the Herbaria at Kew, South Kensington, and Cambridge, for determining some of the

[1] See Proceedings for 12th November of present issue (p. iii.).

rarer plants and for assistance rendered on the occasion of my visits last autumn to the collections under their charge.

Aconitum Napellus, L.—Several plants on Weirhill, Melrose.

Papaver dubium, L.—Several, Galafoot.

P. hybridum, L.—Near Galafoot, one plant growing by the river Tweed.

P. nudicaule, L.—Plentiful at Galafoot, on rubbish.

P. somniferum, L.—Several, on rubbish at Galafoot.

Arabis albida, Stev.—A colony at Galafoot.

Armoracia rusticana, L.—Several plants on bank of Tweed at north end of Suspension Bridge, Melrose.

Barbarea præcox, R. Br.—One plant at Galafoot.

Brassica alba, Boiss.—Several plants, Galafoot.

B. nigra, Koch.—Two or three, Galafoot.

Cheiranthus Cheiri, L.—Abbey walls, Melrose.

Hesperis matronalis, L.—A colony, Galafoot.

Lepidium Draba, L.—Galafoot, plentiful.

L. ruderale, L.—Galafoot, several.

L. sativum, L.—Abundant by sides of Gala and Tweed.

L. virginicum, L.—One or two plants, Galafoot.

Malcolmia maritima, R. Br.—One plant, Lindean.

Raphanus Raphanistrum, L.—Common, Galafoot.

Senebiera pinnatifida, DC.—Plentiful, Galafoot.

Sisymbrium orientale, L.—Abundant, Galafoot to Melrose.

Thlaspi arvense, L.—Common along the Tweed.

Lychnis Githago, Scop.—Several, Galafoot.

Silene gallica, L.—Two or three, Galafoot.

S. noctiflora, L.—Several, Galafoot.

S. rubella, L.—One plant, Galafoot.

Malva moschata, L.—One or two plants, Galafoot.

M. parviflora, L.—A single plant, Galafoot.

Linum usitatissimum, L.—Plentiful on shingle banks of Gala and Tweed.

L. perenne, L.—One or two plants, Tweedside.

Erodium moschatum, L'Hérit.—Two or three plants, Galafoot.

Medicago denticulata, Willd.—Very abundant, growing to large plants when well nourished, such as on wool heaps, etc., and in gardens. To be found from Galafoot to the mouth of the Tweed.

M. denticulata, Willd. var.—On shingle, Tweedside, near Galafoot.

M. laciniata, Mill.—Plentiful, banks of Tweed.

M. maculata, Willd.—Common from Galafoot to Newstead.

M. minima, L.—On shingle banks of Gala and Tweed, plentiful, owing, no doubt, to the warm summer of 1908.

M. sativa, L.—Galafoot.

Melilotus alba, Desr.—Amongst grass above Galafoot, a single plant.

M. arvensis, Wallr.—One large shrub, bank of Gala.

M. indica, All.—A single plant at the mills, Gala.

Pisum sativum, L.—A few, Galafoot.

Trifolium angustifolium, L.—A single plant, Galafoot.

T. resupinatum, L.—Tweedside, on shingle, several.

Lythrum Hyssopifolia, L.—Plentiful from Galafoot to Newstead.

Ammi Visnaga, L.—Galafoot, one plant.

Caucalis leptophylla, L.—Two or three plants, bed of Gala and Tweedside.

Peucedanum Ostruthium, Koch.—Dryburgh, V.C. 80, been there since 1872; and Ettrick Bridge end, V.C. 79.

Valeriana pyrenaica, L.—Yair Bridge and Langlee Woods.

Dipsacus Fullonum, L.—Tweedside, several.

Bidens tripartita, L.—A single plant, Galafoot.

Calendula officinalis, L.—Several, Galafoot.

Calotis hispidula, F. Muell.—On banks of the Tweed, plentiful. A native of Australia.

**Cenia turbinata*, Pers., var. *concolor*.—A single plant, on shingle bed of Gala. It is a common weed through Cape Colony.

Carduus argentatus, L.—Several, Galafoot.

Centaurea Cyanus, L.—Several, Galafoot.

C. melitensis, L.—Very plentiful from Galafoot to Newstead.

C. solstitialis, L.—A single plant, Galafoot.

Cotula australis, Hook. f.—A single plant at Galafoot, gathered by Mr. Fraser.

C. coronopifolia, L.—A few specimens found on moist soil, Tweedside. Native of Australia, New Zealand, South Africa, extra-tropical South America, and some parts of Europe, especially near the sea.

Doronicum Pardalianches, L.—Banks of the Yarrow, Duchess' Walk.

Erigeron acris, L.—Several, Galafoot.

Gnaphalium luteo-album, L.—One plant, Tweedside.

Guizotia abyssinica, Cass.—Plentiful, but scarcely flowers.

**Helipterum corymbiflorum*, Schlecht.—Tweedside. A native of Australia.

Hypochæris glabra, L.—Plentiful, Galafoot.

Lactuca sativa, L.—Galafoot, several.

Madia sativa, Molina.—In several places from Galafoot to Melrose.

Matricaria Chamomilla, L.—Two plants, Galafoot.

M. inodora, L.—Several, Galafoot and along the Tweed.

Petasites fragrans, Presl.—A colony, Weirhill, Melrose.

**Senecio brachyglossus*, F. Muell.—Bed of the Gala, a few plants native of Australia.

**S. lautus*, Forst.—Banks of Gala and Tweed, plentiful. A native of Australia and New Zealand.

S. viscosus, L.—Common at Galafoot and all along the Tweed.

Solidago lanceolata, L.—Banks of Gala, several colonies.

Xanthium spinosum, L.—Abundant, Galafoot and along the banks of the Tweed, but did not flower.

Echinospermum Lappula, Lehm.—A single plant, Galafoot.

Lithospermum arvense, L.—Several, Galafoot.

Lycopsis arvensis, L.—Several, near Melrose.

Lycopersicum esculentum, Mill.—Plentiful along the river banks.

Solanum Dulcamara, L.—Colony at mouth of Gala.

Linaria Cymbalaria, Mill.—Several, Galafoot.

L. vulgaris, Mill.—Plentiful, Galafoot.

Mimulus Langsdorffii, Donn.—Very abundant, almost from the source of Gala to its junction with Tweed.

M. guttatus, DC.—A large patch in Caddon below Clovenfords; one plant at Melrose.

Mentha viridis, L.—By the side of the Gala, a colony.

Herniaria hirsuta, L.—Galafoot and on mill wall, Galashiels.

Paronychia bonariensis, DC.—A single plant at Galafoot. Native of the Argentine.

Amaranthus Blitum, L.—Banks of the Tweed, a few plants.

A. retroflexus, L.—Sides of Gala and Tweed, plentiful.

Atriplex patula, L.—Galafoot, several.

**A. spongiosa*, F. Muell.—Growing plentifully at the junction of the Gala and the Tweed. The berry-like spongy fruit is the interesting part of this plant. A native of Australia.

Chenopodium ambrosioides, L.—A single plant in the bed of the Gala.

C. rubrum, L.—Several, Galafoot.

Fagopyrum esculentum, Moench.—A single plant, Galafoot.

Polygonum lapathifolium. L.—Plentiful, Galafoot.

**Rumex Brownii*, Campd.—Growing plentifully between Galafoot and Melrose.

Euphorbia Esula, L.—A colony, stone bridge above Melrose.

Cannabis sativa, L.—Mouth of the Gala and along the river Tweed; a few plants here and there.

Agrostis retrofracta, Willd.—On shingle between Galafoot and Melrose. An Australian grass, identified for Mr. Fraser by Professor Hackel.

A. verticillata, Vill.—Galafoot; a single plant, verified by Professor Hackel for Mr. Fraser.

Apera Spica-venti, Beauv.—Plentiful between Galafoot and Melrose.

Avena fatua, L.—Several, Galafoot and Melrose.

Briza minor, L.—A single plant, Galafoot.

Bromus hordeaceus, var. *molliformis*, Lloyd.—Several at Galafoot.

B. macrostachys, Desf.—One plant, Galafoot.

B. madritensis, L.—Two or three plants, Galafoot.

B. patulus, Mert. et Koch (*B. japonicus*, Thunberg).—Several, Galafoot.

B. rigidus, Roth.—One plant, Galafoot.

B. secalinus, L.—Several, Galafoot.

B. tectorum, L.—One or two plants, Galafoot.

B. unioloides, H. B. et K.—Several, Galafoot and Melrose.

Brachypodium distachyum, Beauv.—One plant gathered by Mr. Fraser.

Festuca Myuros, Linn.—Plentiful from Galafoot to near Melrose.

F. ambigua, Le Gall.—Several at Galafoot.

F. sciuroides, Roth.—Plentiful, Galafoot.

Hordeum marinum, Huds. — Plentiful, Galafoot and near Melrose.

H. murinum, L.—Plentiful, Galafoot and near Melrose.

H. vulgare, L.—Common along the river.

Kœleria phleoides, Pers.—Several from Galafoot to Newstead.

Lamarkia aurea, Moench.—Several at Galafoot and above Melrose.

Lepturus incurvatus, Trin.—Tweedside above Melrose, one clump, gathered by Mr. Fraser.

Lolium italicum, A. Br.—Common along the river.

Phalaris canariensis, L.—Several at Galafoot.

P. minor, Retz.—Two or three plants at Galafoot.

Polypogon maritimus, Willd.—On shingle, side of Gala, one or two plants.

P. monspeliensis, Desf.—Sides of Gala and Tweed, plentiful.

Secale cereale, L.—A few plants, Galafoot.

TRANSACTIONS AND PROCEEDINGS

OF THE

BOTANICAL SOCIETY OF EDINBURGH.

VOLUME XXIV.

PART II.

EDINBURGH:
PRINTED FOR THE BOTANICAL SOCIETY BY
NEILL & CO., LIMITED.
And to be obtained from the SECRETARY OF THE SOCIETY *at the Royal Botanic Garden.*
1910.

CONTENTS.

TRANSACTIONS

OF THE

BOTANICAL SOCIETY OF EDINBURGH.

SESSION LXXIV.

Presidential Address.

Ladies and Gentlemen,—In taking the chair this afternoon, I wish to express to you my very great regret that I should come to you with an apology for my having been unable to embody in my remarks, in opening the meetings of the Society for the year, any subject of scientific and botanical interest, but I have found that pressure of other matters has made that quite impossible for an amateur like myself, and though deeply interested in the work of the Society, I cannot pretend to take place along with those who from time to time submit communications for our consideration and discussion.

I must therefore content myself with, and ask you to pardon, the restriction of this address to a general statement of the position of the Society, and to our customary reference to those Fellows and Members of the Society who, during the year, have passed away. I am sorry to say that our membership shows some reduction. As the Society now stands we have: 5 British Honorary Fellows; 25 Foreign Honorary Fellows; 109 Resident Fellows; 43 Non-Resident Fellows; 53 Corresponding Members; 9 Associates; 6 Lady Members—making a total of 250 Members of the Society.

These 250, for the purpose of consideration as representing possible active membership, must be analysed. I find that all our Honorary Fellows, all our Corresponding Members, and nearly 70 of our Resident and non-Resident Fellows are either abroad or in England or resident at such distances from us here that they cannot be on what I might call the effective list, and we are left with about 100 others, many residing in the country districts, more or less able to attend our meetings and to take part in our work—a comparatively small number for a Society such as this, and a number I would like to see largely increased, especially in these days when there is so much general interest in botanical matters. During the year we have lost by death: 1 British Honorary Fellow; 3 Resident Fellows; 3 Non-Resident Fellows; 3 Corresponding Members; and by resignation 1 Resident Fellow, while we have added during the year 7 Resident Fellows and 1 Non-Resident Fellow. You will thus see that the Society's numbers are reduced by three as compared with last year.

Turning now to what should be communicated to you regarding those members who have passed away, I would first mention, as an outstanding name, that of the late Sir GEORGE KING, K.C.I.E., LL.D., F.R.S., who died at San Remo in February last, at the age of sixty-nine. He was elected an Honorary Fellow of the Society in 1895. Sir George King was an Aberdeenshire man, born there on 12th April 1840. He was educated at the Grammar School and at the University of Aberdeen. He studied medicine, and graduated in 1865 with the highest academical honours.

Botany had always been his favourite study, and he became for a time the assistant to Professor Dickie, the then Professor of Botany at Aberdeen University. Influenced by the advice of his academic friends at Aberdeen, he resolved to enter the Indian Medical Service. He studied at Netley, and in due time was posted to the Bengal Presidency. It is of interest to know that he was entrusted by Sir William Hooker to convey to India the first ipecacuanha to arrive in that country. This he cared for on the then much longer and more difficult voyage than now, and he handed it over in safety to the Calcutta Gardens in March 1866.

After a certain amount of medical service in India, his qualifications led to his being deputed to act temporarily as superintendent of the Botanic Gardens at Saharanp ur in the North-West Provinces—no doubt much more congenial work,—and from this he passed to the Indian Forest Service. Then in 1871 the superintendentship of the Royal Botanic Gardens at Calcutta, and of the Indian Government's cinchona-planting experiments in Bengal, as well as the professorship of botany in the Medical College at Calcutta, fell vacant, and Dr. King was appointed to these offices. It was no light duty that had been placed in his hands. Cyclones of earlier years had reduced the gardens at Calcutta to a most dilapidated condition, and the Government's cinchona plantations had been but a doubtful experiment. The beneficent Government of India, however, made funds available to Dr. King, and in a comparatively short time the work of a master-hand was seen. The gardens were restored and remodelled, glass-houses, palm-house, and herbarium buildings were provided, and the gardens began to possess all the charm and efficiency for which they are now so justly famed. In a similarly successful way Dr. King tackled the difficulties which had attended the cultivation of the cinchona, and by his skill and administrative ability he enabled the Indian Government to provide for India, and to place within the reach of the poorest natives the necessary remedies obtainable from the cinchona bark. In 1876 Dr. King published a manual of cinchona cultivation in India, and this is the standard work on the subject.

Besides the work of these years—no light task—Dr. King was able to do much valuable botanical work, assisting Sir Joseph Hooker with voluminous material for his work on the flora of British India. In later years, when leisure was more easily got, Dr. King published important contributions to botanical literature. Largely through the liberality of the Government of Bengal, he was enabled to commence the "Journal of the Calcutta Botanic Gardens," which has contained numerous contributions from his pen. Monographs were published, including that of the now notably commercially and financially important genus of *Ficus*, and also other important genera of plants, most of those being of economic importance. At the same time he made extensive studies of the vegetation of the Malay Peninsula. The "Kew Bulletin" of May 1909 gives a list of no fewer than sixty-three works published by the late Sir George King, many of them not only of great importance, but of a nature that must have involved an immense expenditure of labour and time as well as of scientific research.

In 1891 Sir George King was appointed first Director of the Botanical Survey of India, involving a labour so great that he resigned his professorial chair in order that he might have time to discharge the onerous duties of that appointment. After thirty-three years of strenuous work he retired from the service of the Indian Government in 1898. Living at San Remo in the winter months, he devoted in these later years his services to valuable work in the gardens at Kew, on the various lines that had occupied him in his earlier years.

His services to the Indian Empire, which were in no way restricted to his official duties, were recognised by his having conferred upon him the honour of being created in 1898 a K.C.I.E., an honour that was richly deserved. Whilst in Calcutta he was a fellow of the University there, and he took a leading part in its management. He was connected with the inception of the now famous Zoological Gardens at Calcutta, he was a trustee of the Indian Museum, and a member of the Board of the Engineering College of Bengal. Other honours were conferred upon him: the Victoria Medal of the Royal Horticultural Society; honorary membership of the Pharmaceutical Society; the rank of Officier d'Instruction publique, with a ring of honour, from the Czar of Russia: medals of the Linnæan Society, and medallion portraits placed both in the Zoological and Botanic Gardens at Calcutta. You will realise from what I have been able in a few words to outline to you of his life and his work that he was one of the foremost botanists of his day, whose loss we may well deplore, while we may feel that in accepting from us in 1895 the distinction of honorary fellowship of this Society, he conferred on us an honour of which we may well be proud.

I now pass to our loss in the deaths of three of the foreign corresponding members of the Society.

Professor JOÃO BARBOSA RODRIQUES, a well-known

Brazilian botanist, was the Director of the Botanic Gardens at Rio de Janeiro. He was elected a corresponding member of this Society in 1881. Born in 1842, he originally intended to qualify himself for a medical career, but changing circumstances led him to abandon that intention. Turning his attention to botanical science through Professor Allemao of Rio, he undertook a long series of botanical expeditions in the Amazon basin—in the Southern States and in Uruguay and Paraguay. He founded a museum at Manaos, an important city on the Amazon river, and this had his care until 1899, when he became the Director of the Botanic Gardens at Rio de Janeiro—a post which he held until his death. He does not appear to have been much of a collector, notwithstanding the unrivalled opportunities offered by his extensive journeys in botanical quest. He studied from life the plants he found, and filled his portfolios with careful drawings and analyses. The task to which he mainly devoted himself was the elaboration of monographs of the palms and the orchids of Brazil—a wide field of study. Up to 1891, he published diagnoses of no less than 573 new species, 25 new genera, and 1 new tribe of orchids. Orchids, of the two, formed his favourite study. He was unable, however, to carry this to a conclusion, and his work was handed over by him to a more fortunate rival, Professor Cogniaux, who completed the work for the "Flora Braziliensis" of Martius. In the Kew collection there are several hundred copies of Professor Rodriques' plates. He was more fortunate with the monograph of the palms, working under a commission from the Government of Brazil, taking up the work as a field botanist, studying, analysing, and drawing his specimens on the spot. The publication of his "Sertum Palmarum Brasilianarum" was carried out by the aid of a vote of the Brazilian Congress. Other scientific interests attracted him, and his published works include subjects pertaining to archæology, palæontology, ethnography, and the Indian languages.

Of the other deceased corresponding members I cannot give you much detail. Professor Emil Christen Hansen, who was elected by the Society in 1887, was the head of the Physiological Department of the Carlsberg Laboratory at Copenhagen for the study of chemistry and plant physiology with particular reference to fermentation—subjects of the greatest importance in connection with manufactures and commerce.

Dr. FREDERICK WILHELM CHRISTEN ARESCHONG, who became a corresponding member in 1878, held the important position of Professor of Botany in the University of Lund, and held an eminent position in the botanical world.

The deceased Resident Fellows are:—

Mr. JAMES BUCHANAN of Oswald House, Oswald Road, Edinburgh, became a Fellow of the Society in 1878. He was closely associated with chemical science, and he was an enthusiastic amateur gardener.

The late Mr. JAMES R. REID, C.I.E., of Magdala Crescent, Edinburgh, died there in December last year. He was born in 1838, the son of Dr. Alexander Reid of Edinburgh. He was an Indian civil servant, having been for thirty-four years in the Bengal Civil Service. He was Secretary to the Government of the North-West Provinces in 1882 and Chief Secretary to the North-West Provinces and Oudh in 1884, a member of the Board of Revenue in 1890, and member of the Legislative Council in 1891. He was created a Companion of the Indian Empire in 1890, and has passed away at the age of seventy.

The late Mr. T. A. HOG of Newliston in Linlithgowshire and of Kellie in Fifeshire, who became a Fellow of the Society in 1867, died more than a year ago, but by some accident his death had been overlooked and not intimated. He was educated at the Edinburgh Academy and the Edinburgh University, and succeeded to the family estates in 1858. He was a Justice of the Peace for the counties of Linlithgow and Midlothian, and a Deputy-Lieutenant for Linlithgow. He was thus a well-known West Lothian laird, and took a prominent interest in the affairs of his county, where he lived the life of a country gentleman.

Among the deceased non-Resident Fellows, I should refer to the late Mr. THOMAS SOUTHWELL of Norwich, a Fellow of the Zoological Society of London, whose death occurred recently at the advanced age of seventy-nine. He was for many years the Secretary and twice the President of the Norfolk and Norwich Naturalists' Society. He became a non-Resident Fellow of this Society so long ago as July 1853, and he was an amateur naturalist of the best type, his careful and painstaking work being an example even to his professional brethren. A banker by profession, he had but limited time for those detailed studies which appear to have been more directed to zoology than to botany. He was a great ornithologist; and beyond that he devoted much time to collecting and collating all information as to the distribution and migration of whales, publishing a volume entitled "The Seals and Whales of the British Seas," besides works relating to the birds of his native country.

Another old member is the late Dr. S. H. RAMSBOTHAM of Harrogate, who was elected a non-Resident Fellow in 1858, in which year he accompanied the late Professor John Hutton Balfour in a party visiting Switzerland on a botanical excursion. Dr. Ramsbotham practised in Leeds for thirty years, and died at Harrogate early this year.

Dr. JOHN FRASER, a native of Glasgow, and a Non-Resident Fellow of the Society since the year 1865, died at Wolverhampton in April last. In reply to inquiry, his daughter writes that she has asked an old friend of his—Mr Joseph Hough of Codsall Wood—to write a short notice, and I cannot do better than read to you what he has written of his friend :—

"John Fraser was born in Glasgow on 22nd March 1820, and died 13th April 1909. He was the eldest son of David Fraser, the noted stonemason, of whom a short account is given in Hugh Miller's 'My Schools and Schoolmasters.' He took his M.A. degree in 1843 at Glasgow University, where he acquired an extensive and accurate knowledge of classics, the study of which he never laid wholly aside even in the busiest part of his professional life. After he was eighty he read the whole of the 'Iliad,' and in the last three years of his life he found pleasure in reading 'Cicero's Letters.' He also read regularly the Hebrew Bible, especially the Psalms, always a source of joy and comfort to him. Whilst a medical student at Glasgow, where he took the degree of M.D. in 1852, he was accustomed to go with Professor Arnott on botanical expeditions. After being house surgeon at the Royal Infirmary, Glasgow, he was a general practitioner during the years 1852–1854 at Byers Green and Gainford, Durham, and from 1854 to 1906 at Wolverhampton, where he held various medical appointments.

"In 1863 he took part in founding the Dudley and South Staffordshire Field Club. At that time he was a busy doctor with only scanty leisure, but this he devoted mainly to botany and geology, and in his holidays he made excursions far and near to gather, as far as possible, a complete set of British flowering plants and mosses. His principal companions in these excursions were Mr Edwin Lees of Worcester, Mr. Joseph Thompson, Vicar of Cradley, Mr. Wm. Mathews, and Mr. James Bagnall of Birmingham.

"He made a complete set of the British mosses given in Wilson's 'Bryologia Britannica,' adding two new species—*Amblystegium Confervoides*, which he discovered in Dovedale in 1866, and *Stereodon Bambergeri*, which he discovered on Ben Lawers in 1867.

"His collection of flowering plants is very full, especially in the genera *Rubus*, *Rosa*, *Hieracium*, and *Salix*, to which he added the new species *Salix Holosericea*, Willd.

"He also made a very fine collection of most of the typical British fossils, and was elected F.G.S. in 1892. He was a deeply religious man, always actively benevolent, and his 'Nil nisi Cruce' was exemplified in every action of his long, well-spent life. J. H."

These statements, Ladies and Gentlemen, complete the information, so far as we have been able to gather it together, of those who have gone before.

Before passing to the further business of this meeting, I wish to congratulate the Society on having had during the last year a series of fairly successful and interesting meetings, which I think over all have been well attended, and to express the hope that we are entering on a session which will even show an improvement on that which has just passed. But I would like again to refer, as I have done before, to the anxious desire of your Council that we should do all in our power to increase the strength and the popularity of the Society. I think that botany is a subject in which an increasing interest is being taken by what I might call the general public, and I feel sure that if the Society and these meetings of ours were more generally known, we might look not only for an increase of membership of the Society, but also for a greater number of contributions of communications and exhibits of interest to the Society, and of records interesting to botanical science. I think that those of us who have friends interested in botany should endeavour to induce them to join us. We are, unfortunately, not a wealthy Society, and we have not much to offer beyond those interesting meetings and records of our doings, but I venture to think that even these are well worth offering to our friends. A larger membership would undoubtedly give the Society a stronger financial position, and that would enable us to do more in the way of making our *Transactions* attractive, and give us a wider field from which to fill their pages.

In concluding these remarks I would desire to express to the Fellows, Associates, and Members of the Society my thanks for the kind forbearance with which they have received my efforts to fill this chair, and for the kindness and courtesy which I have met with on all hands. I have felt it a great honour and privilege to preside over your meetings, and in my present position to open the session of the year on which we are now entering. I would also express my deep sense of the honour you have done me in re-electing me to the chair for another year, and I give you my assurance that I will do everything in my power for the benefit of the Botanical Society of Edinburgh.

The Present Position of Botanical Survey in Britain. By Wm. G. Smith, B.Sc., Ph.D.

The communication of which this is a summary, outlined the present position of what has come to be known as Botanical Survey. The subject has connections with

Edinburgh, for the first of the more recent papers by the late Robert Smith dealt with the Pentlands.[1] That memoir contains a sketch of the author's objects in undertaking botanical surveys and outlines his methods; although in many ways it was a new method of attacking problems of botanical distribution, it has many links with the work of the older British botanists.

In order to define "what is botanical survey," it is necessary to appreciate the various lines of study involved in plant-geography, a branch of botany which in recent decades has made rapid progress. Plant-geography seeks to answer three questions: what plants occur in the world; where they occur; why they occur in one part and not in another. The data required to answer the first two questions results in the preparation of a "flora," and in the botanical exploration of a country this is the first step towards knowledge of the plants. It entails the observation of all the plants in the area, and the recording of their distribution. Most of the phytogeographical work in Britain, as in other countries, has been of this kind, and it has resulted in a series of floras of the country as a whole, and of counties and other subdivisions. From studies of this kind has arisen the branch of floristic plant-geography which, as recently defined by A. Engler,[2] has for its aims: (*a*) to prepare a floral catalogue arranged in species, genera, etc.; (*b*) to prepare statistics as to abundance and frequency; (*c*) to study the physiognomy, *i.e.* to distinguish the prevailing groups of the flora—forest, bush, heath, etc.—and to ascertain their distribution; (*d*) to divide up the area into floral regions; (*e*) to study the history of the flora. The monographs in the series "Vegetation der Erde," edited by Engler and Drude, are outstanding examples of floristic plant-geography. In Scotland, Professor Trail's "Topographical Botany"[3] is an important contribution to floristic studies.

The attempt to answer the question why plants occur in one place and not in another, involves consideration of

[1] Smith, Robert, "Botanical Survey of Scotland: I. Edinburgh District," Scot. Geog. Mag., July 1900.

[2] Engler, A., "Humboldt-Centenar-Schrift d. Gesell. f. Erdkunde zu Berlin," 1899.

[3] Trail, J. W. H., "Annals of Scottish Natural History."

plant-function and is related to plant-geography on the one hand, and plant-physiology on the other; hence has arisen the branch of Physiological Plant-geography. This attempts to explain the presence of plant species and the occurrence of growth-forms from the conditions of the environment. Some authors, such as A. F. W. Schimper ("Plant Geography," 1903), take up primarily the relation between *plant-distribution* and the factors of soil and climate. Other authors, notably Warming ("Œcology of Plants," 1909), are more concerned with the relation of *plant-form* to environment, and assume as a postulate that similar conditions of environment produce a similar plant-form. Other subdivisions of the subject also appear from the works of various authors: some take up the distribution and ecology of single species, others follow out plant communities.[1]

The ideal botanical survey of a district or country should take account of all these points of view of plant-geography—floristic, distributional, and ecological,—and in all directions something has been done, but much remains to be done yet. The British memoirs which have used the term botanical survey in their titles are now fairly numerous (see list at the end of this paper). When analysed broadly, they will be found to deal with plant communities rather than with single species, and the relation to environment receives a prominent place. The stages of the work can in most cases be resolved into four processes:—

(*a*) *Selection of an area.*—This has generally been some district fairly accessible to the author, so that with frequent opportunity of inspecting the vegetation in all its seasonal phases one may expect a fairly accurate knowledge, even of a large district. The selected areas also contain, as a rule, a large proportion of vegetation little influenced by man's activities, and, as far as possible, large tracts of farmland and city areas are avoided.

(*b*) *Analysis of vegetation into its units.*—The larger masses of vegetation are recorded, and here a map is indispensable, and this map in a reduced form appears in the

[1] The term "plant community" is used here as an indifferent designation for any set of plants growing together; it is equivalent to the use of "group" in systematic botany.

published memoir. The actual field observations are recorded on the Ordnance Survey maps of the scale "one inch to one mile," but in many cases the authors prefer to use the larger scale of "six inches to one mile," and this is certainly the better plan. The usual practice is to colour all the existing types of vegetation covering a sufficiently large area, giving the principal plant communities a distinguishing colour and letter, and indicating mixed communities by blending colours and symbols. In naming these plant communities, the names of distinctive plant species are used, *e.g.* oakwood, heather moor, etc.

(*c*) *Investigations on the influence of climatic, topographic, edaphic, and biological factors and their influence on the distribution of the various plant communities.*—In the earlier primary surveys this side of the research was generally rather superficial, because large areas were dealt with, and obviously the necessary observations for such investigations can only be successfully carried out over small areas. It is noteworthy, however, that each successive memoir devotes more space to the investigations on environment, and just at present there is great activity in this direction which will make itself felt in future contributions.[1]

(*d*) *Examination of analysis from a synthetic standpoint.*—This involves deductions from the observations of the conditions which determine plant-distribution and of the origin and status of the plant communities.

The present position of this aspect of botanical survey in Britain may now be briefly reviewed. Most of the work attempted has been "primary survey" or reconnaissances over fairly large areas with the view of ascertaining the outstanding types of vegetation (see list at end). The result is a series of memoirs with maps relating to districts in England, Scotland, and Ireland. The advantages of the primary survey are generally admitted: it is the best preventive of narrow views, and an essential

[1] The following papers deal more particularly with the environmental conditions of small areas:—(*a*) T. W. Woodhead, "Ecology of Woodland Plants in the Neighbourhood of Huddersfield" (Jour. Linn. Soc. Bot., vol. xxxvii., p. 333, 1906). (*b*) R. H. Yapp, "Stratification in the Vegetation of a Marsh, and its relations to Evaporation and Temperature" (Annals of Botany, xxiii., April 1909).

preliminary to more extensive studies, and as the memoirs are expressed in equivalent terms, a comparison of areas is possible.

The analysis of the vegetation shows that throughout Britain the plant-covering consists of plant communities which recur in places widely apart, and under ecological conditions which appear on the whole to be similar, but fuller information is still needed. Types of vegetation have also been established which, although previously known to some extent, had no particularly conspicuous place in any existing literature. This is specially the case with woodland associations, and the following types of semi-natural woods are now clearly defined:—Ash woods on limestone soils in Yorkshire and Somerset; beech woods of the Chalk of Southern England: the two types of oakwood—oak-hazel with *Quercus pedunculata* dominant on deep moist soils, and oak-birch with *Q. sessiliflora* dominant on dry shallow soils: and the birch wood so characteristic of the Highlands.[1] Amongst the moorland associations so established are Calluna heath, Calluna moor, and Eriophorum moor, all well-defined types.

The synthetic treatment of the observations is now beginning to be evident. The earlier papers were naturally reticent in expressing broad conclusions, because the areas surveyed were limited, but with wider information it is now becoming safe to draw up conclusions. The influence of man, whether as forester or disforester, as shepherd, farmer, or game preserver, has left its mark over great tracts of our native vegetation, and to British workers (as indeed to workers in ecology everywhere) it is obvious that no scheme of botanical survey can ignore man as a biological factor of the environment. It is therefore necessary to examine how man has altered a more primitive vegetation. How far the botanical survey method has traced the influence of man is seen in the "Woodlands of England," and there it is shown that although few truly natural woods exist, yet it is possible to arrange all but

[1] "The Woodlands of England," by Moss, Rankin, and Tansley, 1910, gives details of these woodland associations; it may be obtained in pamphlet form (36 pp.; price 1s. 1d. post free) from Secretary, Committee for British Vegetation, 13 George Square, Edinburgh.

the youngest plantations under the classification of woodlands which the authors propose. It has been further shown that certain methods of woodland treatment have led to the deterioration of woodlands into scrub or moorland. Thus in the case of oak-hazel copse, a widespread type of vegetation in Southern England, it has become evident that long-continued coppicing has resulted in impoverishment of humus and other changes unfavourable to tree-growth; hence the oak has gradually disappeared, leaving behind a scrub of hazel or other shrubs or, in extreme cases, a grassy common with bracken and gorse. It is also evident that many of our Scottish heather moors are retrogressive phases of former woodland, the trees becoming replaced by ling and other moorland plants, which now retain their dominance as a result of sheep-grazing and moor-burning. From correlation of observations such as these, there has arisen a strong view that what is known as "succession" plays an important part in the present distribution of vegetation. This has recently been stated by C. E. Moss[1] in a paper which traces the historical development of nomenclature in ecological plant-geography. Briefly stated, the theory is that vegetation in any habitat starts in one form (*e.g.* lichens and mosses) and progresses through a succession of phases (*e.g.* grassland and scrub) till it reaches a final phase which on many soils is some type of woodland. The study of these progressive phases of vegetation has thus become an important part of botanical surveys. In conclusion, it may be pointed out that the whole study has important bearings on forestry and agriculture.

List of Botanical Survey Memoirs with Map-Surveys.

1900. Smith, Robert. "Botanical Survey of Scotland. I. Edinburgh District. II. Northern Perthshire." Scot. Geograph. Mag., July and August 1900. Pocket Edition by Bartholomew, Edinburgh.
1903. Smith, Wm. G., and C. E. Moss. "Geographical Distribution of Vegetation in Yorkshire. Part I. Leeds and Halifax District." Geographical Journal, April 1903; also Bartholomew, Edinburgh.
Smith, Wm. G., and W. M. Rankin. "Geographical Distribution of Vegetation in Yorkshire. Part II. Harrogate and Skipton District." Geographical Journal, August 1903; also Bartholomew, Edinburgh.

[1] C. E. Moss, "Fundamental Units of Vegetation," 1910 (Pamphlet 2, Committee for British Vegetation, 36 pp., price 1s. 1d. from the Secretary).

1904. Lewis, F. J. "Geographical Distribution of Vegetation in the Basins of the Rivers Eden, Tees, Wear, and Tyne." Geographical Journal. Part I. March ; Part II. September 1904.

1905. Smith, Wm. G. and Robert. "Botanical Survey of Scotland. III. and IV. Forfar and Fife." The Scottish Geographical Magazine, December 1904, and January, February, and March 1905.

Pethybridge, G. H., and R. L. Praeger. "The Vegetation of the District lying South of Dublin." Proceedings of the Royal Irish Academy, xxv., December 1905.

1906. Hardy, M. "Esquisse de la Géographie et de la Végétation des Highlands d'Ecosse," 1906.

Moss, C. E. "Geographical Distribution of Vegetation in Somerset." Royal Geographical Society (special publication), 1906.

The following will probably be issued soon, having been delayed in publication :—The Peak of Derbyshire (C. E. Moss), Hampshire and Isle of Wight and North-West Yorkshire (W. M. Rankin), Kent (A. G. Tansley), Norfolk Broads (M. Pallis and J. Shaw), North-East Yorkshire (W. G. Smith). Surveys are in progress in the following districts :—South-East Scotland, Orkney Islands, Caithness, Lanarkshire, Galloway, Dartmoor, East Devon, the Malverns, Cheshire, East Yorkshire, and Dublin.

Since this communication was read, Professor Trail, in the presidential address to Section K, British Association, Sheffield Meeting, Sept. 1910 (see *Nature*, No. 2136, p. 452, Oct. 1910), has issued a strong appeal for a complete botanical survey of the British Islands. He outlines the present state of knowledge, and points out where gaps exist. The address takes a somewhat broader view than has been attempted here, taking account of all sides of plant-distribution, and it should be read by all interested in the subject.

Notes on the British Species of Utricularia. By Arthur Bennett, F.L.S.

No. 1. *Utricularia vulgaris*, Linn., "Sp. Pl.," 18, 1753.—Linnæus here mentions a major and a minor form, but no one seems to have taken them up. *U. vulgaris*, L., var. *a typica*, Meister ex Williams, "Prod. Fl. Brit.," pt. 6. 345, 1909. *U. vulgaris*, L., var. *magniflora*, Kamienski, *l.c.* These varietal names are necessary, as Meister and Williams consider *U. major* (*neglecta*) as a variety of *vulgaris*.

This seems to be generally distributed through the British Isles, occurring in about thirty Scottish counties, sixty English, and thirty-eight Irish counties on the plan of Mr. Praeger.[1] But there may be some counties in which the specimens may prove to be *U. major* (*neglecta*).

No. 2. *U. major*, J. C. Keller in ed. Schmidel, "Ic. Plant," p. 80, t. 21, figs. *a–l*, 1762, ex Williams. *U. neglecta*, Lehmann, "Schul-prog., etc., des Hamburg," p. 38, 1828.

According to Dr. Williams,[2] Schmidel's "Icones" were pre-Linnæan (1747), and Keller in 1762 republished twenty-five of his plates.

U. vulgaris, L., var. *neglecta*, Meister. *U. macroptera*, G. Brückner, "Arch. Fr. Nat. Mecklenberg," vii. 234, 1853.

Dr. Williams and Prahl[3] make Brückner's plant belong to *major*, but Boll., "Nach. Flora v. Mecklenburg," p. 125, 1864, under *U. minor*, L., says, "*U. macroptera* Brückner hierher gehört." *U. spectabilis*, Madauss, "Arch. U. Fr. Nat. Mecklenb." (1873), p. 49.

Probably in about fourteen Scottish, twenty-three English, and six Irish counties, but in some cases no flowers have been seen.

Dr. Williams remarks that Herr Meister believes "that *U. vulgaris*, var. *Rhenana*, and *U. vulgaris*, var. *neglecta*, are extreme states of one species, and linked by means of many intermediates." No doubt *vulgaris* is variable, but I should rather consider them distinct.

In an account of our *Utricularias* by Rev. E. F. Linton,[4] he gives a plate of *U. neglecta*, but the flowers unfortunately are shown without the bright red anastomosing streaks on the palate: though faded, they are well shown on specimens gathered in Cheshire by Mr. A. Croall.

I possess specimens from between Staines and Wraysbury, Middlesex, Sept. 1882, G. Nicholson, with flower-stalks 15 inches long, and the whole plant about 30 inches long. This I take to be the *U. neglecta, f. gigantea*, Prahl, in "Krit. Flora Schleswig-Holstein" (1890). p. 173, where it is characterised "mit 1·5 m. langem Blütenstand fand Prahl."

There is some uncertainty as to the application of *macroptera*. Ascherson and Graebner, *l.c.*, have a long note

[1] "Irish Topograph. Botany" (1901), 234.
[2] "Prod. Fl. Brit.," part 6, 1909, pp. 344–50.
[3] "Krit. Fl. Schles.-Holstein," p. 173, 1890.
[4] Proceed. Dorset Nat. Hist. and Ant. Field Club, xv. 81, 1894.

on this, and seem to consider the plant named *neglecta*, v. *macroptera* of Häcker from Wesloe in Lubeck to rather belong to *U. Bremii*, Heer., and formerly Brückner[1] seems to have referred it to *intermedia*.

No. 3. *U. intermedia*, Dreves and Hayne in Schrader, "J. Bot.," iii. 18, t. 5 (1800). *α* (*typica*) *Grafiana*, Koch in "Flora," 1847, p. 265. *β Kochiana*, Asch. and Graeb., "Fl. N. Flachlandes," 1899, 651.

U. media, Schumacker, "Enum. Saell.," 1/9/1801.—This again varies considerably, and we are far from knowing the life-histories of these very interesting aquatics (all our species are aquatics). Dr. Williams gives an interesting means of distinguishing this "when pulling it out of the water, is to notice the cross-section of one of the shoots which is not angular as in all the other European forms, but reniform." Occurs in twenty-nine Scottish counties, eleven English, and twenty-two Irish.

No. 4. *U. intermedia* × *minor*, Neuman in "Bot. Notiser," 65, 1903. *U. ochroleuca*, Hartmn. *l.c.*, 35, 1857. *U. brevicornis*, Celak, "Oest. Bot. Zeit.," 253, 1886. *U. ochroleuca*, *f. microceras*, J. Strandmark! *l.c.*, p. 66.

U. intermedia, sub-sp. *ochroleuca*, Lange, "Hand. Danske Fl.," 524, 1887.—This was formerly supposed to be confined to Sweden, but is now known to occur in Bohemia, Germany, Tyrol, S. Norway, Finland, and nine provinces of Sweden. In 1903,[2] I reported it for Scotland, based on specimens gathered at Broadford, Skye, by Mr. Symers M. Macvicar, July 1895. Others probably to be so referred are from: W. Sutherland, E. S. Marshall, 14/8/1887; Moidart, Argyll, July 1893; Dumfries, Loch Ur, J. Fingland, 1887; Wigtown, Capenoch Moss, J. M'Andrew. Since then I think specimens from S. Ebudes, Colonsay, Loch Fad, M'Neill, may belong here.

Of course as reputed hybrids they vary considerably; the Dumfries specimens represent a slender and delicate form, the Wigtown probably *sub-intermedia*. Mr. S. Macvicar kindly sent me numerous specimens from Moidart, and both he and I were greatly puzzled where to place them. One would hardly suppose that a double hybrid was distinguish-

[1] M. Dętharding's "Consp. Fl. Megalop." (1828), p. 5.
[2] "Ann. Scot. Nat. Hist.," pp. 123, 250.

able, but Melander in the "Botaniska Notiser," 175, 1887, reports a *U. litoralis* = *U. ochroleuca* × *intermedia*.

I have good specimens of the Swedish plant, gathered by R. Hartmann himself, "e loco classico," sent me by Dr. O. Nordstedt.

Others I would refer here are from: Isle of Harris, O. Hebrides, 7, 1889, Mrs. Duncan.

No. 5. *U. minor*, Linn., "Sp. Pl.," 1st ed. (1753), 18.—Dr. Williams, *l.c.*, records that Zabel has recently (1907) described a land-form of *U. minor*. This I found on Woking Heath, Surrey, July 17, 1880. Hundreds of plants were growing among moss, and in full flower.

A very delicate form gathered by Mr. A. Croall, on Flinders Moss, near Stirling, 9/7/1880, has the flowers fully expanded, and excellently dried. The flower-stalks are only 2 inches high, and the whole plant with very finely divided and small leaves. Recorded from thirty-two Scottish counties, forty-four English, and thirty-nine Irish.

No. 6. *U. Bremii*, Heer ex Kolliker, "V.P.G. Zurich," 142, 1839, and Hegetschweiler and Heer, "Fl. d. Schweitz," 984, 1840. *U. pulchella*, C. B. Lehm ex Koch, "Syn. Fl. Germ. et Helv.," 2. 666, 1844. *U. minor*, L., γ *Bremii*, Druce, "List Brit. Pl.," p. 55, sub. No. 1978 (1908).

This plant was first noticed in British books by Mr. Webb[1] (as *Bremii*), where he gives a very interesting account of its history. But there is no doubt the plant was first gathered by the Rev. J. B. Brichan of Banchory, who found it flowering abundantly in the moss of Inshoch, Nairnshire, 16th August 1833.[2] He there speaks of having received specimens named *intermedia* from the Loch of Spynie in Morayshire, and he refers to the "Collectiana for a Flora of Moray," p. 2, 1839, by the Rev. G. Gordon:—"Observed to flower annually since 1830 in some holes whence turf seems to have been cut. If there be a specific difference between this and *U. minor*, the Spynie plant, upon closer inspection, will probably be found to belong to the latter species." Hence the doubt which species to refer it to: and it seems now there can be no doubt the plant was *U. Bremii*.

[1] "Journ. of Botany," 1876, p. 142.
[2] See "Phytologist," i. p. 259, 1842.

I have good specimens from the moss of Inshoch (but unfortunately they are not in flower), gathered on 13th August 1898 by Rev. E. S. Marshall. On these specimens I have noted: "Compared these with Schles.-Holstein specimens and they seem to me to be the same, *i.e. Bremii.* The shape, arrangement of the bladders, and general facies are the same 21/11/98."

I also refer to *Bremii*: "*Utricularia* sp., Loch A-na-Luinahe, Broadford, Skye. S. M. Macvicar, 7. 1895. *Utricularia* sp., East Loch, Fad, Isle of Colonsay, 26/7/1908. M. M'Neill."

I have seen a specimen in Winch's "Herbarium" from the Loch of Spynie, which is placed on a sheet of *intermedia*, and I have no doubt that also is *Bremii.*

Mr. Townsend, in his "Flora of Hampshire," 2nd. ed., p. 329, 1904, says: "*U. Bremii*, Heer, possibly occurs in ditches between Horringford and Newchurch, Isle of Wight, and also on Titchfield Common; and Mr. Webb notes this flowerless bladderwort from Dr. Broomfield from the only station in that isle." To these Dr. Williams adds: "Gordon moss in Berwickshire." Another specimen I should place to *Bremii* is, "Moidart 1891, Argyll," S. M. Macvicar sp. This is very like the moss of Inshoch specimens, giving off branches in which there are very few leaves, but as many as thirty bladders.

For notes on Scottish Utricularias, see Linton in "Trans. and Proc. Edin. Bot. Soc." (1894), p. 110.

Dr. Williams' (*l.c.*) account of the British species is very full, but there are still points to be determined, and cultivation of the various forms is much to be desired.

There are still other specimens that it is difficult to place: especially so are those gathered by Rev. E. S. Marshall at "Lochan Feior, near Skaig Bridge, Loch Assynt, W. Sutherland, Sept. 14, 1887." Rev. E. F. Linton, *l.c.*, names this "as a suspected locality for *Bremii.*" Though the foliage might pass for such, the bladders are double the size of any Continental *Bremii* I possess; still, the leaves agree well with a Slesvig specimen from Herr Fridericksen, and in a Swedish specimen (Herr Mortelin) the bladders are larger than any others seen. There are no signs of flowers, but all the branches end in "winter-buds."

REPORT OF SCOTTISH ALPINE BOTANICAL CLUB EXCURSION TO TEESDALE AND TO KIRKBY LONSDALE, 1909.

The Club met at High Force Hotel, Teesdale, on Monday, 26th July, three of the members making the journey by motor; the remainder, travelling by rail, reached Middleton-in-Teesdale Station before 2 o'clock p.m. The motor party found on the roadside, about ten miles north of High Force, *Carex curta, C. pulicaris, Saxifraga hypnoides, S. stellaris*, and *Sedum villosum*; and at High Force, in the neighbourhood of the hotel, *Carex pallescens, C. paludosa, C. panicea, C. pulicaris, C. sylvatica, C. vulgaris*, and *Potentilla fruticosa*. A visit was made that afternoon to Widdy Fell, two to three miles north-west from the hotel, where the members were fortunate in finding all the plants noted by the Club on this hill on its previous visit several years ago.

The members were much struck by the quantity and wide distribution of *Kobresia caricina*: *Primula farinosa* also seemed to be plentiful everywhere. Caldron Snout Waterfall, as well as the fall at High Force, was a very fine sight, owing to the heavy rainfall of the previous day. The morning of this day was showery, but fortunately the afternoon turned out very fine, and the day, a comparatively easy one after the experiences of the members on Scottish mountains, was much enjoyed. It may be mentioned here for future guidance that the best route to reach Widdy Fell is by the first gate leaving the main road on the left after passing the Chapel, about two miles north of High Force; the path leads, after crossing the bridge over Langdon Beck, a tributary of the Tees, past Widdy Bank Farm, along the north bank of the Tees, right to the Caldron Snout. The following plants were found:—

Allosorus crispus, Areneria verna, Asplenium viride, A. trichomanes, A. putamuraria, Bartsia alpina, Betonica officinalis, Blysmus compressus, Carduus heterophyllus, Carex ampullacea, C. capillaris, C. dioica (female), C. fulva, C. pallescens, C. panicea, C. pulicaris, Comarum palustre, Equisetum variegatum, Galium boreale, Gentiana verna, Gymnadenia conopsea, Habe-

naria albida, Juncus triglumis, Kobresia caricina, Lastrea propinqua, Lathyrus macrorrhizus, Listera ovata, Lycopodium Selago, Orchis latifolia, Pimpinella Saxifraga, Polygonum viviparum, Polystichum aculeatum, Polypodium Phegopteris, Potentilla fruticosa, Primula farinosa, Saxifraga aizoides, S. hypnoides, Scabiosa Columbaria, Sedum Rhodiola, Selaginella selaginoides, Stachys Betonica, Tofieldia palustris, Triglochin palustre, Viola amœna.

On Tuesday, the 27th July, it was decided to visit Cronkley Fell, and as the members understood that the best access was by the bridge across the Tees at Cronkley Farm, they drove to the first path on the left of the road after passing the Post Office, but having crossed the bridge, they were informed that there was no public path to the mountain in that direction. They were, however, kindly led to the proper path by two sons of the farmer. This path, which is a right-of-way, leads from Wynch Bridge, which crosses the Tees, a quarter of a mile below High Force Hotel, direct over the white scars on the north of Cronkley Farm to Caldron Snout Waterfall. The day was fortunately fine though dull, and on arriving at the white scars, which is the name given to an outcrop of sugar-loaf limestone, plants of *Helianthemum canum* were found growing alongside plants of *H. vulgare*, also plants of *Gentiana verna.* A little further on, the dwarf form of *Dryas*, known to grow in this locality, was found in large quantity, as well as numerous plants of *H. canum.* One member, who had not had time to visit Caldron Snout the previous afternoon, continued by the path and, crossing the Tees by the bridge at the waterfall, spent some time on Widdy Fell looking for *Carex limosa*, without, however, finding it. Another of the party returned to the bridge along the foot of the rocks at the north side of the fell, where he found a fine plant of *Lastrea filix mas*, var. *cronckleyensis*, and saw numerous plants of *Lastrea montana* and *Polystichum aculeatum.*

The other members returned to the bridge by the way they came, and all arrived safely back at the hotel after a very enjoyable day.

The following plants were found:—*Antenaria dioica,* *Arenaria verna*, *Allosorus crispus* (on sugar loaf at top of Whiteforce), *Arctostaphylos Uva ursi*, *Carex ampullacea*, *C. capillaris*, *C. curta*, *C. dioica* (female), *C. ovalis*, *C. panicea*, *C. pilulifera*, *C. pulicaris*, *C. vulgaris*, *Draba incana*, *Drosera rotundifolia*, *Dryas octopetala*, var. *minor*, *Gentiana campestris*, *G. verna*, *Helianthemum canum*, *H. vulgare*, *Kobresia caricina*, *Lastrea Filix mas*, var. *cronckleyensis*, *L. montana*, *L. propinqua*, var. *depauperata*, *Lycopodium Selago*, *Potentilla fruticosa*, *Polystichum aculeatum*, *Primula farinosa*, *Sanguisorba officinalis*, *Selaginella selaginoides*, *Thalictrum alpinum*, *Vaccinium Oxycoccos*, var. *Vitis idæa*.

In addition to the above, the member who crossed on to Widdy Fell and returned by the north bank of the Tees found *Carex pallescens*, *C. glauca*, *C. vulgaris*, *Saxifraga stellaris*, *Scabiosa Columbaria*, and *Trollius europæus*.

As it had been arranged to leave High Force for Kirkby Lonsdale by the train about 2 o'clock on the afternoon of Wednesday, 28th July, it was decided to spend the forenoon on the banks of the Tees, near the hotel. The party crossed the Tees by Wynch Bridge ; those botanising down-stream found a plant well known in this locality, *i.e.* *Serratula tinctoria* : others, working up-stream, examined the numerous ferns growing on the shady banks on the south side of the river opposite the hotel, where they found two very good varieties of *Athyrium* f.f., also a polydactylous form of *Lastrea propinqua*. Besides the above, the following plants were found :—*Carex ovalis*, *C. paludosa*, *Juniperus communis*, *Lastrea montana*, *L. propinqua*, *Lysimachia nemorum*, *Populus tremula*, *Potentilla fruticosa*, *Prunus Padus*, *Stachys Betonica*, *Taxus baccata*.

At 1.30 the members left for Kirkby Lonsdale, three of them in a motor, in which they arrived at their destination before 5 o'clock, the route taken being *via* Middleton-in-Teesdale, Brough, Kirkby Stephen, and Sedbergh, a distance of about sixty miles. The road was very hilly and somewhat rough in places, but the day was very fine and warm, and the drive a very pleasant one. The remainder of the party, travelling by train, had a most tedious journey, and did not reach the hotel at Kirkby Lonsdale till about 8 o'clock, owing to long waits, first at Barnard Castle, and secondly at Tebay Junction. After tea, the three members who motored spent some time examining the west bank of the river Lune in the neighbourhood of the town, where they found the following plants:—*Asperula odorata*, *Calamintha Clinopodium*, *Mimulus luteus*, *Origanum vulgare*, *Sedum acre*.

While waiting at Tebay Station, the members coming by rail found *Arabis hirsuta*, *Cystopteris fragilis*, var. *alpina*, *Juncus glaucus*, *Mimulus luteus*, *Ranunculus hederaceus* (sub form), *Scirpus cæspitosus*.

On Thursday, 29th July, the members motored to a point on the road to the north-west of Farleton Knott, in order to botanise on this hill, which is a well-known landmark in the south-east of Westmoreland. The members began the ascent from this point, and gradually worked their way along the various limestone ridges on its summit and on Hutton Roof Crag towards Kirkby Lonsdale. The day, though very windy, kept fair until about 4 o'clock, when heavy rain came on, making botanising most disagreeable and difficult, and rendering walking on the limestone most dangerous owing to the wet making the surface very slippery. All the well-known lime-loving plants known to grow on this hill were found, the ferns *Lastrea rigida* and *Scolopendrium vulgare* being found in great quantity and luxuriance. Large clumps of the limestone polypody (*Polypodium calcareum*) were seen, also *Arabis hirsuta*, *Arenaria verna*, *Arum maculatum*, *Asperula cynanchica*, *Calamintha Clinopodium*, *Carlina vulgaris*, *Circæa alpina*, *Convallaria majalis*, *Epipactis rubiginosa*, *Geranium lucidum*, *G. Robertianum*, *Hedera Helix*, *Lactuca muralis*, *Linaria Cymbalaria*, *Listera ovata*, *Lastrea rigida*, *Melica nutans*, *Plantago media*, *Polygonatum officinale*, *Polypodium calcareum*, *Polystichum aculeatum*, *Sanicula europæa*, *Saxifraga tridactylites*, *Scilla nutans*, *Scolopendrium vulgare*, *Taxus baccata*, *Thalictrum flavum*, *Verbascum Thapsus*, *Viburnum Opulus*.

On Friday, 30th July, the party having been reduced to three, owing to members having to leave for one cause or another, motored to Ingleborough in order to visit the Craven Nursery there, belonging to Mr. Reginald Farrer, which the members were shown round by Mr. Redman, the foreman, with whom the President had had considerable correspondence.

The members much enjoyed their visit both to the nursery, where they saw many very rare alpines, and to the private gardens and to the recently made natural rock garden bordering the lake. They were also shown *Areneria gothica* growing in its native habitat. In the evening of this day the following plants were found in the neighbourhood of Kirkby Lonsdale:—*Campanula latifolia, Chærophyllum temulum, Helosciadium nodiflorum, Malva moschata, Tamus communis, Torilis Anthriscus.*

On Saturday, 31st July, the President and Secretary left Kirkby Lonsdale by motor in order to visit the famous garden at Levens Hall, where several hundred specimens of topiary work were seen, this being the most famous garden of the kind in the country. Thereafter the journey was continued *via* Kendal, where fine collections of varietal forms of native ferns owned by Messrs. George Whitwell and J. J. Smithies were visited, on to Lowood Hotel on Lake Windermere, where the week-end was spent. The weather during the week was somewhat broken, but on the whole a very pleasant time was passed, many of the plants gathered and the localities visited being new to the majority of the members of the party.

The wonderful limestone formations on Farleton Knott, cleft and cut in every direction and worn into every conceivable shape, will well repay a visit by anyone who happens to be in that neighbourhood: while the outcrop of sugar-loaf limestone at High Force is also most interesting, both being very different from anything we are accustomed to in Scotland.

NOTES ON PLANTS OBSERVED DURING A VISIT TO CHILE. By W. BALFOUR GOURLAY, B.A., L.R.C.P. & S.E. (Plates VII. and VIII.)

To write an adequate account of the flora of Chile could only be undertaken by a trained botanist, after years of travel and research in a country where conditions vary so greatly in its different parts. As I spent only a few months in Chile in the year 1908, all that I can hope to give you is a slight impression of the general conditions of the country as a whole, and a slight sketch of the flora of the few places visited by one who has little botanical knowledge, and takes but an amateur interest in the great subject of botany.

Chile is a country with a wonderfully varied flora, as will be readily understood when the following conditions are borne in mind. The country stretches from north to south, a distance of 2700 miles, from the arid deserts about Tacna (lat. 18° S.) to Cape Horn, with its snow and ice, about lat. 56° S. The country, whose width varies from 100 to 250 miles, may be regarded as the western slope of the Andes; so that, on the whole, one ascends on proceeding inland. In addition to this, the rainfall decreases continuously from south to north in association with a gradual change in the direction of the prevailing winds, opposite in character to the direction of the hands of a clock. Thus in the south the prevailing wind is westerly and the annual rainfall is very great. Further north the prevailing wind is found to be south-westerly, with a diminished rainfall; while in the extreme north the wind blows always from the land, and rain hardly ever falls.

	Latitude.	Mean Temperature.	Annual Rainfall.
Tierra del Fuego . .	52–55° S.	42° F.	Great in S. & W.
Ancud (Island of Chiloé) .	42°	53° F.	130 ins.
Valparaiso	33°	59° F.	10–20 ins.
Iquique	20°	64° F.	practically nil.

In the desert of Atacama, in the north, the temperature may fall from 100° F. in the day to 36° F. at night. At certain times of the year in Valparaiso a sudden drop of 30° of temperature is often experienced at sunset. One cannot move in any direction in Chile and remain in the same conditions with regard to temperature, altitude, or rainfall. Consequently, a small change in one's position corresponds with a considerable change in the surrounding flora.

Chile may be divided into three regions whose boundaries merge into one another.

In the arid northern region vegetation is very scarce.

The central region from Santiago to Temuco is very fertile, and is mainly occupied in commerce and agriculture. In the northern half of this territory, which has a short rainy season followed by a long dry one, irrigation is required, the water being supplied by numerous shallow streams which flow down from the Andes. The canals and waterways, lined, as they are, by tall poplars at regular intervals, form a characteristic feature of this part of Chile.

From Temuco to near the Straits of Magellan there is an abundant rainfall, and dense forests prevail.

Our ship, the s.s. "Oronsa," left Liverpool in July 1908, and touched at La Rochelle, Oporto, Lisbon, the Cape Verde Islands, Rio Janeiro, Monte Video, and Port Stanley in the Falkland Islands. These islands resemble our own Outer Hebrides in appearance, and are largely tenanted by Scottish sheep-farmers. The climate is very severe. Leaving Port Stanley, we passed through the Straits of Magellan, thereby obtaining an idea of what the southern end of South America is like in cross section. The country bounding the eastern end of the Straits is flat, dry, and uninteresting. A little gold is found here in the stream beds. Passing through a narrow part of the Straits, we were able, with the help of glasses, to discern on the island side a herd of wild guanacos browsing on the scrubby little bushes which were all that could be seen in the way of flora. As we proceeded the scenery became more mountainous, and vegetation increased.

We spent the night and some hours next day at Punta Arenas (Sandy Point), the most southerly town in the world. I was anxious to walk to the forest and examine the trees. Unfortunately a wide belt of trees behind the town had been burned, leaving only blackened stumps. The edge of the forest did not look far off, but the distance was deceptive and the track difficult, and I had to return with my object unaccomplished, or risk the chance of being left behind. The soil was peaty, and the flora similar in general appearance to that of a Highland moor. There were grasses and mosses, and a little plant with a black berry and with a habit of growth and appearance resembling *Empetrum* or *Vaccinium*. On the dry ground was a *Berberis* with small elliptical leaves. Judging by the stumps, the trees were not conifers. I think they were a species of *Nothofagus* or Southern Beech, probably *N. antarctica*.

Proceeding further, we were held up by snow showers, and had to remain at anchor in a little sheltered bay for more than twenty-four hours. A neighbouring hillside was covered with dense forest which invited inspection, but I was unable to obtain leave to go ashore. An officer, who had been ashore there before, told me that the trees were not conifers except for an occasional cypress (possibly *Libocedrus tetragona*).

Next morning we were steaming in a north-westerly direction up the narrow and most beautiful part of the Straits. On the northern side were high snow mountains with glaciers, the lower slopes being clothed with a dark green belt of forest. A species of *Nothofagus* grew down to the water's edge, and showed a very remarkable degree of wind-pruning. The trees near the water's edge were only a few inches in height, but inland they showed a rapid increase in stature. The trees were crowded together like Box, and looked as if one could walk on the tops of them. I think the condition must have been partly due to the salt from the water. (The water is probably only moderately saline in these places.)

Leaving the Straits, our next port was Coronel, which is a coaling station. Here we were met by a friend who lives in Concepcion, and two of our party (including myself) accompanied him to that town by means of a light railway which is owned by the Arauco Colliery Company. We jogged along over a flat sandy plain covered with aromatic evergreen bushes, mostly "boldo" (*Peumus boldus*), a little white anemone covering the ground in patches.

There were plantations of *Pinus insignis* on the hills above Concepcion. The open ground on the hills was covered with charming little flowers, the only one I can remember being a small strawberry plant with a very large blossom (*Frageria chilensis?*). In a natural wood I saw that beautiful creeper, the "copihue" (*Lapageria rosea*), "quintral" (*Loranthus tetrandus*)—a parasite with long, tubular, scarlet flowers, and a small and very beautiful species of *Cassia*. A small bamboo formed a matted tangle of undergrowth, which made walking almost impossible except on the path.

We joined the "Oronsa" again next day at Talcahuano, and sailed for Valparaiso.

The country about Valparaiso is very hilly. The soil, which is dark red in colour, is very brittle, and is furrowed and fissured by the streamlets which descend during the short rainy season, when rain falls very heavily. Owing to the dryness of the atmosphere, many of the small herbs come up, produce flowers and seed, and die down again with great rapidity, so that the aspect of the hillside changes markedly from week to week. One day the hill is all white in places with a small liliaceous flower (*Ornithogalum* sp.). Ten days later, hardly a specimen can be found, but the hillside is pink with *Leucocoryne*, for example. And so the changes are rung, and the collector is hard put to it to keep pace with the fugitive flora.

Striking amongst the smaller plants are *Pasithea cœrulea*, *Œnothera acaulis* and *O. Berteriana*, *Triptilion spinosum*, *Sisyrinchium speciosum*, *Calandrinia grandiflora*, and some orchises of the genus *Chlorœa*, with certain species of *Loasa* and *Alstrœmeria*. *Calceolaria* and *Oxalis* are represented by a number of species, the latter being always either pink or yellow. A maritime *Oxalis*, with yellow flowers, has thick fleshy stems and leaves.

Familiar flowers are *Tropæolum tricolorum*, and species of *Schizanthus*, *Salpiglossis*, *Escallonia*, and *Alonsoa*. The Compositæ are well represented, *Mutisia* being an interesting genus. Among the larger flowering plants are tree *Senecios*, a tall erect *Cactus*, and a large red-flowered *Lobelia* which has a great attraction for the humming-birds. The order Bromeliaceæ is represented by the curious "chagual," of which there are two species, one with yellow and one with greenish-blue flowers (*Puya chilensis*, and *P. Whytei*, Hook. = *Pitcairnia cœrulea* respectively). A bushy *Euphorbia* is everywhere present.

The native trees about Valparaiso are for the most part small and of slow growth, while the majority of them are evergreen. The "coligue," a species of bamboo, forms an undergrowth in many places. Native woods contain the fragrant "boldo" (*Peumus boldus*), "peumo" (*Cryptocarya Peumus*), "quillai" or soap-bark tree (*Quillaja saponaria*), "maqui" (*Aristotelia maqui*), the fruit of which resembles small cherries, and the handsome but poisonous "litré" (*Rhus caustica*, Hook. et Arn. = *Lithrœa venenosa*, Miers.). To touch this tree, or merely rest within its shade, produces in some people a severe form of dermatitis, the symptoms being a rash, accompanied by great irritation and swelling. The beautiful evergreen "patagua" (*Tricuspidaria dependens*) grows a few miles inland in damp places. The "honey palm" (*Jubœa spectabilis*, H. B. et K.) grows in several of the valleys near Valparaiso, especially fine examples being seen in the neighbouring Salto Valley. The tree is greatly prized for its sweet sap, from which is prepared by evaporation the *miel de palma* or "palm honey" which, with omelette, forms a favourite Chilian delicacy. Formerly the natives, with typical improvidence, were wont to cut down the trees to obtain the sap; and the palms, from being exceedingly abundant, became comparatively scarce. Darwin in the year 1834 endeavoured to count the trees on one estate near Petorca, but failed, after having numbered several hundred thousand. In 1859 Dr. Philippi wrote: "There are now few palm-groves remaining, as at Cocalen, at Ocoa in the valley of the Aconcaqua river, and the Cuesta de las Palmas between Petorca and Illapel!" At Ocoa, some forty miles E.N.E. of Valparaiso, the palm-trees are now tapped, and the honey, evaporated and tinned, is sold throughout the Republic. With such trees and shrubs are the valleys clothed, while the higher plains are barer, being dotted over with an orange-flowered and sharp-thorned *Mimosa*. Other scrub includes "chacai" (*Discaria* sp.) and "arrayan" (*Eugenia apiculata*), with an occasional clump of evergreen trees such as the graceful "maiten" (*Maytenus boaria*). The "belloto" (*Bellota Miersii*, C. Gay), a very handsome evergreen tree with thick glossy leaves, grows particularly well in the Central Valley, where it affords excellent shelter for cattle. The nuts which fall from it are devoured by pigs with great enthusiasm. Where the ground is damp, one may find a species of *Ribes*, a handsome climber, the "coile" (*Lardizabala biternata*), or the pink *Mutisia* (*M. ilicifolia*).

The commoner forms of timber used for building purposes in Valparaiso are the native "roble" and "rauli" (*Nothofagus obliqua* and *N. procera* respectively), from the south of Chile. "Alamo" or French poplar, grown in the country, is used where a soft wood is required, as in ceiling mouldings. The best wood used for building purposes is that of the Douglas fir (*Pseudotsuga Douglasii*), known commercially as "Oregon pine," which is imported in large quantities from North America.

Though native trees about Valparaiso grow very slowly, most of the trees introduced from abroad grow with extreme rapidity. Among them we see *Araucaria excelsa* from the Norfolk Islands, *Cupressus macrocarpa* from California, *Eucalyptus*, *Casuarina* and *Grevillea* from Australia, and *Pinus canariensis* from the Canary Islands. The French poplar is of very great value to the Chilian farmer. The trees are planted, about two feet apart, at the edge of each irrigation canal, and are of such rapid growth as to be ready for cutting when about fourteen or fifteen years old. They are then sold standing, or cut into boards by the farmer himself with a portable saw bench. Besides yielding timber, the lines of poplars protect the cattle in summer from the sun, and in winter from storms of rain and wind. In some districts the poplars are attacked by that beautiful but destructive parasite, the "quintral" (*Loranthus tetrandus*), which is spread from tree to tree by birds. As in the case of its British relative, the mistletoe, the "quintral" berry has very viscid juice, which prevents the bird eating the fruit from swallowing the seeds. These it scrapes from its beak on to a branch, where they adhere and germinate. When firmly rooted, the parasite destroys whole avenues of poplars. The weeping willow, also planted beside streams and canals (where it grows with singular luxuriance), is similarly attacked. In the neighbourhood of Valparaiso, it was only after careful search that I found the parasite growing on a native host (*Discaria* sp.), although rampant on the alien poplars and willows.

Among alien flowers growing wild about Valparaiso are:—*Eschscholtzia californica*, *Argemone mexicana*, and *Centaurea melitensis*. The *Eschscholtzia* escaped from the garden of an English lady living in Viña, a suburb of Valparaiso, about forty years ago. Aided by an excellent seed-dispersal mechanism, it spreads along the cliffs and railway embankments, and wherever the ground is broken. However, one occasionally meets with an isolated patch of it miles from any other specimens. Growing in great orange masses on the cliffs between Viña and Valparaiso, it forms a spectacle of the most dazzling brilliance.

A great many of the plants about Valparaiso and in the comparatively dry parts of Chile are aromatic. Some people say that they can smell Chile when miles out to sea. A large proportion of the plants in such a neighbourhood are prickly. Especially is this the case with the very small plants. The ground feels prickly to the hand.

Shortly after arriving in Valparaiso, I travelled south and visited Temuco and Valdivia. Unfortunately I had no apparatus with me for collecting and drying plants, owing to some of my property having been stolen from the steamer on the way to Valparaiso.

In passing through the Great Central Valley, Chile's greatest agricultural asset, I was much struck by the alien flora. The growth of bramble was such as no one who had not seen would believe. It grew fifteen feet up the poplars lining the fields, and at the same time formed hedges about six yards broad. In some places it grew entirely by itself, the interlacing stems forming dome-shaped masses about six feet high. An immense total of valuable farm-land is thus wasted by being covered by this persistent and useless bush. When once the bramble has taken root, its eradication from the soil is a matter of great difficulty. Various expedients have been tried. One method is to burn the bushes, and then fence in the site, turning goats into the enclosure. The animals eat off the new shoots as soon as they appear; and, in the course of time, the roots die. Some parts of the land were overrun by that handsome artichoke, the cardoon (*Cynara cardunculus*), which, however, attains its maximum development on the plains of the Argentine.

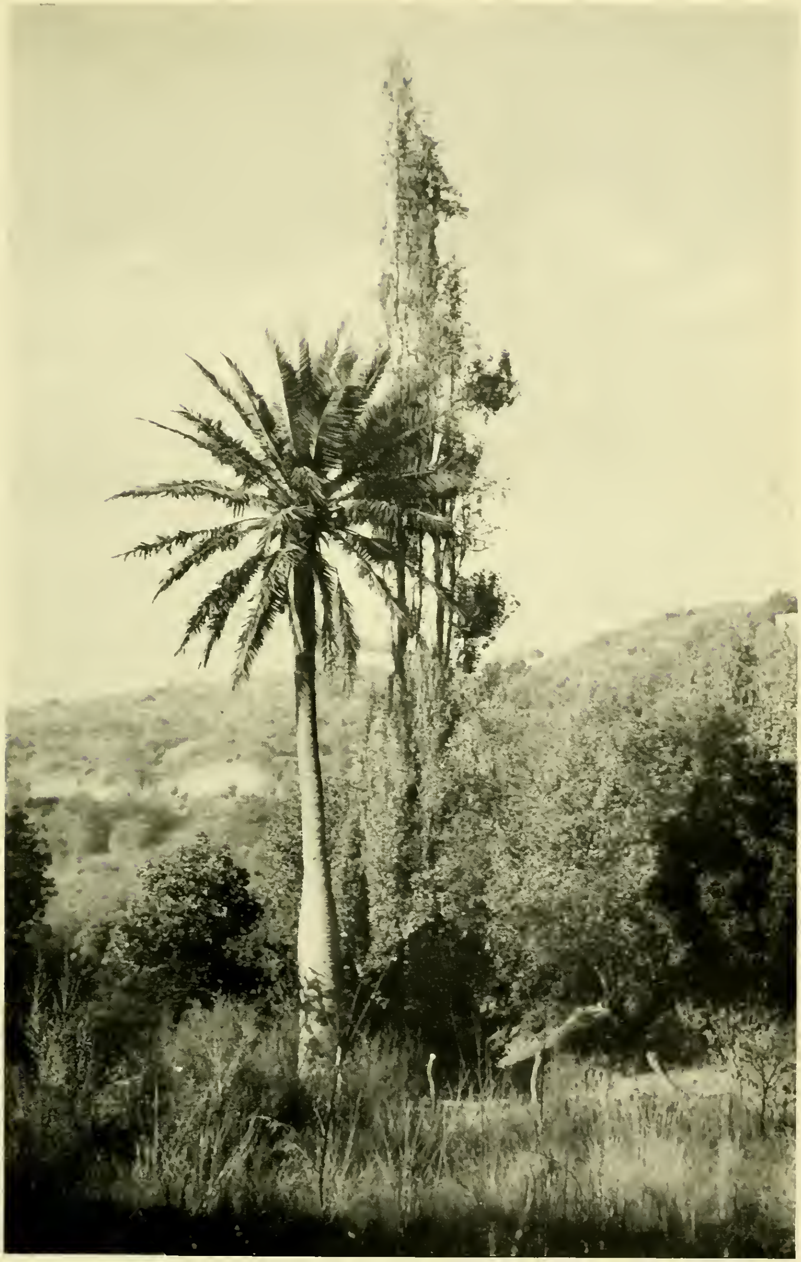
After passing over a high table-land, we reached the forest country of the south. At first we passed through miles of blackened stumps of burned trees, with little settlements here and there near the new railway over which we were travelling. Corn was seen coming up between the prostrate stumps of trees which had not as yet been removed. Later we passed through dense forests of evergreen trees with an occasional bush of *Berberis Darwinii* covered with orange blossom.

Valdivia, with a climate like that of the west of Scotland, is very attractive. (Since my visit, the town has been destroyed by fire.) The trees there are mostly evergreen, and many of them have conspicuous flowers. One of the most beautiful is the "canelo" or Winter's Bark (*Drimys Winteri*), with bright green leaves and clusters of white flowers. Flowering branches of this tree are used with charming effect in ecclesiastical processions. Of the southern beeches, the "coigüe" (*Nothofagus Dombeyi*) is the most handsome. The shallow streams were overhung with the golden blossom of the "pelu" (*Sophora tetraptera*), a small leguminous tree.

I was surprised to find two species of climbing violets. The flowers of one species were mauve in colour, and the other of a rose pink. These plants climbed, without specialised organs, by twining up neighbouring plants. The forms of leaf and flower were not unlike those of our wild violets. The mauve species tended to straggle over the ground and twist upon itself, but the pink species climbed two or three feet up the hedges or neighbouring plants.

Primroses, foxgloves, and gorse grew near the town, and were probably introduced by the Germans, who form a large community.

We left Valparaiso early in December, crossing the Andes, and traversing the Argentine Republic. During our ascent on the mountain railway, the vegetation grew more scarce. We passed tall cacti covered, in patches, with a blood-red parasite. The tunnel being at the time incomplete, we crossed the summit in coaches, which rattled down the steep Argentine descent and swung round sharp corners in a somewhat alarming manner. Even quite near



Honey Palm (*Jubæa spectabilis*) and French Poplar attacked by *Loranthus tetrandus.*

W. Balfour Gourlay, B.A.

Puya Whytei, Hook.

W. Balfour Gourlay, B.A.

the summit, at a height of nearly 13,000 feet, I noticed occasionally a small composite flower.

I stayed for a few days at Puente del Inca, on the Argentine side of the Andes, to examine the plants in this neighbourhood, at a height of 9000 feet. Among the species most conspicuous were *Tropæolum polyphyllum*, a *Berberis*, and species of *Adesmia*. I also found a small *Calceolaria* and many of the Compositæ.

At Mendoza, we left the Transandine railway, and, crossing the great plains of the Argentine, sailed for Liverpool from Buenos Aires, thus completing a most interesting visit to the New World.

The Genus Carex in Britain. By Arthur Bennett, F.L.S.

In the "Annals of Scottish Natural History," January 1910, pp. 46–52, is a paper entitled "Critical Remarks upon the *Cyperaceæ-Caricordeæ* as treated in 'Das Pflanzenreich' by G. Kükenthal, 1909, Leipzig," by Mr. G. C. Druce.

In the following notes I have to some extent followed the above "remarks," amplifying them in some cases. I have done so because my name happens to be mentioned here and there.

I have not seen this part of the "Pflanzenreich," so cannot say to what extent the author recognises his indebtedness to my late friend Mr. C. B. Clarke of Kew; but having often talked matters over with Mr. Clarke, and seeing many MSS. of the author, I know how much he owed to Mr. Clarke.

I have given the original descriptions of some varieties named that do not appear in British floras.

Carex binervis, Sm., var. *alpina*, Drejer (1), No. 52.

C. Sadleri, Linton.

C. binervis, var. *nigrescens*, Druce.

C. frigida. Syme, non All.

"β alpina humilior spicis paullo brevioribus Faerö ad Quivig! Lyngbye. Hujus plantæ modo 2 frustula male conservata in herbaria nostra deposuit Lyngbye, quæ tamen satis luculenter probant, plantam hujus floræ civem esse."

In No. 15 I refer var. *nigrescens* to β *alpina*, Drejer.

Carex flava, L., var. *recterostrata*, Bailey, "Bot. Gazette" (1888), 84.

"Plant less yellow, or entirely green: spikes more scattered, the lowest two or three inches remote and usually conspicuously stalked; beak shorter, straight, or nearly so."

Vancouver Island, Macoun, *C. irridula*, Boott, "Ill.," *Carex*, t. 523, may possibly belong here, *l.c.*

Carex Goodenovii, Gay, var. *strictiformis* (7), Bailey (*sub vulgaris*).

"Tall and lax ($1\frac{1}{2}$ to $2\frac{1}{2}$ feet high), the leaves long and narrow; staminate spike, longer pedunculed; pistallite spikes looser and often longer than in the species, the perigynia never being so densely packed, and usually becoming browner. This plant stands midway between *C. vulgaris* and *C. stricta*."[1] This American *stricta* is much like the var. *virescens* of *C. aquatilis*, Wahlb.

Carex rostrata, Stokes, var. *utriculata*, Bailey (No. 3).

C. utriculata, Boott in Hook., "Fl. Bor. Am.," ii. (1840), 221.

To this Herr Kükenthal refers the Irish plant I named in error *C. rhynchophysa*.

Professor Bailey (No. 7) writes: "A study of much material, in field and herbarium, renders the differences between the European *C. rostrata* and our plant apparent. From the European species *C. utriculata* is separated by grosser habit, lack of stoloniferous character, broader and proportionately shorter leaves, heavier and more scattered spikes, of which the lower are less pedunculed, and much sharper scales."

Carex acuta, L., var. *strictifolia*, Uechtz. = *C. strictifolia*, Opiz in "Reich. Ic.," viii. (1846), 15 = *C. prolixa*, Fries, "Mant.," iii. (1842) 150. Uechtz. in "Sch. Ges. Vat. Cult." (1875), p. 30, seems to be the first to have made the above combination; but Hartmann, "Hand. Sk. Fl.," 4th ed. (1843), calls it *C. acuta*, var. *prolixa*, and this must stand (Bennett, 15).

No. 14. Andersson here discusses the various forms of these two species as they occur in Swedish Lapland, and

[1] *C. stricta*, Lam., "Dict. de Bot.," iii. (1789), 387, not of Smith.

shows, as the elevation, etc., increases, they become dwarfer, and with other lessened characters. He mentions with great approval Læstadius's "Loca Parral. plant. in Suecia boreali observatiis." This work, written in 1832, was not published until 1839. It is written in Latin, and contains a vast number of notes upon the variation of plants as induced by climate, etc. Much in both these papers are of value even to-day.

C. ampullacea brunnescens, And.—"The halm, seldom exceeding 2 feet in height, is quite obtuse, clothed below with conspicuous reddish scales; the leaves lighter than usual and shorter; f. spikes shorter, of a high brown colour, especially noticeable after pressure. The utricles are less inflated, with few indistinct nerves. Male spikes always two." Andersson, *l.c.*

C. vesicaria alpigena "acquires a shorter but more robust halm, clothed by broad-keeled leaves, with triangular summits as long as the halm, and surrounded below by dry sheaths. Usually two female spikes, rarely three or one, the lowest stalked all erect, 1 inch long, with brown or blackish shining scales; stigmas three."

C. vesicaria dichroa.—"The halm is about 2 feet long, somewhat curved at the base, the leaves attenuated towards the point, f. spikes more or less lax, the lowest almost always nodding, glistening from the scales, which are scarious at the edges and points; male spikes mostly two." Andersson, *l.c.*

C. rostrata, var. *sparganifolius*, Murray, Scotland (Druce) in "Das Pflanzenreich," 1910.

C. rostrata × *vesicaria*, Figart, 1887.

× *C. Pannewitziana*, Figart (1887).—Ascherson and Graebner, "Syn. Fl. M. Europ." (1903), 213, refer *C. Friesii*, Blytt, to this, but the specimens of this I have seen seem to me different.

I have this from Perth, gathered by Dr B. White; and Rev. E. S. Marshall gathered it in Glen Callater. (Bennett, No. 15.)

Herr Kükenthal uses *C. Hudsonii*, A. Benn. (for *C. stricta*, Smith, non Lamarck), instead of *C. elata*, Allioni. There is no specimen in Allioni's herbarium, and there is some doubt whether the name applies to *stricta*, Sm. or *acuta*, L.

C. aquatilis, Wahlb. (Bennett, 15).—Herr Kükenthal gives a new form, *angustata*, Kuk., from Forfar (Somerville) and Easterness (Marshall); var. *spagnophila*, "Fr. Sum. Veg. Scand.," 72, 1846.

From Clova (Boott): S. Aberdeen (Druce).—This is very near var. *epigejos*, Laest., "Vet. Ak. Handl." (1822), 339, but Andersson says of the latter: "squamis fusco-atris fere brevioribus, fusco iridis"; of the former, "squamis pure viridis."

The plant from Methven Bog, named *epigejos* by Dr. Almquist seems not to belong to that variety; see my remarks in No. 15. There is some discrepancy between the Herb. Normale specimens and the description in Andersson and his drawing.

C. alpina, Sw. (1798) is used instead of *C. Halleri*, 1766–72; but there is a *C. alpina*, Schrank, "Baier. Fl.," 299 (1789) = *C. sempervirens*, Will., so that perhaps it would be well to go back to C. *Vahlii* (1801).

Lang in Linn., xxiv. (1851), p. 563, notes that his name *C. borealis*, Lang, "Flora," March 1843, p. 142, antedates Fries' *C. epigejos*, "Bot. Not.," July 1843, but of course this only applies if the plant is held to be a species. He says it is intermediate between *C. aquatilis* and *C. rigida*, and that specimens sent to him have borne both names. The remark is made "Ann.," *l.c.*, p. 50, as to Scotland, "does it really occur there." As Herr Kükenthal has himself named specimens from "Corrie Kander" (see No. 16) as "*C. aquatilis*, var. *epigejos*, Anderss." (why the var. is placed to Andersson I do not know, as Læstadius named it *aquatilis* β *epigejos* in 1822), it seems it does occur there.

The *salina* form I name (15) as having seen only three specimens of, *i.e.* one at Kew, one in the Boswell herbarium, and one sent me by Dr. Buchanan White as "the alpine form from Clova of *aquatilis*," is a difficult one to give a name to: it certainly comes very near the *C. epigejos*, Fries (non Læst.), "Bot. Not.," 105 (1843), see No. 15 = *C. discolor*, "Nyl. Spic. Fl. Fenn.," iii. 12 (1846).

C. fusca, Allioni, "Fl. Ped." (1785), ii. 269.—"A good specimen in Allioni's herbarium." Bailey, No. 7.

C. polygama, Schk., "Riedg.," 84, t. 76 (1801).

C. subulata, Schum., "En. saell.," i. 270 (1801).

C. Buxbaumii, Whlbg., "Act. Holm.," 163 (1803).

The first is the proper name if the law of priority is followed.

Herr Kükenthal substitutes "*concolor*, (Br.), Kük.," for the *C. rigida*, var. *inferalpina* of Læstadius (1839). If by this he means *C. concolor*, R. Br., in supp. app. "Parry's Voy.," 218, 1823, then I think he is wrong, as the plant of Brown is nearer the var. *saxatilis*, Fr., *i.e.* nearly the typical form "inferalpina, Læst. (luxurians), pedalis et ultra; foliis latissimus inferioribus subexcurvatis, superioribus erectis; bracteis late foliaceis; planiusculis; spicis fem. inferioribus exserte pedunculatis, clavatis, subrarifloris, ad masculum approximatis; glumis acutiusculis." Andersson, No. 20.

The original description of Læstadius in the "Loca Parell." does not lend itself to quotation, Andersson first putting it into descriptive form.

C. lagopina, Wahl. (1803), is used instead of *C. Lachenalii*, Schkr. (1801). Richter, "Pl. Europ.," i. 151, 1890, places the latter under the former, and Kunth., "En. Pl." ii., 1837, also does so, but uses "*C. leporina*, L., Sp. 2, 1381, non Suec."

Carex aquatilis × *kattegatensis*, Fr. = × *C. Grantii*, A. Benn. in No. 15. Richter omits *C. kattegatensis*, Fries, in "Ind. sem. hist. Up.," 1857. This hybrid was gathered in Caithness by Mr. Grant of Wick.

C. aquatilis × *Hudsonii* = × *C. hibernica*.—A. Benn. in No. 15. Kerry, Ireland, W. Scully.

C. aquatilis, Wahlb.—Mr. C. E. Salmon, No. 17, rightly remarks to a var. *angustifolia*, Kühl: "It seems unwise to name individuals in this way." The fact is, *aquatilis* in Sweden, Norway, and Finland varies greatly, any number of so-called forms may be made of it, and their collation seems almost impossible when hundreds of specimens are seen!

"And *C. salina* is worse, no two authors agreeing in the disposition of the forms; even in the Caithness *C. kattegatensis*, Fr., the series of twenty-two gatherings kindly made for me by Mr. and Miss Grant, along the whole extent of its growth on the Wick river, these it is impossible to collate with European forms; they are individual variations of a species."

C. canescens, L., is used for *C. curta*, Good.—Varieties under it are given:

1. Var. *tennis*, Lang, in "Linn.," xxiv. (1851), p. 538. Ben More, Druce.

"γ *tennis*.—Tota valde gracilis et debilis habitum fere referens Caricis Persvonii. Spiculæ pauciflorae. Hujus memorabilis formæ cæspitem circiter culmorum octodecim in consortio normalis plantis prope Erlangum quondam legi.

"Habitus Caricis canescentis statim a præcedente Carice norvegica differt. Color normalis illius pallide canescens, quare optime canescens nominata est Carex. Spiculæ multifloræ et fructus conspicue minores sunt quam Caricis norvegicæ," pp. 538–9, *l.c.*

β *robustior* (Blytt).—"spiculis crassis, fulvescentibus, summis valde approximatis; fructibus late ovatis." Andersson, No. 20, p. 57.

2. Var. *robusta* (Blytt) in Andes, "Cyp. Scand." (1849), 57. The reference to the "Sum. Veg. Scand." (1846), is to a name only. That to the "Herb. Norm.," fas. 7, n. 85, Sept. 1840, is to the plant. Blytt's own description is in "Norge's Flora" (1861), p. 201. Lang, *l.c*, has a var. *robusta*.

3. Var. *fallax*, F., Kurtz in Asch. et Graeb., "Syn. Fl. Mitteleurop." ii. 2, 61 (1902) = var. *dubia*, Küken., non Bailey (Scottish Highlands, Druce).

The var. *robusta* is the plant long called *alpicola* by British botanists. Lang's plant has "spiculæ ut planta tota crassines, habitu non mutato."

C. fulva, Good., is named as *C. Hornschuchiana* × *Œderi*, of which three forms are given:—

C. glauca, "Scop. Fl. Carn.," 2nd ed., 223, 1772. (In the first edition, 214, 1760, without a name.)

C. flacca, Schreber, "Sp. Fl. Lips.," add. 1771. The *C. glauca*, Murray, "Strip. Goett.," 1700.

In a letter Mr. C. B. Clarke writes as to this:—"Printed by Nyman, copied by nearly all since, even by Richter, who is usually more careful. But as far as we can discover here (*i.e.* Kew), it is purely a falsehood with a purpose; we cannot find the name *glauca* in Murray's

'Gottingen Flora,' 1700, on the page cited, or on any other page; nor can we even find the plant under any name. Now, *C. recurva*, Good., is very fully and well described by Goodenough in his paper read 1792, published before 1794: the name *recurva* is not taken up by Hudson till his edition of 1798."

C. Œderi, Retz.

C. Œderi, *β subglobosa*, Storck., "Salzb." (1857), 76 = *C. subglobosa*, Mielich., "Flora," xxii. (1839), 257. Herr Kükenthal records it a "forma" from Lough Neagh (Ireland), Druce.

C. Œderi, Elub., sub. sp. *œdocarpa*, Anders., "Cy. Scand.," 25, 1849; not as a variety.

C. elytroides, Fries, from Anglesea, was disposed of by Mr. Marshall in No. 16, but with the reference I do not agree.

C. ligerica, Gay (Scilly Isles), was named by Boeckeler, but no doubt some of his work is not good. But of course his name is not mentioned.

C. diluta, Bieb., and *C. punctata*, Gaud.—A supposed authentic specimen of the first shown me by Mr. C. B. Clarke was undoubted *punctata*, and I see Trautvetter (Supp. "Led. Fl. Ross") conjoined them, as did Treviranus in "Bull. Soc. N. Mos." (1863), i. 541. And Mr. Clarke observed that his Kasmir specimens of *C. diluta* had a considerable range of variation, and that Cabul specimens of *diluta* were marked *punctata* by Boeckeler.

(1) Drejer.—Revis. Crit. *Caric. borelium*, 1841.
(2) Bailey, L. H.—Notes on *Carex*.—Bot. Gaz., 1888, 82–89.
(3) Bailey, A. Prem.—Syn. of N. American Carices, pp. 59–157. Proc. Am. Acad. of Arts and Sciences, 1886.
(4) Bailey.—Bot. Gaz., 117–122, 1884.
(5) " " 137–141, 1884.
(6) " " 203–208, 1885.
(7) " Studies of the Types of various species of the genus *Carex*.—Mem. Torrey Bot. Club, i. (1889), 1–85.
(8) " Bot. Gaz., 293–295, 1885.
(9) " " 317–319, "
(10) " " 379–382, "
(11) " " 328–330, 1886.
(12) " " 82–89, 1888.
(13) " Jour. Bot., xxvi. (1888), 321–323.
(14) Andersson.—On *C. ampullacea*, Good., and *C. vesicaria*, L.; with Remarks on their Modifications of Form. N. J. Andersson in Nya Botiniska Notiser, 1850.
(15) A. Bennett.—Jour. Bot., June, July, 1897.

(16) E. S. MARSHALL.—*L.c.* (1898), 73–82.
(17) C. E. SALMON.—*L.c.* (1906), 224–227.
(18) M'LAREN.—On some British Carices.—Bot. Gaz., iii. (1851), 17–27.
(19) PRIESTLEY.—On *Carex.*—Trans. Bot. Edin., iv. (1853), 71.
(20) ANDERSSON, N. J.—*Cyperaceæ Scandinaviæ*, 1849.
(21) RICHTER.—*Plantæ Europeæ*, i., 1890.—*Carex*, pp. 145–171.
(22) ASCHERSON and GRAEBNER.—Syn. Fl. Mitteleurop.—Flora *Carex*, v. 264, 1902–3. Index, 1–33, 1904.
A very full Bibliography of *Carex* will be found at pp. 154–157 (1753-1886) in Mr. Bailey's No. 3 Paper.

NOTE ON THE RELATIONSHIPS OF PRIMULA ELATIOR AND P. VULGARIS TO SOIL CONDITIONS. By R. S. ADAMSON, M.A., B.Sc.

The observations contained in this paper do not in any way profess to be complete. They are the result of some investigations in a few areas of more or less natural woodland in Cambridgeshire, and more especially in Gamlingay Wood, on the borders of the counties of Cambridge and Huntingdon.

In this district at the present time *P. elatior* is confined to woods of the *Ash-Oak* type on Boulder Clay. It does not occur at all in the damp meadows, where it is so frequent in its Continental localities.

The Boulder Clay in Cambridgeshire is for the most part a very heavy fine-grained clay, with few stones and very little sand or gravel intermixed. The lime percentage is somewhat variable, but on the whole it is a distinctly calcareous soil. For agricultural soils Foreman[1] gives the lime content as varying from 1 per cent. to 5·7 per cent., but in the woods it seems to be rather higher, sometimes reaching 7·08 per cent., with an average of about 4 per cent. This difference is probably due to the greater amount of leaching out that occurs in the soils of cultivated land.

Locally the Boulder Clay has a different texture—much more sandy. This loamy part is much less calcareous, the lime content averaging about ·8 per cent.

The water-holding powers of these two soils are very different. In the woods both become almost or quite saturated in the winter. The clay, in fact, is often super-

[1] "Journ. Agric. Sci.," ii., 1907.

saturated, the water-table rising to the surface. In summer the clay as a whole always remains moist, while the loam may get very dry.

M. Christy[1] says of the distribution of the two species of *Primula* that though *P. vulgaris* occurs all round the area occupied by *P. elatior*, the two do not overlap to any extent. In the woods of West Cambridgeshire, however, this sharp distinction does not hold in most cases. Some of the woods have only a single species, but in most the two species occur and largely mixed together. Generally where *P. elatior* occurs it is the more abundant if the soil conditions are suitable.

The factors determining the distribution of *P. elatior* seem to be mainly amount of lime and water content. It does not seem able to flourish if either gets below or above a certain amount, and the range does not seem very great in these woods.

It flourishes most, apparently, on the clay with a lime content of about 4 per cent., and a water content high in spring and never falling much below 30 per cent. at any time of the year. However, it cannot stand a very wet soil: in those woods where the soil remains nearly saturated throughout the year, though the lime content may be quite sufficient, *P. elatior* does not flourish, and *P. vulgaris* takes its place.

Should the soil be drier, again, *P. elatior* ceases to flourish—its lower limit would seem to be about 25 per cent. Thus in some woods and parts of others which have better drainage there are few or no plants of *P. elatior*, but large quantities of *P. vulgaris*.

P. elatior is extremely intolerant of non-calcareous soil. On the loamy patches of the Boulder Clay it is entirely absent, though *P. vulgaris* is present in quantity. The absence in this case is not due to the lowering of water-content alone, and in parts of the loam the requisite amount is present at all times of the year, but no oxlips occur.

P. elatior is not a plant that demands a very dense degree of shade. After the coppice in the woods has been cut it increases in quantity very rapidly and flowers with

[1] "J. Linn. Soc.," xxxiii., 1898.

great profusion, while near the end of the rotation of the shrubs it flowers comparatively little and is much less obvious, but responds quickly at any place where there is an increase of light—such as along paths, etc.

With regard to all three factors *P. vulgaris* is much less exacting and has a much wider range of habitats in consequence. It seems very indifferent to lime unless the amount rises too high, as above the chalk, and can flourish in quite non-calcareous soils.

Wherever the two species occur in close proximity hybrids occur in large quantity. These hybrids seem to have a slightly wider range of soil conditions than *P. elatior*, but not nearly so much as *P. vulgaris*. With regard to water content they seem able to flourish in soils too dry for *P. elatior*. But on this point further investigation is necessary.

To summarise, *P. elatior* demands a soil with high water content, especially in spring, but not a saturated soil. This must be combined with a moderate but not excessive amount of lime. Where either of these conditions is unfulfilled, it ceases to flourish and *P. vulgaris* occurs alone, which makes much less demand on the soil.

Other factors certainly come into play in determining the distribution, but in the eastern county woods the above seem the most important.

The flowering season of *P. elatior* is very short: it starts a week or more later than *P. vulgaris* and ceases a considerable time before, and how far this character influences the distribution would make a very interesting study.

CAREX AQUATILIS, WAHLB., AND ITS SCOTTISH FORMS. By ARTHUR BENNETT, F.L.S.

C. aquatilis, Wahlb., in "Vet. Akad. Handl." (Stockholm), 1803, p. 165.

Richter[1] quotes it as of "Act. Holm.," but the other reference is more easily found.

He gives under it four varieties, but of these *nardifolia*, Wahlb. *l.c.*, belongs to *C. Goodenovii*, Gay, as authentic

[1] "Plant. Europ." i. (1890), p. 155.

specimens from Wahlenberg in Boott's herbarium at Kew show.

The first record of *aquatilis* as a Scottish plant was in "Eng. Botany," suppl., t. 2758 (1832): "Found on the Clova range of mountains by W. J. Hooker, W. S. Burchell, and R. K. Greville" (about 1824).

The description was by Dr. Greville, and I have specimens gathered by him in 1831. In Hooker's "Brit. Flora" (1830), p. 398, it appears as *C. rigida*, Good., var. β. In the 3rd ed. (1842), 427, he quotes Boott's doubts as to its being the plant intended by Wahlenberg: but now no doubt is felt, and I have myself seen specimens named by Wahlenberg.

In the year 1851 Mr. J. M'Laren read a paper, "Remarks on some British Carices," before this Society, which was also published in the "Botanical Gazette," iii. (1851), pp. 17–27.

In this he suggests three varieties of *C. aquatilis*, but gives them no names. His γ is the nearest we possess to the type plant of Wahlenberg; the habitat he gives is "Glen Isla, and by the bridge at Clova." His β is the Clova tableland plant, and his α comes in between them.

This *Carex* is now known from twenty-three Scottish counties, ten Irish counties, two English counties, and one Welsh county. Yet, in 1860, Hooker and Arnott, in their "British Flora," give only the stations of "the Clova tableland, and in the valley by the bridge at Clova."

One of the most interesting facts with regard to its distribution in Britain is its occurrence in Wales, and Kerry in Ireland, at low levels; yet it is not on record for either Denmark or North Germany. In one of its forms (*C. stans*, Drejer) it extends in Greenland north to 72° N. lat. In Finland it occurs in both Finnish and Russian Lapland to 68° N. lat., and to Nova Zemblia.

Though I have tried, it seems impossible to specifically separate our lowland plants from the high northern forms.

In the "Journal of Botany" for June and July 1897, I gave five forms as occurring in Scotland:—

1. var. *cuspidata*, Læstad.
2. „ *virescens*, Anders.
3. „ *minor*, Boott.
4. „ *elatior*, Bab.
5. „ *epigejos*, Læst. non Fries.

No. 1, *cuspidata*, Læst., in "Vet. Ak. Hand." (1822), p. 339. —This is now regarded as a hybrid = *C. aquatilis* × *salina cuspidata*, and I see no reason to doubt this may be so with the Caithness plant, *i.e. C. aquatilis* × *kattegatensis*, Fr.; it occurs with the parents on the Wick river, where it was gathered by Mr. Grant.

As I remarked (*l.c.*), I find it difficult to separate it from Læstadius's var. *subacuta* in "Nov. Act. Upsal.," xi. (1839), 289.

As the name *cuspidata* implies, the glumes are drawn out into a long cuspidate point.

2. Var. *virescens*, Anders., "Cyp. Scand." (1849).—Exactly the opposite to the last, the glumes only half the length of the fruit, and the fruits very symmetrically arranged. Perth, B. White!; Spittal of Glen Shee, E. Perth, E. S. Marshall, sp.; Spey bank, Aviemore Co., 96, Messrs. Wilson and Wheldon, 1909; W. Sutherland, E. S. Marshall, sp., Co. Donegal, Hart, sp.; Co. Limerick, Phillips, sp.

3. Var. *spagnophila*, Anders., *l.c.*—He quotes Fries, "Sum. Veg. Scand.," pp. 72, 220, but there is no description there; and "Herb. Nor.," xi., No. 78: "culmo pedali obtusanguli; foliis culmum æquantibus, fructibus squamas acutas pallidas æquantibus; pur viridis."

Swamps on the tableland between Glens Doll, Caness, and Fiagh frequent, 27/6/1904, E. S. Marshall, sp.

4. Var. *elatior*, Bab.! "Man. Brit. Bot." (1843), p. 341: "3-4 feet high, glumes oblong, blunt, shorter than the fruit." = var. *Watsoni*, Syme, "Eng. Bot.," 3rd ed., x. (1870), 113.

Some years ago Professor Babington wrote me that "I do not now consider that this is worth a name." Anyhow, it is the largest form we have, and sometimes comes near the original type.

5. Var. *epigejos*, Læst., "Vet. Akad. Hand." (1822), 339 = *C. epigejos*, Hartm. non Fries:—"culmo subpedali, superne scabro; foliis planis, strictissimus; bracteis spicim masculum subæquantibus, spicis fem. subrariflorus oblongis, fructibus flavoviridibus, squamis fusco-atris fere brevioribus fusco-viridis." Anders., *l.c.*

In the paper cited I noted that Dr. Almquist had named specimens from Methven Bog, Perthshire, as *C. epigejos.*

I there remarked that I doubted this naming, and it has proved a form of Goodenovii.

Specimens gathered by the Rev. E. S. Marshall: "By the Spey, below Kingussie, v. c., 96, 1898." On these Herr Kükenthal remarked, "approaches var. *epigejos*, And."

In the "Ann. Scot. Nat. Hist." (1910), p. 50, it is stated that Herr Kükenthal[1] makes *epigejos* synonymous with *C. stans*, Drejer. "Rev. Car. Bor.," No. 32 (1841), p. 458. Drejer there says: "Hæc species, cujus perigonia modo immatura vidi, ex distylis *C. aquatili* et *saxatili* (*rigida*, Good.) maxime affinis est." Now Hjelt in his "Fl. Fennica" 1895), 270, remarks that Drejer's plant passes for three:—

1. *C. aquatilis* × *rigida*.
2. A small form of *aquatilis*.
3. The arctic *C. stans* of Greenland

To me Mr. Marshall's specimens belong to No. 2. Neither Richter, *l.c.*, nor Nyman[2] mention *C. stans*.

6. Var. *forma angustata*, Küken. *l.c.*—From Forfar (Somerville) and East Inverness (Marshall). I have specimens of both these, and how they are to be separated from No. 3 puzzles me. Marshall rightly observes, when these were called *f. gracilis*, "I do not think these are really worth separating."

7. Var. *rigidis*, A. Benn., "Ann. Scot. N. Hist.," Linlithgow; A. Sommerville, sp., 1897.

Kirkcudbright: (1) the Dam, New Galloway, 1887, J. M'Andrew, sp. (2) Kenmore Holms, New Galloway, 1887, J. M'Andrew, sp. (3) River Ken, New Galloway, 1884, J. M'Andrew, sp.

In this the male spikes are 2–3, thick, rigid, and adpressed to the stem; female spikes 3–4, stout, continuous, the fruit closely packed, glumes with upper spikes subequal, in the lower often exceeding the fruits, edged with rich brown: middle (broad) green. Stems 2–3 feet high, leaves broad, almost flat, edges very slightly involute.

The habit is much like some *salina* forms, or like a rare Portuguese species, *i.e. C. fasiculata*, Link. The stigmas are very long, 3–4 times that of the fruit.

[1] In Engler's "Das Pflanzenreich," *Carex*.
[2] "Consp. Fl. Europ." (1882), 777.

Hybrids.

8. ×*C. hibernica*, Ar. Benn., "Jour. Bot.," June (1897) =*C. aquatilis*×*Hudsoni* (*stricta*, Good.), Ireland.—Galway's river, Old Kenmore Road, Co. Kerry, 15/6/1889, R. W. Scully.

9. ×*C. Grantii*, Ar. Benn, *l.c.*=*C. aquatilis* × (*salina*) *kattegatensis*.—By the Wick river, Caithness. J. Grant, sp. 1884. C. L. Marshall, sp., 1900.

10. *C. aquatilis* × *rigida*. — Sphagnum swamp (2000 ft. alt.) with the parents below corrie of Clova, Forfar, 1904. C. S. Marshall, Lochnagar, Aberdeen, 1851; J. F. (Boswell) Syme, sp.

11. *C. aquatilis*×*Goodenovii*.—Caness, Forfar; F. W. Miller, sp., 1884; near Spittal of Glen Shee, East Perth; E. S. Marshall, sp., 1906.

The figure of *aquatilis* in "Fl. Danica" supp., t. 33 (1852), seems to come between No. 3 and 4.

In Don's "Herbarium Britannicum," fas. 8 (1806). No. 192, are specimens of the var. *elatior* of Babington, under the name of *C. stricta*, var.—new species—*Carex*, perhaps only a variety of *stricta*. He says: "I have seen this *Carex* in several places in Scotland, but it is of the rarer species. My specimens were collected from the side of the river Esk, near Eskmount, three miles from Brichen, in Angusshire."

In the "Comp. Cybele Brit." (1870), 589, Mr. Watson mentions that Dr. Boott made out other affinities with forms of *aquatilis*, writing, "in the specimens from the Almond river (near Edinburgh) collected by Professor J. H. Balfour in September 1838, very like *stricta* (Lam.) of America." Thus the *C. Virginiana* of Smith is placed next to *aquatilis* by Bailey;[1] and certainly some of the forms of *aquatilis* do come near to that very variable American species.

[1] "Proc. Am. Acad. Arts and Sciences" (1886), p. 84.

Some Further Mosses and Hepatics from the Isle of May. By William Evans, F.R.S.E.

Since the publication of my list of Bryophytes from the Isle of May in the *Transactions* of the Society two years ago (vol. xxiii., part iv., pp. 348–351), I have paid several further visits to the island and succeeded in finding other seventeen mosses and two Hepatics. These are:—

Polytrichum piliferum, Schreb.—On 17th June 1909 Polytricha were met with in some abundance on wind-swept rocky knolls near the lighthouse. Capsules were present though not plentiful. Besides examples referable to *P. juniperinum*, there were others with the long hoary arista characteristic of *P. piliferum* which Mr. Dixon says they undoubtedly are.

Ceratodon purpureus (L.), Brid.—A few patches, bearing old capsules, on old cinder heaps near the lighthouse. September 1910.

Pottia Heimii (Hedw.), Fürnr.—Sparingly, with ripe capsules, at side of path, June 1909.

P. Wilsoni (Hook.), B. and S., sub-sp. *asperula*, Mitt.—Several patches bearing abundance of capsules, some of them already ripe, were found on 23rd September 1910, where a little soil had collected on the rocks at the south-east corner of the island.[1]

Tortula muralis (L.), Hedw.—A little on rock at the lighthouse, September; fruit scarce.

Barbula rubella (Hoffm.), Mitt.—Common on old track, June 1909; barren.

Funaria hygrometrica (L.), Sibth.—On the path near the lighthouse, common and fruiting freely, June 1909; also on old cinder heaps, September 1910.

[1] Regarding this moss—perhaps the most interesting I have found on the island—Mr. Dixon writes me as follows: "Your *Pottia*" (which I sent to him as *P. Wilsoni*) "is rather puzzling; it is quite easy to run it down by the key to *P. asperula*, for it has the larger cells of that as compared with *P. Wilsoni*, and quinquefarious leaves; but then the capsule is more elongate, rather. The rough calyptra seems to place it without doubt under *P. Wilsoni* or *P. asperula*, and the two are very close to one another, scarcely, I think, separable. I do not think you can be very far wrong in calling it *P. asperula*, in spite of the fact that that has been only found in the south hitherto."

Bryum capillare, L.—A few small barren tufts on a moist rock near the lighthouse, September.

B. atropurpureum, W. and M.—A few plants, bearing old capsules, growing among the *Ceratodon*.

B. argenteum, L.—A little coming up on the track near the harbour, June 1909.

Camptothecium sericeum (L.), B. and S.—On damp rock near the lighthouse, September 1910.

Brachythecium plumosum (Sw.), B. and S.—A little among *Grimmia maritima* on rocks. Determined by Mr. Dixon.

Plagiothecium undulatum (L.), B. and S.—Two large patches in hollow near the low lighthouse, September 1910.

Hypnum polygamum, Schp.?—A *Hypnum* gathered in a marshy spot on 14th July 1910 is, Mr. Dixon considers, probably this species, although somewhat abnormal. It must, I think, be a state of this moss.

H. fluitans, L.—Abundant in small pools on the higher ground south of the engine-house, June 1909 and subsequent dates.

H. resupinatum, Wils.—Sparingly on rocks near south end, July 1910.

H. cuspidatum, L.—In damp hollow on east side, August and September 1910.

Plagiochila asplenioides (L.), var. *humilis*, Nees.—Sparingly on rocky bank near south end, July 1910.

Lophocolea cuspidata, Limpr.—In same situation as the last; with inflorescence. Determined by Mr. Macvicar, who has also examined the *Plagiochila*. Other specimens of *Lophocolea* growing among grass may have been *L. bidentata*, but no inflorescence was found by which to decide.

In a recent part of the *Proceedings of the Royal Society of Edinburgh* (vol. xxx., part ii., published in January 1910), Mr. George West mentions twelve Bryophytes observed by him on the Isle of May during a visit to it in August 1905. Some of these have not, so far, come under my notice. In June, and again when staying on the island in September, this year, I looked in vain for *Lunularia* in the cave where Mr. West states he saw it growing in 1905. *Cono-*

cephalum, also mentioned by him, was there in profusion, and in all stages of growth.

The present instalment brings the number of Bryophyta I have collected on the May up to forty-four; *i.e.* Musci thirty-five, and Hepaticæ nine. Several of the species recorded in my former list were this year met with in other spots, showing them to be more common than I had thought. I have again to thank Messrs. Dixon and Macvicar for kindly examining a number of my specimens.

SUPPLEMENTARY NOTE ON MOSSES OF PRINCE CHARLES FORELAND, SPITZBERGEN. By H. N. DIXON, M.A., F.L.S.

A small packet of mosses collected on the above island was put into the hands of Mr. J. Hunter by an assistant who accompanied Dr. Bruce on the expedition of 1906–7. These Mr. Hunter handed to me for examination, with the remark that they were sent just as he had received them, and consisted only of four or five species probably, with apparently very little interesting about them except in so far as they came from a hitherto unexplored tract. On examination I found that about eight species were represented, mostly of the usual arctic type. Not being aware that the mosses of the expedition to this island were being worked out by Dr. Hagen, I was satisfied with determining the species, and it was not till Dr. Hagen's article appeared in the *Transactions* (xxiii., p. 326, 1908) that I became aware of it. Had I known this to be the case, I should of course have communicated the results of my examination of these specimens to him, in order that they might be incorporated in his list.

Since my list includes one or two forms not recorded in Dr. Hagen's account, and therefore new to Prince Charles Foreland, it seems worth while to supplement that account by publishing their names. I give the full list, marking with an asterisk those which are not included in Dr. Hagen's article.

Aulacomnium palustre, Schwaegr.—In quantity.

**A. turgidum*, Schwaegr.—A stem or two of this typically arctic species occurred.

Polytrichum alpinum, var. *brevifolium* (R. Br.), Brid.

Hypnum uncinatum, Hedw.—In two forms; one which I labelled "a rather short dense form" may no doubt be referred to the var. *abbreviatum*, B. and S. The other I had determined as var. *orthothecioides*, Sindb., but it is no doubt the var. *fœneum* described by Dr. Hagen.

**Hypnum revolvens*, Sw.—A few stems, with *H. sarmentosum.*

H. sarmentosum, Wahl.—A short form, very probably the same as that described by Dr. Hagen.

H. stramineum, Dicks.

**H. badium*, Hartm.—A stem or two, with *H. revolvens* and *H. sarmentosum.*

TRANSACTIONS AND PROCEEDINGS

OF THE

BOTANICAL SOCIETY OF EDINBURGH.

VOLUME XXIV.

PART III.

EDINBURGH:
PRINTED FOR THE BOTANICAL SOCIETY BY
NEILL & CO., LIMITED.
And to be obtained from the SECRETARY OF THE SOCIETY, 5 *St Andrew Square.*
1911.

CONTENTS.

TRANSACTIONS

OF THE

BOTANICAL SOCIETY OF EDINBURGH.

SESSION LXXV.

Presidential Address.

Ladies and Gentlemen,—In rising to address you from the Chair on the occasion of the opening of the seventy-fifth session of the Botanical Society of Edinburgh, it is perhaps hardly necessary for me to offer you an apology for the fact that these remarks of mine cannot be on a scientific subject connected with botany, because you all know that I am not a man of science, far less a scientific botanist qualified to take up and deal with a botanical subject in a manner worthy of this learned Society. All the more, then, I have felt it a very great honour that you should have permitted me, a mere lover and a mere grower of plants and flowers, to preside over your meetings for two sessions, and to do what little has been in my power in taking an interest in the work and the welfare of the Society. My remarks to-night, then, can only deal with the position of the Society, and the changes that Time has brought upon us, and the work which, as a Society, we have, during the past session, been enabled to do.

In the first place, it is right that I should refer to the loss sustained by the Society in the death of its Patron, King Edward VII. As you will remember, an address of condolence to King George V. was submitted and directed to be sent to the Secretary for Scotland. Due acknowledgment of this was received in July last, and that was duly communicated to you, his Majesty having been graciously pleased to receive and to thank the Society for their expression of sympathy and loyalty. It will, I am sure, be your wish that the Council should take such steps as may be necessary to endeavour to secure the patronage of his Majesty King George in succession to that of his revered father.

Turning, then, to the position of the Society as regards its membership, we have during the past year added to our numbers 4 Resident Fellows, 1 Non-Resident Fellow, and 1 Lady Member, making a total of 6 added to our number. But, on the other hand, death has removed 2 Foreign Fellows, 3 Resident Fellows, 1 Non-Resident Fellow, and 1 Associate—a total of 7, while 4 Resident Fellows of the Society have resigned their membership. This involves a net loss of 5 in our numbers. I had fain hoped that I would not have had to report to you a reduction of membership, but there it is; and it is for us members of the Society to do what we can in the coming session to bring within our membership some of the many who, in these times, are interested in botanical science, either from a popular or a scientific standpoint. As a Society we have, during the past session, made certain changes in our laws which will enable us to bring into the Society a class of Ordinary Members—ladies or gentlemen—who, though not desiring to become Fellows of the Society, may obtain the advantages of membership on reasonable terms, and many of whom, we hope, may later on become Fellows of the Society, and so recruit our ranks in that respect. I am glad to think we are already making a commencement in the election of this class of member.

Although the coming number of the "Transactions" of the Society will not be a bulky volume, I think we may consider that it will record and contain a considerable amount of interesting botanical information, which will make it a useful work of reference. I might mention particularly the communications from Mr. Arthur Bennett on the genus *Carex* in Great Britain, and the notes on rare Mosses by Mr Evans, and by H. N. Dixon. But besides this there has been published, since we last met, a very important botanical work—as Volume XXV. of the "Transactions and Proceedings" of the Society—"The Distribution of Hepaticæ in Scotland," by Mr. Symers A. Macvicar. This volume has been issued to the Fellows of the Society and to the various bodies with whom we exchange publications. While the Hepaticæ are perhaps not a race of plants which appeal to all classes of botanical students, those of you who have had time to examine this work cannot but be convinced of its great importance as an addition to botanical literature and science, and you cannot fail to be impressed with the immense amount of research and work which Mr. Macvicar has devoted to his subject. The Society may congratulate itself that such a work should have been published under its auspices, and we may in turn congratulate Mr. Macvicar on his work, and on the reception it has met with in scientific circles.

I must now make reference to those of our number who have passed away during the year.

Herr Max Leichtlin.—The first of these is a name well known to all botanists and florists. I refer to Herr Max Leichtlin of Baden-Baden, a Foreign Honorary Fellow and a Corresponding Member of the Society since January 1886, who died on 3rd September last at the advanced age of seventy-nine years. Born at Carlsruhe in 1831, he appears to have had his first horticultural experiences at Ghent, in the famous nursery of Louis Van Houtte. Later he spent some time in the gardens at Glasnevin, Dublin, under the late Dr. Moore; but, naturally enough, he returned to his native country, and devoted himself to growing and collecting plants. His name is surely well known by the specific adjective "Leichtlinii," which appears added to many species and varieties. His interests seem to have been chiefly centred in plants of the Liliaceous tribe and their allies. I have before me a list of some thirty-five plants introduced by him, and recorded in the "Botanical Magazine" between the years 1870 and 1908, almost entirely Liliaceous, though including other valuable hardy plants such as the beautiful *Incarvillea Delavayi*, *Campanula mirabilis*, and others. There is the fine aubretea which bears his name, the *Primula rosea Ostrowskia magnifica*, and many other choice hardy plants. And yet, though he did so much, his garden was very small—on a steep hillside at his villa at Baden-Baden, laid out in a series of terraces. The climate there favoured him—warmer in spring and summer, and colder in winter than the English climate, and therefore favourable to the cultivation of the plants he was most devoted to. He seems to have been a man of genial and kindly habits, and to have had a host of friends and admirers. He worked among his plants more for love than for money, and never seems to have taken advantage of the commercial side of horticulture which his opportunities and abilities made available to him. His name will long be remembered in botanical circles.

Dr. MELCHIOR TREUB.—The other Hon. Foreign Fellow whose decease I have to record is Dr. Melchior Treub, who died at the comparatively early age of 58, at Saint Raphael, Var, France, on 3rd October last. He, too, had been a corresponding member of the Society since January 1886. He was Professor in the School of Agriculture and Director of the Botanic Garden at Bustenzorg, Java. Dr. Treub was a very great botanist. Born in Holland, he went early to Java, being the first to hold the appointments I have just mentioned. He found there a wide sphere of research, and the result of the earliest of his investigations was the discovery of what is known as Chalazogamy in the fertilisation of certain plants—notably in Casuarina. This received great attention from European botanists, and led to much valuable research and discovery in the more temperate regions of Europe. Dr. Treub was of the opinion that his European compeers had their investigations in far too narrow a compass, as tropical vegetation was practically outwith their ken, and he achieved a most important work in establishing in Java a Laboratory to enable European botanists to have a wider field of study, and I believe that this had been taken advantage of by a large number with most valuable results. Dr. Treub has passed away very soon after retiring from his active work, and it is to be feared that his long residence in the Tropics may have hastened his early death.

Turning now to the Resident Fellows no longer with us:—

Lord M'Laren.—The first name on the list of Resident Fellows whom I would mention is that of a prominent townsman of our own. I refer to the late Hon. Lord M'Laren, one of the Senators of the College of Justice, and a Fellow of this Society since June 1850. With, I think, only two exceptions, Lord M'Laren was the oldest of the Fellows of the Society. He passed away at an advanced age in April last, having been one of our members for sixty years. It seems hardly necessary here that I should refer in detail to the life of one so well known in the City of Edinburgh, with which he had such a close personal connection, and where he was so highly honoured and respected. His interest in botanical science was only one of other avocations with which his somewhat limited leisure time was occupied. Other scientific subjects and other scientific societies equally had their attraction for him, and his high position involved him in much public work apart altogether from the calls of his extensive practice at the Scottish Bar, and, later, his arduous duties as one of the Senators of the College of Justice.

Mr. John Montgomerie Bell.—I would record the death of Mr. John Montgomerie Bell, Writer to the Signet, Edinburgh, one of the oldest Fellows of the Society, having become a Resident Fellow in February 1857. The son of the late Alexander Montgomerie Bell, Professor of Conveyancing in the University of Edinburgh, he was born in 1837, and educated at the Edinburgh Academy. He attended the late Professor Balfour's Class of Botany at the University of Edinburgh in 1857, and it is evidence of his enthusiasm as a botanist that he won the class medal for the best herbarium. It is of interest to remember that in August of the following year, 1858, he formed one of a party—I think he was the last survivor of a party—of botanists who, under Professor Balfour, visited Switzerland on a botanical expedition, of which a most interesting record has been published. Travelling was not so quick in those days, and perhaps time was not so valuable, for a week was passed before Switzerland was reached; but, once there, a fortnight was spent in various centres, and a large and varied collection of Alpine and Continental species was obtained, of which a complete record is in the publication referred to. Besides being a Fellow of the Society, Mr. Bell was a member of the Scottish Alpine Botanical Club and of the Edinburgh Botanical Society Club. Throughout his life Mr. Bell took a keen interest in field botany. In 1898, I think, he accompanied Mr. Alexander Cowan of Valleyfield on a botanical expedition to Norway, extending over some weeks, and at a later date he read a paper to the Society which is published in our "Transactions." Mr. Bell died in June last in his 74th year.

Mr. ALEXANDER MILNE.—I have also to record the death of Mr. Alexander Milne of Messrs. Dicksons, Edinburgh, a Fellow of the Society since March 1883. He was a well-known citizen of Edinburgh, and a member of a very old-established firm of nurserymen. His energies and interests were chiefly directed to Coniferous and Forest trees, but very naturally a business such as his embraced every branch of his profession.

Mr. D. F. MACKENZIE.—Another loss sustained by the Society is in the death of Mr. D. F. Mackenzie, Factor on the estates of Mortonhall, Midlothian, a Fellow of the Society since 1902. Few men in his walk in life were better known than Mr. Mackenzie. His interests were, I must say, chiefly in the department of forestry, on which he was an admitted authority. He had been a member of the Royal Arboricultural Society since 1872, and their Transactions contain many articles contributed by him during the long period of his membership. He was ahead of others in his views as to the necessity for the afforestation or the re-afforestation of waste lands—now so prominently before the people of this country. In 1890 (twenty years ago) he delivered an important address on the subject. He held the position of examiner in forestry to the Highland and Agricultural Society. An important work, and one of distinct interest to the Fellows of the Botanical Society, was carried out in 1893, when Mr. Mackenzie prepared and presented to the Arboricultural Society a series of micro-sections of a large number of British-grown trees and shrubs, made up into lantern slides, and showing the varying tissues of the different species in an admirable manner. Later on, he prepared and also presented to the Arboricultural Society a very fine collection of micro-photographic slides, illustrative of plant physiology and specially relating to forest trees. In recognition of the original work represented by the preparation of these sections and slides, the Society awarded him their gold medal. Mr. Mackenzie had been in failing health for a number of years before his death in July last, but he stuck to his work and to his duties, and in the end he died in harness, having been taken suddenly ill while in the superintendence of farm improvements under his charge.

Mr. George Stables, of Levens Milnethorpe, Westmoreland, a Non-Resident Fellow since November 1883, who died on 4th January last, was a botanist of no mean repute. Born in 1839, he was a schoolfellow of Richard Spruce, from whom he acquired his love for the Hepaticæ; and Mr. Stables is one of the authorities quoted from time to time by Mr. Macvicar in the work recently published. The Cryptogamic Flora of the Lake District was his favourite study, and he has published a valuable series of papers on the Hepaticæ and Mosses of Westmoreland, and has added rare species to the British Flora. One genus, Stablesia, has been named after him. Failing sight, however, forced him to retire not only from his profession, but from his favourite study of the Cryptogamia. He had been quite blind for the last year or two of his life, but, notwithstanding this affliction, it was a continual pleasure to him to have plants brought to him that from feeling and description he might identify them. His death occurred very suddenly while sitting in conversation with friends. An appreciative notice of his work is recorded in the "Journal of Botany."

Mr. Robert Panthing was an Associate of the Society since 1898, and an eminent botanist. To the authorities at Kew I am indebted for particulars of his life and work.

Mr. Robert Panthing, whose death took place on 6th February 1910, was a native of the North of England.

His father was in the service of his Grace the Duke of Northumberland, and young Panthing, having early shown an interest in flowers, entered the Duke's service in his sixteenth year as an apprentice gardener at Syon House. After three years' preliminary training there, he was admitted to the Royal Botanic Gardens, Kew, at the age of nineteen, on 5th July 1875. He received promotion at Kew on 7th February 1876, and left on 14th July 1877 to take up a post in the Royal Gardens at Windsor.

His services at Kew had been such that when, in December 1878, a vacancy was announced in the staff of the Government Cinchona Plantations in Bengal, Mr. Panthing was recommended as a suitable candidate, and was given the appointment of Assistant in the Cinchona Department in 1879. He had hardly been a year in India when the post of Curator in the Royal Botanic Garden, Calcutta, fell vacant, and he was selected to fill this position. Another year had hardly passed, however, before the post of Senior Assistant in the Cinchona Department also fell vacant, and Mr. Panthing, whose health had showed signs of impairment at Calcutta, was transferred once more to the Cinchona Plantation. Here the rest of his Indian service was spent, eventually being promoted to the position of Deputy Superintendent.

During the whole of the time he had served in the Cinchona department, Mr. Panthing had devoted much of his leisure to botanical studies, and more especially to work on the natural family Orchidaceæ, of the Indian species of which, and especially the species from North-Eastern India, he had acquired a very extensive knowledge, which he increased not only by study of the living plants he brought together, but by making botanical journeys in Independent Sikkim and in Assam. A natural gift for drawing he cultivated, with what excellent results may be judged from the illustrations prepared by him from living plants for the eighth volume of the "Annals of the Royal Botanic Garden, Calcutta," which is devoted to a monograph of the Orchids of the Sikkim Himalayas, of which Sir George King supplied the letterpress, while Mr. Panthing supplied the drawings. The talent, industry, and skill to which these illustrations testify were worthily recognised by this Society when, in 1898, it enrolled Mr. Panthing among its Associates.

The preparation of the numerous drawings included in this work, and of many others of species from provinces other than Sikkim, led to some impairment of Mr. Panthing's eyesight. This circumstance, coupled with the diminished leisure due to his promotion to the executive charge of the Cinchona Plantation, prevented him from making available to the public after 1898 the extensive knowledge of the family which he had acquired, and debarred him to a large extent from further pursuing his botanical studies. His health gave way towards the end of 1909, and early in 1910 he had to be invalided to Europe. He died at Suez, on the way home, after having served the Government of Bengal for thirty-one years, at the age of fifty-four.

That, Ladies and Gentlemen, completes our somewhat melancholy survey of those members whom we have lost during the year. Their record of work and devotion to duty will, I hope, encourage those who are with us, especially the younger ones, to increased zeal and to thoroughness, to much original research, and, let us hope, to the continued efficient and successful carrying on of the great work of the advancement of botanical knowledge and botanical science.

It only remains for me now to repeat my great appreciation of the high honour that the Society has done me in permitting me to hold this Chair for two successive sessions, and to thank all the members of the Society for the consideration and kindness with which they have received my imperfect efforts to carry out its duties. It is with unfeigned pleasure that I congratulate the Society in having selected as my successor Dr. Borthwick, in whose favour I now vacate this Chair.

On the Peopling by Plants of the Subalpine River-bed of the Rakaia (Southern Alps of New Zealand). By L. Cockayne, Ph.D., F.L.S. (Plates IX., X., and XI.)

CONTENTS.

1. General.

The relation between the evolution of a land-form and its plant-covering is a matter of high phyto-geographical interest, but one extremely difficult to estimate in the majority of cases, although it seems evident that such a relation must exist. The difficulty arises from the fact that, while geological changes are extremely slow, those of vegetation are comparatively rapid. These latter, too, depend not merely on the topography, but also on climate, on the plants themselves, and on those changes which occur so frequently in the soil, independently of any surface-change. There are cases, however, where the evolution of a land-form may be so rapid as to be watched, as also its synchronous occupation by plants, while the plant-formations themselves may be so distinct, each for its own particular land-form, as to be easily noticeable. The best known case of this kind is afforded by the land-forms and the plant-associations of a dune-area.[1]

[1] For a description of those of New Zealand see Cockayne, L., *Report on the Sand Dunes of New Zealand*, Wellington, 1909.

A New Zealand stony river-bed, such as is about to be described, also affords an excellent, though less known, subject for study, while in its case there is probably proceeding before our eyes the same procession of events which culminated in the present steppe-vegetation of the stony river-formed lowland plains and flat valley floors of the higher land. That is to say, the peopling of a subalpine river-bed in the neighbourhood of the glacier-source of the stream may be a very similar phenomenon to what happened on the Canterbury Plains during their formation in the New Zealand glacial period. This statement does not imply that the species were then exactly the same as now,[1] but it assumes that similar growth-forms were then existent, and that these would behave as at the present time.

The study has, moreover, an economic bearing, since, leaving the lowland plains out of the question, it deals with the evolution of the vegetation of those "river-flats" which form some of the most valuable grazing-ground of the sheep-farmer, and it is clear how a knowledge of the methods by which Nature clothed them with nutritious grasses has a close bearing on any scheme dealing with their regeneration and improvement.

The subalpine river-bed of the Rakaia has been selected for description, not only because it is typical of the glacier river-beds on the eastern side of the Southern Alps, but because I had an opportunity during the summer of 1909–10 of examining its vegetation in the light of observations made previously elsewhere. The portion studied was the southern side of the river almost opposite the terminal face of the Ramsey Glacier at about an altitude of 900 m. above sea-level, and where the valley is about 1 km. in width. The general aspect of the locality may be better judged from the fine photograph taken by my friend Mr. R. Speight, M.Sc., F.G.S., to whom I am much indebted for many valuable suggestions while preparing this paper, than from any pen description (see Plate IX.).

[1] *Raoulia Haastii* is essentially a plant of forest-climate, and as the neighbourhood of the terminal faces of the great pleistocene glaciers would have, most likely, an extreme steppe-climate, the more xerophytic *Raoulia* species would be the pioneer plants.

2. Physiography.

Amongst the many land-forms of the Southern Alps and their environs none are more characteristic than the broad beds of bluish-grey stones, sometimes 1·5 km. or more in width, over which, in many anastomosing streams, the rivers wander.

In the lower part of its course such a river-bed is confined between high, permanent terraces clad with yellow tussock-grasses, but nearer the source the terraces are low and temporary, or altogether wanting, the river's spread being limited only by the mountain slopes on either side. Thus, in many places, the mountain valleys consist of river-bed alone, the origin of which is not difficult to determine.

The Southern Alps are built up for the most part of much-jointed sandstones, greywackes and slates, rocks which are very easily disintegrated by frost. Everywhere the snow-clad mountains are scarred by black patches of rock and present steep precipitous or craggy faces from which avalanches of stones, large and small, fall on to the glacier below in such quantities that the clear ice buried beneath a thick and heaped-up stony covering is frequently not visible for a distance of several miles from the terminal face. Eventually the morainic matter falling from the terminal face of the glacier is seized by the turbulent stream issuing from its ice cave and deposited on the valley-floor, the water exercising a powerful sorting action, so that the stones of the river-bed gradually decrease in size on proceeding towards the sea, huge blocks first of all dominating the scene (see Plate X.).

Besides the actual morainic material the tributary torrents and lateral rivers supply vast quantities of débris, the mountains below the snow-line having in their gullies, and even on their slopes, extensive stone-fields ("shingle-slips") very many metres in length, which afford an inexhaustible supply of material.

The valleys themselves are plainly of glacial origin. The presence of numerous ancient moraines, truncated or ice-overridden spurs, roches moutonées and other glacial land-forms, testify unmistakably to a former most extensive glaciation, and show that the present ice is but a remnant of what formerly existed. Furthermore, the upper valleys are of the characteristic U shape, but are now filled to a great depth with shingle, the lofty mountains rising abruptly at a steep angle on either side.

The surface of a river-bed, this being really a narrow stony plain, to the eye looks quite flat, as indeed it is in cross-section, though the gradient is more or less steep, the steepness increasing rapidly as the source of the river is neared. Issuing from its ice cave, the river is generally at first in one stream, the steep gradient and great size of the rocks preventing its wandering, but lower down the bed it soon divides, and at times there may be a dozen or more shallow but rapid streams, bounded perhaps by rudimentary terraces, the number of streams depending altogether upon the water-supply. The streams themselves do not occupy permanent channels by any means; on the contrary, there is a constant but generally slow change in progress, though in time of flood movement can be so rapid that high and dry shingle occupied by vegetation may be swept away, a stream or a naked stony surface subject to more or less frequent submersion occupying its place. On the other hand, a former stream-channel and the ground adjacent may, in their turn, be brought beyond the influence of the rapidly-flowing water, for a longer or shorter period, and become at once suitable for plant life.

As already mentioned, in these upper river-valleys permanent high terraces are wanting, those which occur being merely temporary and quite low structures, the superabundance of material carried by the streams altogether overcoming their erosive power, so that *they build but do not erode.* The river-bed itself is virtually flat, but the surface is far from even. Large stones, or even rocks, stand up above the general level; there are dry watercourses, long since abandoned by their streams, and others only temporarily dry. Islands, small or large, remnants of an older flood-plain, of irregular form with flat surfaces, bearing perhaps a scanty plant-covering, surrounded by water during the heaviest floods, show here and there upon the open river-bed. Close to the slopes, on either side, but never forming a continuous margin, there are frequently other pieces of the old flood-plain, "river flats" they are called locally, occupied by vegetation, even, perhaps, by a closed covering, and quite abandoned by the river proper, though at their junction with the present flood-plain they end in a ragged or undermined face of bare stones.

The streams are not confined to any special part of the bed, but generally every few kilometres the main stream crosses from one side to the other of the valley, the point of departure being very often a rocky bluff against which it abuts, there deepening its bed and depositing its load of shingle on the lower side of the bluff. Thus the river-flat, lying below such a rocky point washed by a non-shifting main stream, is the most stable portion of the valley, and bears the oldest plant-covering.

The Rakaia river-bed here dealt with shows excellently all the features detailed above. The two glaciers from which the source-branches of the river issue are covered with an astonishing quantity of moraine (see Plates IX. and X.) for a distance of several kilometres from their terminal faces; there are numerous torrents bringing shingle from the débris-fields, and distributing it, fan-like, on the main river-bed; there is a wide expanse of bare shingle traversed by a network of unfixed anastomosing streams subject to frequent floods; there is abundance of dry stony ground, and there are islands and flats of every degree of stability. The stable flats are themselves watered by streams, which may be connected with the main river or have their origin on the adjacent heights, but these streams are generally much less rapid than the branches on the flood-plain proper, and may contain more or less plant-life in consequence. The main stream at about 4 km. from its source in the Lyall glacier flows all in one channel (see Plate IX.) except at flood-time, and generally rushes with such violence that the sound of the great stones it carries along, grinding one against the other, may be heard very plainly even from the slopes 600 m. above, or more.

The river-water contains a very great amount of fine glacial mud, so that it is quite milk-white in colour, consequently the retreating waters after a flood leave much fine silt deposited between the stones, or coating the floors of hollows with a layer of varying thickness.

It is evident that a river-bed such as is here described offers a quite unstable substratum for a plant-covering; but, generally speaking, the changes wrought by the shifting streams take place slowly, and there is a gradual procession of events from the merely temporary occupation by plants of ground liable to frequent submersion to closed associations of considerable age. These latter, where a river flows through a narrow valley with mountains descending steeply on both sides to the flat bed, are always liable to destruction, but nevertheless extensive stony flats, situated at no great distance apart, and occupied by grass, shrub, or even forest formations, are quite common and bear the appearance of perfect stability and considerable age. Notwithstanding the extreme instability of river-bed vegetation, a complete cycle of events is always in view, every progressive phase of the development of the vegetation existing at various spots from the first insecure occupation of the ground to its final conquest by steppe, shrubbery, or forest.

3. Ecological Conditions.

(*a*) climatic.

Although no statistics are available as to the rainfall and number of rainy days at the source of the river Rakaia, there can be no doubt that both are excessive, the former, judging from statistics elsewhere, doubtless exceeding 250 cm. a year. There is, in fact, a *forest-climate*, which is defined by the average distance reached by the heavy rainfall from the west, as distinguished from the dryer, or *steppe-climate*, of the area lying to the east of this line. Heavy downpours, accompanied by high wind, constantly occur on the mountains and in the valleys near the sources of the glacial rivers, while at a kilometre or two to the east there is no rain at all, but a fierce gale favouring excessive transpiration will rage.

Snow must fall in great abundance at the higher levels during the months of June, July, and August, and, indeed, heavy falls occur both earlier and later than those months. But at the altitude of the river-bed here dealt with it is probable that snow does not usually lie upon the ground for more than a week or two at a time; in other words, the river-bed lies at some distance below the winter snow-line.

As for the heat factor, the average temperature is doubtless less than in the lowlands, nor will there be nearly as much sunshine as even at the same altitude, or higher, further to the east. But on clear days insolation is very powerful, as evidenced by the heat of the stones of the river-bed. Judging from other parts of alpine New Zealand, the minimum temperature probably does not exceed $-18°$ C. But it must be pointed out that frost may occur during any month of the year; that in the shade the ground may remain hard-frozen for several days at a time, and that even in winter the plants will frequently lack the protection, not only from cold, but from the excessive transpiration that a snow-covering affords.

The wind blows with extreme violence from the north west, the prevailing quarter. Its effect on increasing transpiration is frequently much lessened through its being charged with moisture and its not being a dry wind, as further to the east. On the river-bed the violence of the wind is intensified, hemmed in, as the valley is, by the contiguous high mountains.

From the above it may be seen that the climate is partly hygrophytic and partly xerophytic, for the effect of the excessive rain is neutralised by the insolation, the frost, and, above all, the high winds, so that although there are periods when typical hygrophytes could thrive, there are also frequent periods which demand xerophytic structure.

(*b*) EDAPHIC.

The soil conditions of a river-bed are in a perpetual state of change. This arises from three causes: the first of which is the humus-making power of special growth-forms, especially of certain cushion-plants which rapidly convert their old leaves and shoots into soil; the second, the catching power of the plants with regard to wind-borne dry glacial silt (rock-flour); and the third, an ever-varying distance of roots from ice-cold water.

Leaving the humus out of the question for the present, the soil consists chiefly of stones, large and small, mixed with a certain amount of sand and silt. The stones are of all sizes, very large ones, and indeed rocks, being quite common. They are arranged most unevenly, though the general surface is flat. Such a soil is deficient in available nutritive salts, and in itself provides merely desert conditions for plant-life, no matter how frequent the downpour. With the drying of the river-bed, and especially of those parts liable to frequent submersion, the silt, which is composed of very fine particles, is moved by quite a gentle breeze, while, during the frequent gales, it, together with the finer sand, is deposited in the lee of rocks and caught by the vegetation. The silt supply being constantly renewed by floods, the amount of light soil which is conveyed by the wind to the old flood-plain is very considerable and has led to a thin coating of light silky loam which, though far from being a fertile soil, is quite sufficient to support, with the addition of the self-supplied humus, a closed formation of those plants which are provided with certain "adaptations."

The stony soil is porous to the extreme; the shallow silty soil, too, dries rapidly, and its water-content is usually small. But the frequent rain renders the surface wetter than might be expected, and the humus, which finally becomes an important constituent, is able to absorb and hold abundant water. Beneath the surface, just under the top layer of stones, the soil is generally more or less moist, the stones hindering evaporation. The larger stones and rocks also play an important part in checking evaporation, both from the shelter from wind and the shade from sun which they afford. These aids towards conserving the rain-water are of special importance, since, as will be shown, it possibly forms the chief water-supply of the plants.

There is obviously no lack of underground water, the water-table, except in winter, lying very near the surface, the distance, however, depending on the height of the older flood-plain and the distance from the sides of the valley. This abundance of water arises from the fact that the streams of the river, numerous and rapid though they are, represent only a small portion of the actual river-water, so porous are their beds; in fact, the greater part of the river's flow is subterranean. The presence of the underground stream makes itself plainly visible in flood-time through the rapid formation of new streams and the filling of dry channels, while, on the other hand, a diminution of the supply, as in winter, may cause the suppression of the streams altogether. A river-fan is frequently quite dry, yet at its termination streams gush forth. Similarly, some river-beds are normally without surface-water in one part, while in another, higher up, there will be a rapid stream which, all on a sudden, disappears beneath the surface.

The river-water, issuing as it does from the ice, and in large part the result of its melting, is, at most, but a few degrees in temperature above the freezing-point, and is therefore of little moment for plant-life. Nor can the underground stream be much warmer. *A glacial river-bed, then, near its source, appears to be both a physical and physiological dry station.* The physical dryness seems in itself sufficient to govern the plant-life, since far from the river's source in the lowlands, where the river-water is much warmer, the plant-life is very similar in character, many species being identical, as well as growth-forms; indeed, on the whole, the subalpine river-bed, owing partly to its more abundant rainfall, is the less xerophytic station of the two. In winter, when the streams dry up more or less, the subterranean water must be considerably lowered, and lie beyond the reach of most of the plants.

How far the heat from the sun can penetrate into the soil I cannot say, but probably to no noticeable depth, except between the chinks of the stones. These latter become so strongly heated during a period of insolation that one can hardly bear to touch them with the hand, and the reflected heat must be very considerable so far as the ground plants are concerned. On the other hand, the stones rapidly lose their heat when the sun's rays are obscured.

As for aeration of the soil, that will be abundant.

From the above it is evident that a river-bed is a strongly xerophytic station, and that, notwithstanding an abundant rainfall, the conditions primarily resemble those of a desert.

4. GROWTH-FORMS.

(a) GENERAL.

In order to understand the all-important relations of the plants to one another a knowledge of their growth-forms is essential, since on their humus-making capacities, power of affording shelter, germination facility, vegetative increase, root-systems, xerophytic structure, and so on, depends almost entirely the sequence of events. In other words, though the first colonists are those fortuitously brought by various agencies from the comparatively rich flora of the neighbourhood, only those suited to the severe ecological conditions can gain a footing in the first place; but afterwards it is the growth-forms of the plant-colonists themselves which finally, or at anyrate equally with soil and climate, determine the character of the associations and the procession of events.

(b) SYNOPSIS OF SPECIES ACCORDING TO THEIR GROWTH-FORMS.

A.—*Low Trees.*

(a) Summergreen.

Gaya Lyallii[1] (Hook. f.), J. E. Baker (branches slender, somewhat fastigiate; leaves bright-green, not thick).

(b) Evergreen.

Phyllocladus alpinus (2), Hook. f. (trunk slender; cladodes thick, coriaceous).

B.—*Shrubs.*

(a) Leafless (more or less).

* Summergreen or partly so.

(1) Shoots frequently reduced to spines.

Discaria toumatou, Raoul. (erect, 60 cm.–4·5 m. tall; branches numerous, divaricating; leaves small; young stems and spines green; roots long).

(2) Shoot-axes green, assimilating organs.

Carmichaelia grandiflora, Hook. f. (erect or decumbent,

[1] Also shrubs.

30 – 60 cm. tall or less; leaves ternate or pinnate; leaflets 1·2 cm. × 8 mm.; roots long).

* Evergreen; leaves scale-like.

Helichrysum depressum (Hook. f.), Benth. and Hook. (erect, little-branched, rigid, spreading; about 43 cm. tall × 20 cm. through; scale-leaves very small, adpressed to stem few; woolly; root very long).

(*b*) Leafy, evergreen.

* Erect.

(1) The divaricating form.

Coprosma rugosa, Cheesem. (leaves narrow-linear).

§ Leaves small, coriaceous.

Coprosma parviflora, Hook. f.
C. propinqua, A. Cunn. (?)
Aristotelia fruticosa, Hook. f.

(2) The tree-composite form.

Leaves coriaceous, tomentose on under surface.
Olearia ilicifolia, Hook. f. (leaf with spinous margin, musk-scented).
O. avicenniæfolia, Hook. f.
Senecio elæagnifolius, Hook. f.

(3) The ball-like form.

Veronica salicifolia, Forst. f. (branches not dense; leaves about 7 cm. long).
V. subalpina, Cockayne (dense-growing; leaves 2·5 cm. long, more or less).

** Creeping or depressed.

(1) Stems rooting.

§ Prostrate stem subterranean.
† Erect.

Styphelia Fraseri (A. Cunn.), F. v. Muell. (3–10 cm. tall; stems slender, wiry; leaves small, stiff, pungent, imbricating).
Lycopodium fastigiatum, R. Br. (7·5–9 cm. tall; stems slender, stiff; leaves small, thick, often yellowish).

†† Prostrate.

Muehlenbeckia axillaris, Walp. (mat-former; stems slender, wiry; leaves small, thick).

§§ Prostrate stem above ground.

Coprosma brunnea (T. Kirk), Cockayne (stems stout, rigid; leaves narrow-linear, very small; root very long).

(2) Stems not rooting.

Pimelea lævigata, Gærtn., var. *repens*, Cheesem. (stem spreading, flexible, forming a loose mat; leaves small, thick, glaucous).

C.—*Lianes.*

(*a*) Scrambler (climbing by hooked prickles or midribs).

Rubus schmidelioides, A. Cunn., var. *coloratus*, T. Kirk (leaves coriaceous, 3–5 foliate; leaflets flat, tomentose beneath).

(*b*) Pendril-climber.

Clematis australis, T. Kirk (stem slender; leaves much divided, subcoriaceous).

D.—*Herbs and sub-shrubs.*

(*a*) Summergreen.

Subterranean stem creeping; aerial erect.

Coriaria ruscifolia,[1] L. (aerial stem woody; leaves moderate-sized, thin).

C. thymifolia, Humb. and Bonpl. (aerial stem succulent; leaves small, thin).

C. angustissima, Hook. f. (aerial stem succulent; leaves very narrow, small, thin).

(*b*) Evergreen.

* Spot-bound.

(1) The rosette-form.

Geranium sessiliflorum, Cav. (rosettes form small, round patches flattened to the ground about 7 cm. in diameter; leaves orbicular, about 1·2 cm. in diameter, moderately thick, covered with silky hairs).

[1] In many situations *C. ruscifolia* is a true shrub or even a small tree. It is probable more than one species is included under the name.

Ranunculus lappaceus, sm. var. *multiscapus*, Hook. f. (rosette small, open; leaves moderately thick, hairy).

Viola Cunninghamii, Hook. f. (Rootstock stout, subwoody; rosettes open, leaves thin).

Craspedia uniflora, Forst. f. var. (rosettes open, often several together; leaves spathulate, 10 cm. or more long, semi-erect, woolly).

Angelica Gingidium (Forst. f.), Hook f. (rosette large, open; leaves pinnate, 15 cm. or much longer, thick, coriaceous, waxy beneath; root long, fleshy).

(2) The erect, tufted form.

§ Woody, more or less.

Stem erect, wiry, woody at base, about 14 cm. tall; leaves moderately thick, coriaceous.

Epilobium melanocaulon, Hook. (stem black, leaves reddish).

E. glabellum, Forst. f. (leaves often reddish beneath).

§§ Not woody.

° Grass-form.

‡ Leaves narrow.

Festuca rubra, L. var.

‡‡ Leaves broad, flat.

Trisetum Youngii, Hook. f. (leaves pilose).

Luzula campestris, D.C. var. (leaves coriaceous).

°° Tussock-form.

Poa cæspitosa, Forst. f. (tussocks 30 cm. tall and more; leaves filiform involute).

Poa Colensoi, Hook. f. (tussocks small, leaves very narrow, involute).

** Creeping and rooting.

(1) The cushion-form.

§ True cushions.

Raoulia Haastii, Hook. f. (glabrous or nearly so).

R. glabra, Hook. f. (glabrous or nearly so).

§§ Semi-cushions or round patches.

Raoulia lutescens (T. Kirk), Cockayne (tomentose)

R. australis, Hook. f. (tomentose).

(2) The mat-form.

§ Stems suffruticose.

The species of *Acæna* (leaves thin, more or less silky).

Helichrysum bellidioides (Forst. f.), Willd. (stems slender, much-branching, leaves small, flat, tomentose beneath).

Veronica Bidwillii, Hook. f. (stems much-branching, wiry; leaves very small, thick, glossy).

§ Stems herbaceous.

° Leaves tomentose.

Helichrysum filicaule, Hook. f. (aerial stems, very slender, hardly branched, about 6 cm. tall).

Gnaphalium Traversii, Hook. f. (leaves in rosettes which form close patches).

°° Leaves pilose.

Cotula squalida (stems slender, far-creeping; leaves deeply-cut, in open rosettes.

°°° Leaves glabrous or nearly so.

Asperula perpusilla, Hook. f. (stems filiform, leaves very small, thin).

Hydrocotyle novæ-zelandiæ, D.C. var. *montana*, T. Kirk (stems comparatively stout, matted; leaves small, coriaceous).

Pratia angulata (Forst. f.), Hook. f. (stems rather fleshy; leaves small, moderately thick).

Uncinia divaricata, Boott (leaves grass-like, flat, somewhat rigid).

Wahlenbergia saxicola (R. Br.), A., D.C. (leaves in open rosettes about 15 mm. in diameter, thick, coriaceous).

Poa anceps, Forst. f. var. (leaves sub-coriaceous, concave, tufted).

(*c*) THE RAOULIA-FORM.

Several species of *Raoulia* (compos.), a genus consisting of seventeen endemic and one or two Australian species, are so characteristic of river-beds, and their growth-form plays such an important rôle in the evolution of the vegetation, that some special details seem necessary.

The New Zealand species are either patch- (frequently circular-), or cushion-plants, but in this case both growth-forms are constructed in exactly the same manner, intermediates between them exist, and the difference of one from the other is of degree merely.

There is a central woody main stem and a deeply-descending chief root. From near the base of the stem a number of prostrate and rooting branches pass off radially. These branch abundantly in their turn, the divisions having a tendency to grow upwards, and this is assisted by the frequent branching and consequent increasing density hindering their horizontal extension. This closeness of growth, too, shutting off the light, causes the death of all the interior leaves and many of the stems, so that only the stouter persist, the interspaces becoming filled, in the case of the thicker cushions, with peat, and in that of the patches and low cushions with wind-blown silt. According to the relation between the rate of horizontal spread and vertical growth are patch-plants or cushions produced.

The leaves are small, generally more or less imbricating, and very frequently tomentose. The ultimate shoots are sometimes pressed so closely together that they form a hard and unyielding surface, as in the case of the various "vegetable-sheep" (*R. eximia*, *R. Goyeni*, etc.). When large quantities of peat (raw humus) are stored up within the cushion, the upper branches put forth adventitious roots by means of which the plant gets most of its water and salts, the main root serving chiefly as an anchor.

Raoulia Haastii, the most important species of the subalpine river-beds of much of the Canterbury and Westland Southern Alps, forms bright green cushions of considerable dimensions, that shown in the photograph (Plate X.) measuring 68×57 cm. There is a stout, woody main stem and branches. The leaves are crowded near the ends of the ultimate branchlets, the leafy part of the shoot being about 9 mm., or even less, in length. They are glabrous, coriaceous, and the base is sheathing; the sides of the blade are bent upwards, making the upper surface concave. A cross-section of the cushion shows a very narrow green zone of living leafy shoots, a second rather wider brown zone of stems with dead leaves attached, a third 4–5 cm. deep or more, with many of the branches and leaves turned into peat, but not fallen away, a fourth where the peat has fallen away from the stems and where the bare shoot-axes have put forth roots, and the fifth, the final zone, which consists of creeping and rooting stems. These latter only give off roots in relation to wet soil, as when growing on silt or peat, since they are quite rootless when extending on a bare rock-surface.

The species of *Raoulia* show an interesting epharmonic gradation of forms from the rapidly-growing creeping patches or mats of *Raoulia tenuicaulis*, with its open mesophytic leaves of seedlings and reversion-shoots, to the highly differentiated dense woolly masses of the vegetable-sheep (*R. eximia*, etc.), denizens of wind-swept and sun-scorched alpine rocks; and it is easy to see how the present species have been evolved from mesophytic creeping herbs by xerophytic conditions arising from migration to xerophytic stations, or, what is more likely, in the first instance, a dry climatic period.

5. The Peopling of the River-bed.

(*a*) general.

The peopling of the river-bed, which station, it must be remembered, is absolutely new ground, resolves itself into several distinct stages, each of which is really a valid plant-association, always present on the river-bed, and although, like any presumedly stable plant-formation, capable of change, is just as much a regular feature of the landscape as is a forest.

(*b*) the unstable bed (*Epilobium Association*).

On that part of the river-bed subject to occasional flooding there are, at wide intervals apart, occasional plants, about 16 cm. tall, of *Epilobium melanocaulon* (Onagrac.), conspicuous through its dark purple stems and usually reddish leaves. The wind-borne seeds, their rapid germination and the quick growth of the seedlings, enable this species to speedily establish itself. Although the station is fully exposed to the wind, the stones offer abundant protection to the quite tender young plants, and this applies to every part of the river-bed. Their roots, although short, will quickly reach the water under the uppermost stones, and this will frequently be much warmer than that of the actual river. In a few places there are the silvery mats, 40 cm. in diameter, more or less of *Raoulia tenuicaulis*, the most rapid-growing of the species, thanks to its heterophylly and the more mesophytic reversion-shoots. The low mat-form (patch-form) of the plant offers a minimum of resistance to the wind, its tomentose leaves check transpiration, its numerous short adventitious roots can secure the warmer water, while its descending main root serves as an anchor. Other species of *Raoulia* present, but much fewer in numbers and with similar "adaptations," are *R. australis* and *R. glabra*.

If this pioneer colonisation has taken place on a part of the bed liable to flood, it can proceed no further, but if the ground remain dry enough, or a change towards dryness comes about, then other plants arrive and the second phase of colonisation begins.

On many river-beds, especially in the drier localities or by the sides of mountain torrents, the *Epilobium* association is more important than that just described, *E. glabellum*, of a similar growth-form to *E. melanocaulon*, being especially abundant, while mats of *E. pedunculare* will be everywhere, and the beautiful *E. macropus* where shallow still-water lies.

(c) STABLE RIVER-BED.

a. *Raoulia Association.*

When for some reason or other a portion of the river-bed has got quite beyond the influence of floods, as when a stream has receded or terrace-building has provided a dry station, then there is a gradual procession of events. First of all, a dark-coloured crustaceous lichen coats the stones large and small, *Epilobium melanocaulon* and *Raoulia tenuicaulis* appear, and are rapidly reinforced by *R. lutescens*, *R. australis*, *R. glabra*, and, above all, by *R. Haastii*, which soon becomes dominant and gives a striking character to the association through the presence everywhere of its great green cushions, which grow either singly or merge into one another. Nor are they confined to the flat surface of the river-bed and the small shingle, but they spread over the larger stones and even rocks, conforming to the irregularities (see Plate XI.). While being raised up, and the supporting rock hidden, the cushion appearance becomes still more marked.

As for the other species of *Raoulia* mentioned above they are fairly common, though not nearly so abundant as on montane or lowland river-beds of the drier localities. The hoary xerophytic moss *Racromitrium lanuginosum*, forming small cushions, or patches, is extremely abundant and of physiognomic importance; indeed it is almost the first-comer on ground beyond the reach of floods. This moss becomes exceedingly dry during fine weather, and the long hyaline points to the leaves are pressed against the shoot and so much increase the hoary appearance, since when wet the leaves expand, are held semi-horizontally, and the points project outwards. A yellow, low-growing moss, which also dries rapidly, is very common, occupying the chinks between the stones. Small colonies of a white fruticose lichen, a species of *Cladonia*, are here and there.

Another common plant of this early stage is that very curious grey-coloured shrub, *Helichrysum depressum*, looking, with its rigid stems and few scale-like grey leaves, even when at its best, more than half dead.

As soon as these early xerophytes are established, other plants make their appearance, the "seeds" brought by the wind or other agencies; but, generally speaking, they cannot thrive upon the stony ground, and, with certain exceptions, those alone gain a footing whose seeds light upon the cushions of *Raoulia Haastii*. There, thanks to the abundant moisture contained within the cushions, and to their peat-content, the seeds germinate and the young plants thrive. On one cushion, and this was a fair average, the following were present: small plants of *Poa Colensoi* (Gramin.), small rosettes of *Wahlenbergia saxicola* (Campan.), some *Styphelia Fraseri* (Epacrid.), *Hydrocotyle novæ-zelandiæ* (Umbell.), its leaves pressed closely to the cushion, *Microlis uniflora* (Orchid.), stunted *Lycopodium fastigiatum* (Lycopod.), and a few small woolly rosettes of *Craspedia uniflora* (Compos.). The "seeds" of these and other plants falling upon the *Raoulia* cushion are firmly held between the shoot-apices, while the frequent rain favours their rapid germination, upon which the root easily reaches the water-supply at a few millimetres beneath the surface of the cushion.

It is easy to see that as the epiphytes on the cushion increase in size they cut off the light-supply from its leaves, which are none too many on each stem at best, and the *Raoulia* dies piece by piece, leaving behind it a deep layer of humus. Since there are large *Raoulia* cushions dotted everywhere at a distance apart of 30 cm. or so, while fresh cushions are continually becoming established on the intermediate stony ground, it is evident that what was originally an edaphic desert may be rapidly converted into fairly fertile ground by the agency of *Raoulia Haastii* alone, aided by the abundant supply of moisture. The xerophytic moss *Racromitrium lanuginosum* also plays some part as a humus-former, as do likewise the other species present of *Raoulia*, especially the quite low but dense silt-holding cushions or patches of *R. lutescens*.

In addition to the species already noted, certain others early on occupy the stony ground between the cushions, though these latter still remain dominant. Amongst these early comers are: *Veronica Bidwillii* (Scrophular.), which forms on the stones open green mats of slender, wiry, creeping stems and short leafy branches; *Styphelia Fraseri*, in broad brownish patches, the short erect wood stems raised 3 cm. above the stones; *Coprosma brunnea* (Rubiac.), with stiff prostrate woody stems; *Muehlenbeckia axillaris* (Polygonac.), forming round patches, its slender, almost black wiry branches flattened to the ground and the small yellowish-green leaves almost touching but held nearly vertically; *Wahlenbergia saxicola*, with its small open rosettes and, in their season, rather large white flowers; *Geranium sessiliflorum*, in small circular patches made up of several rosettes flattened close to the stones and small tussocks of *Poa Colensoi* (Gramin.). As the last-named increase in numbers, the tallness and density of this growth-form giving it an advantage over the creeping plants, etc., the species, by degrees, becomes very common. Also it adds further humus to the soil by its decay, and at the same time the wind-borne silt and sand is caught and held, so that, by degrees, the stony substratum becomes the sub-soil. On the other hand, the upper layer, formed altogether through the action, direct and indirect, of the vegetation, will consist of silty loam mixed with humus, averaging perhaps 5 cm. in depth, or even more, becoming capable of supporting a closed plant-covering of a steppe character.

β. Steppe.

The absence of bare spaces between the plants, the dominance of the tussock-form and the presence of many of the species of the *Raoulia* association, together with a number of others, defines the steppe association.

The association is not altogether virgin, since sheep, hares, and red-deer graze upon the herbs and shrubs, but this has affected luxuriance of growth rather than brought about any fundamental change.[1]

Poa Colensoi is, in many places, the chief tussock grass, the individual plants sometimes growing closely together and excluding other vegetation. Where the upper soil is deeper, the much more robust *Poa cæspitosa* is plentiful, and the character of the association is then that of ordinary tussock-steppe. *Poa anceps* var. is also a common grass in some parts; it does not form erect tussock, but the culms and leaves are more or less prostrate, and form a thick mat which may contain much dead matter and is then a soil-maker. But this grass plays a more important part on the firmer débris-fields ("shingle-slip") of the adjacent slopes. Between the tussocks, and benefiting from the shelter these give, there are patches of *Styphelia Fraseri*, small mats of *Coprosma brunnea*, dwarfed *Carmichaelia grandiflora* (usually much eaten by hares and sheep), *Hydrocotyle novæ-zelandiæ* growing close to the ground, *Luzula campestris* var. (Juncac.), *Craspedia uniflora* var., *Lycopodium fastigiatum*, *Ranunculus foliosus*, *Asperula perpusilla* (Rubiac.), considerable round patches of *Coriaria thymifolia* and the feathery *C. angustissima* (Coriariac.), abundance of *Pimelea lævigata* var., *repens*

[1] The presence of grazing animals, by reducing the amount of shelter, is favourable to steppe and antagonistic to forest.

(Thymeleac.), occasional plants of *Angelica Gingidium* (Umbel.), with its tufted, coriaceous pale-green leaves, small colonies of *Veronica Bidwillii*, the grasses *Festuca rubra* var., and *Hierochloe Fraseri*, *Geranium sessiliflorum*, *Wahlenbergia saxicola*, and *Viola Cunninghamii*.

Raoulia Haastii cushions are still present, but in much smaller quantity, but their remains in various stages of decay are, in places, much in evidence. On the oldest river-bed there is abundance of *Acæna Sanguisorbæ* var. *pilosa* (Rosac.) and *A. inermis*, and as the scrub is approached *Geranium microphyllum* becomes extremely common.

As for erect shrubs, plenty of stunted *Coprosma rugosa* is dotted about, and the spiny *Discaria toumatou* (Rhamnac.) is frequent in many places.

γ. *Scrub.*

Scrub is the final association, so far as the river Rakaia is concerned. On other river-beds *Nothofagus* forest may be the climax, but it is generally on slopes or the summits of high terraces that forest occurs.

The scrub is simply subalpine scrub which has descended to the river-bed, and so needs no detailed description. It consists of: *Gaya Lyallii* (Malvac.), *Olearia ilicifolia*, *O. avicenniæfolia*, *Senecio elæagnifolius* (Compos.), *Phyllocladus alpinus* (Paxac.), *Coprosma propinqua* (?), *C. rugosa*, *C. parviflora* (Rubiac.), *Discaria toumatou* (Rhamnac.), *Veronica subalpina*, *V. salicifolia* (Scrophular.), and *Coriaria racemosa* (Coriariac.). As lianes there are *Rubus schmidelioides* var. *coloratus* (Rosac.) and *Clematis australis* (Ranun.).

Discaria scrub, or perhaps better *Discaria* steppe, is quite distinct from the above. It frequently occurs at a much lower elevation, and probably is not a phase of the succession, as here described, but a primary formation depending on a certain stability of the river-bed. It is especially plentiful on the fans of tributary streams, and makes quite a dense scrub not easy to penetrate on account of its formidable thorns. *Discaria* is the sole component; the dark colour of its stems and its few leaves render the association conspicuous, even from a distance.

(*d*) Affinities of the River-bed Associations.

The river-bed, prior to its peopling, is more closely related to shingle-slip than to any other land-form. It differs ecologically in its flat surface, stability of the substratum, and greater amount of surface-moisture, whereas the stones of the shingle-slip are always liable to move while the rain-water will pass off more rapidly. The consequence is that, contrary to expectations, true shingle-slip and river-bed have virtually no species in common, those of the former land-form being highly specialised and confined, or nearly so, to moving débris as their station. Where, however, large stones fill the bottom of a shallow gully and are fairly stable, certain species of *Raoulia* may be present (*R. tenuicaulis*, *R. australis*, *R. lutescens*), but *R. Haastii* is invariably absent, so it is possible that the first three-named species may tolerate a certain amount of burial, whereas it may be the intolerance to this which confines the plant in question to the river-bed, since its "seeds" must constantly be blown on to the bare mountain slopes.

The subalpine river-bed *Raoulia* association is closely related to that of the lowlands and of the mountain steppe-climate, both ecologically and floristically, but in the lowlands *Raoulia Haastii*[1] is wanting; and as the other species of the genus do not nearly so much favour the presence of epiphytes, owing to the absence of peat within the cushions, or supply so much humus by their decay, the advent of tussock-steppe is a slower process.

The steppe is floristically and ecologically related to that of the drier mountain slopes, but is made up of fewer species. Some of its plants, however (*e.g. Poa anceps* var., *Carmichaelia grandiflora*, *Coprosma rugosa*), do not generally occur except where there is an abundant rainfall.

The scrub association, as already noted, is almost identical with the subalpine scrub of the immediate neighbourhood, and the *Discaria* thickets have their counterpart on lowland river-beds and sand-dunes, and may be considered a form of steppe rather than subalpine scrub, which latter is a mark of a forest-climate.

[1] In Westland *R. Haastii*, thanks to the wet climate and proximity of lofty mountains, descends to at least 300 m. altitude.

Mites and Acarodomatia.

By Professor G. F. Scott-Elliot, M.A., B.Sc., F.L.S.

A Swedish botanist, Lundstrom (1), published in 1887—now a very long time ago—a classical paper upon mites and their dwelling-places, or, as he called them, acarodomatia. It was then a new subject, and the article, deservedly, attracted a great deal of attention. It is seldom that an original research is not only thorough, exhaustive, and exactly careful in details, but is also both suggestive and extremely interesting.

Quite a number of other botanists began to observe mites and look out for acarodomatia during the next few years. Then, however, followed an interval during which I have not met with any papers on the subject. Since 1903, however, several Italian and other botanists have been studying mites, and the attention of British botanists should be directed to this interesting subject.

The mites are a well-defined and strictly limited class of insects, and yet within the group there is an astonishing variety not only in structure but also in habit of life.

To the mites belong *Tetranychus* (red spider), *Phytoptus* (the currant mite), and *Tyroglyphus*, which are amongst the very worst vegetable parasites known to us. Certain mites are parasites on animals and birds, such as that which forms scabies (or itch) in man. Others live on the feathers of birds. Some live almost entirely in water, and many are saprophytic. Others, again, are active and nimble hunters, true carnivorous animals preying upon all sorts of minute insects.

The particular group of which I wish to speak includes especially two species, *Tydeus foliorum* and *Gamasus* spp. I am not a sufficiently good entomologist to be able to say anything about the classification of these mites, and I am not sure if these names still hold. What has interested me most has been their ways of life and their part in the economy of the vegetable world, and it is under these names that they are mentioned in botanical literature.

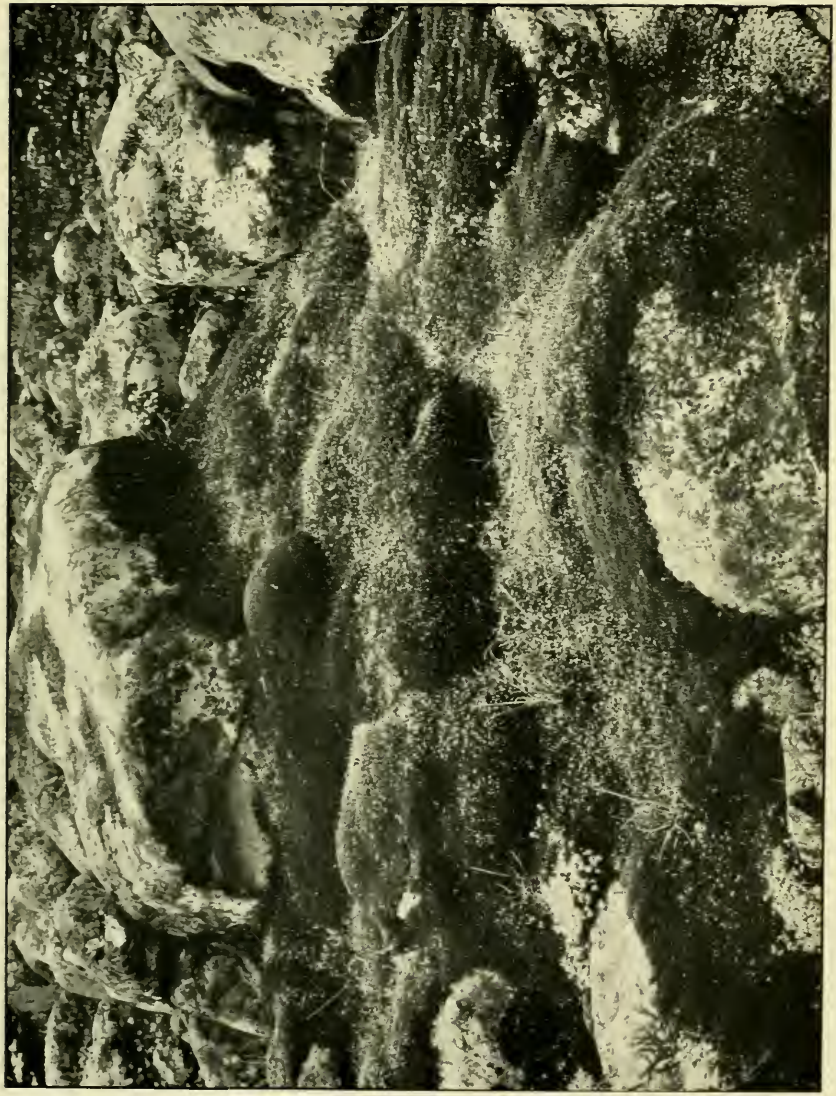
These particular mites are exceedingly common, as one soon realises when beginning a systematic search for them.

General view of the Rakaia river-bed. Ground liable to flood in foreground. Terraces being built in centre, and behind is terminal face of the Ramsey glacier. (Photo., R. Speight.)

L. Cockayne, Ph.D.

Source of River Rakaia. Moraine-covered terminal face of Lyall glacier in centre. (Photo., M. C. Gudex.)

L. Cockayne, Ph.D.



Irregular cushion of *Raoulia Haastii*, 68 cm. × 57 cm. The white patches are the moss *Racomitrium lanuginosum*, 4 cm. deep. River-bed of Rakaia. (Photo., L. Cockayne.)

L. COCKAYNE, Ph.D

On the under side of almost any leaf of any of our common trees there are to be found tufts of hairs, often at the angle where a side vein joins the midrib. The small hollows behind the hairs are the homes and shelters of the mites, and have been called acarodomatia. Within the little angle where the side vein branches off, there is often a curiously intricate and complex little cavern reaching up into the tissue, and guarded by a sort of *chevaux-de-frise* of special trichomes.

I have tried to draw sections of these little caves, but gave up the attempt in despair, for they are very difficult to section and are almost impossible to draw.

During the day, the mites pass their time in these caverns. If disturbed, they come out with every appearance of irritation and run about with extraordinary quickness, or, as Lundstrom says, with "unglaublicher Schnelligkeit." They are strictly nocturnal, like so many other beasts of prey, and object to being exhibited in daylight.

As the summer goes on, they seem to get more and more numerous, and they are especially abundant in September; but when the leaves begin to dry up, and the little hairs which guard the entrances of their shelters shrivel away, some of the mites abandon the leaves altogether and appear to take refuge in crannies of the bark, in the bud-scales, often in the fruit, and sometimes even on the seed itself.

It has been found that, when such seeds are sown, the mites infect the seedling leaves as soon as these are sufficiently mature.

I am by no means sure that all the mites abandon the leaves before the latter fall in autumn. I suspect that many winter in leaf-mould, but only a skilled entomologist could decide such questions. On the bramble in spring I have found mites still active on last year's leaves when the new leaves were just ready to be infected. I have also found them in the lenticels of an oak and on the cut end of a pear twig.[1]

It is clear, however, that there is no difficulty about the succession of mites from year to year.

In the summer the number of these mites is extra-

[1] These may not have been the mites which inhabit the leaves in summer.

ordinary. It is difficult to realise this point until one has really tried to find them systematically.

I have myself observed them on the following plants, though not always in special acarodomatia. If there are appropriate nooks or crannies somewhere on the plant which are fit for shelters, the mites naturally make use of them. I ought to mention also that these were all the benignant mites, not, so far as I could judge, the sucking "red spiders":—

Anemone japonica, pæony, larkspur, aconite, a garden form of *Thalictrum minus*, *Helleborus viridis*, *Liriodendron tulipiferum*, common barberry, mahonia, *Hypericum androsæmum*, *H. calycinum*, *Gypsophila* sp., *Lychnis chalcedonica*, *Sidalcea malvæflora*, common lime tree, ivy-leaved geranium, *Acer rubrum*, common sycamore, *A. campestre*, horse-chestnut, holly, *Dictamnus fraxinella*. They are very common both on Leguminosæ and Rosaceæ. I found the following plants to be regularly inhabited, viz.:—Broom, *Vicia cracca*, bean, kidney bean, *Lupinus mutabilis*, *Galega orientalis*, *Robinia pseudacacia*, common laburnum, gooseberry, black currant (*Phytoptus* is not common at Newton), bramble, raspberry, loganberry, strawberry, common sloe, gean, cherry, *Prunus padus*, *P. laurocerasus*, *P. lusitanicus*, *Spiræa ulmaria*, *S. filipendula*, *S. aruncus*, and three other species of Spiræa, *Geum urbanum*, *Rosa canina*, *Cotoneaster frigidus*, hawthorn, apple, pear, *Pyrus aucuparia*, *P. fennica*, *Epilobium montanum*, *Deutzia crenata*, *Philadelphus* sp., and *Astilbe* sp., *Heracleum spondylium*, *Eryngium planifolium*, ivy, *Aucuba japonica*, common elder, *Viburnum opulus*, honeysuckle, *Valeriana pyrenaica*, *Cephalaria tartarica*, *Echinops Ritro*, *Senecio vulgaris*, *Solidago virgaurea*, Jerusalem artichoke, tansy, *Aster corymbosus*, Michaelmas daisy, and a tall garden variety of *Achillea millefolium*, *Campanula carpatica*, *Lobelia cardinalis*, *Rhododendron ponticum*, common azalea, *Lysimachia vulgaris*, *Fraxinus elatior*, *F. ornus*, lilac, privet, *Forsythia viridissima*, *Gentiana asclepiadea*, *Veronica longifolia* var., *Antirrhinum majus*, foxglove, *Lamium maculatum*, *Monarda didyma*, *Polygonum virginicum*, box, common nettle, *Ulmus montanus*, alder, hazel, birch, oak, beech, hornbeam, *Salix caprea*, Solomon's seal. They also occur on the male fern, lady fern, and common bracken—that is, on about 113 species, mostly of herbaceous garden plants, and belonging to 44 natural orders. These were observed in the garden at Newton, near Dumfries (Kirkcudbrightshire), and at various places in Dumfriesshire.

This list is by no means the result of an exhaustive study of common British plants. I began by choosing plants at random, intending to obtain a percentage of British and cultivated forms which are regularly visited. But I have been so often deceived by not at first detecting the mites that I came to the conclusion that such a list would be misleading.

It is very difficult to be sure that any plant is free from them. No one would ever suppose that almost glaucous rain-shy plants like Gypsophila and Thalictrum were inhabited by them. Nor are they absent from either glossy leaves or very hairy leaves, as some have supposed.

It has been said by several authorities that acarodomatia only occur on dicotyledonous trees and shrubs. That is not, however, the case. They are very common on tall herbaceous plants, and even occur on quite lowly herbs, though this is unusual.

True acarodomatia have been found on two species of Dioscorea in the Congo by de Wildemann (2), and Zimmermann (3) also speaks of mites on the under side of the leaves of *Arundinaria japonica*. That they occur on the common Solomon's seal, where I found them abundantly at the base of the stem leaves, is a very interesting point.

Another point that should perhaps be mentioned is that acarodomatia do not afford a clear proof of a warm, humid climate. Peola (4), in studying the fossil Tertiary flora of Piedmont, discovered well-marked acarodomatia on the leaves of *Oreodaphne Heerii*, *Cinnamomum polymorphicum*, and *Laurus canariensis*: but it can hardly be said that this in itself shows that the climate was warm and humid. There are plenty of acarodomatia not only in Britain but in the tropics.

It would be easy to give a list of those plants which have acarodomatia, but this is hardly necessary. The researches of Lundstrom, von Lagerheim (5), Malme (6), Loesener (7), Schumann (8), Ludwig (9), Magoczy-Dietz (10), Penzig and Chabrera (11), Guerin (12), Delpino (13), and Rocchetti (14) have shown that these shelters exist in the following natural orders, viz.: Melastomaceæ, Menispermaceæ, Euphorbiaceæ, Piperaceæ, Dipterocarpeæ, Thymeleæ, Styracaceæ, Simarubeæ, and especially in Lauraceæ and Rubiaceæ. The last-mentioned author has a list of 270 acarophilous species.

Moreover, many plants which are regularly visited or inhabited by mites are without anything that one can call an acarodomatium. The mites take up residence in any convenient nook or cranny, and one cannot say that these crevices are specially produced for the good of the mites.

Thus many forest trees have holes in the trunk where some branch has decayed away, and birds such as the titmouse nest in holes of this kind. Titmice are very useful to the trees, and find these hollows very convenient, but the holes were not formed for the good of the titmouse, although this bird is one of the most useful of British species.

When one reflects on the multitude of mites visiting regularly so many plants, it is impossible not to speculate as to what is their part in the general economy of plant life.

Lundstrom suggested that they kept the leaves free of dangerous fungi and insects.

It is well known that in tropical and subtropical countries many plants are subject to the attacks of leaf-epiphytes. It is quite common to find leaves entirely covered by a heterogeneous vegetation of algæ, lichens, mosses, and liverworts. Stahl has figured the leaf of a Medinilla so overgrown by an epiphytic vegetation of this kind that it must have been impossible for it to carry on its functions. Such leaf-epiphytes are exceedingly common in many vegetation formations in the tropics.

Now, most of Lundstrom's mite-plants belong to certain districts in South America. Malme some time afterwards visited the same locality. He found that in these light woods known as "Capoes" smooth-leaved shrubs were infested with these epiphytes, but that the acarophilous plants with acarodomatia were much less or not at all affected. Penzig and Chabrera confirm this observation.

Even in this country it is unusual to find either "red spider" or "Phytoptus" on the same leaf as the benignant mites. I have never myself seen them together, and very seldom seen aphides accompanying the true mites.

Certain observations which have been made on the habits of the benignant mites are of great importance.

Their mouths are not adapted for sucking the sap of plants, but for chewing or biting (Aurivillius (15)). Lundstrom himself saw fungus spores between the mouth parts of living acarids. Spores and fragments of fungus hyphæ have been found in their shelters. Dr. Aurelio de Gasparis caught *Tydeus foliorum* in the act of piercing an insect's egg.

According to Banks (16), *Tydeus gloveri* eats the eggs and young of scale insects, and both Rhyncholophus and Cheyletus are also said to prey on scale insects. Cheyletus also eats the eggs of a cicada, and certain Gamarid mites live on minute plants, bacteria, small fungi, etc.

These observations seem almost to prove the truth of Lundstrom's suggestion. It would be interesting to try if these mites could not be utilised to keep down "mussel scale" and similar pests in greenhouses.

These mites, therefore, may be regarded as an active and numerous police, keeping in check all sorts of fungus and insect pests which might otherwise do serious harm.

But there is another possibility which, to my mind, is of even more importance.

The atmosphere is, in its lower layers, crowded with enormous quantities of motes or dust-particles. They are of the most diverse origin. Of the inorganic dust-particles some did not belong to our earth originally, but formed part of a falling star or perhaps a comet's tail. Other particles have been thrown out in volcanic eruptions. The dust from Krakatoa, for instance, is said to have been reflected out and back again, and to have passed right round the world three or four times.

Fine dust from the Sahara and other deserts probably travels great distances. I have seen quantities of it on a steamer's deck quite a long way from shore. Mr. John Aitken (17), in one of his classical papers on this subject, describes how dust-particles from the densely inhabited districts of France and Belgium seemed to have been caught up in a cyclone, carried right round by the north of Scotland, and reached his instruments at Kingairloch (28 miles from Ben Nevis) with a north-westerly wind.

These inorganic dust - particles must, therefore, be miscellaneous; they probably differ both in chemical constitution and in physical character, though they are all exceedingly minute.

But the organic part of the dust-particles is perhaps even more interesting.

It is hardly necessary to say much about the enormous number of germs, spores, pollen grains, and other organic material which seems usually to hover in the atmosphere.

Dust-like seeds are characteristic of many phanerogams, and especially, according to Ridley, of many of those which have colonised oceanic islands. Fern-spores also must be abundant in the atmosphere. I need hardly recall the classic case of Krakatoa, for, even in this country, many kinds of ferns and even some flowering plants establish themselves on trunks of trees, bridges, and walls, sometimes miles away from their nearest neighbour.

With mosses and lichens, the facts of their distribution both in the Arctic and Antarctic and on mountain summits are very remarkable. Fink (18) discovered no less than thirty forms of lichen on a wall that had only been built thirty years. One should also mention, perhaps, the trades dust which falls in the Atlantic, and which consists of an alga, *Trichodesma Hildenbrandtii* forma *atlantica*, the regular distribution of yeast-cells on fruits, Dietel's experiments which showed that spores of rust-fungi could always be detected on plates left exposed during the summer.

Many other instances could be mentioned, but this hardly seems necessary. One of the most recent papers, however, can hardly be omitted in this connection.

Galeotti and Levi (19) studied the distribution of bacteria and fungus spores on the snow of high Alpine summits. From a cubic centimetre of water melted from the snow found on Point Strahling, at an altitude of 3116 metres, they obtained 147 colonies of bacteria and 20 colonies of Hyphomycete fungi. In one case (Lyskamm) they found only one colony of Hyphomycetes; yet on another summit

(4560 metres), Gnifetti, there were no less than 40 bacterial and 3 fungus colonies from a cubic centimetre of melted snow.

However much allowance may be made for the share taken in the transport of spores by insects and birds, these instances are enough to show that even at altitudes of 13,000 feet the air contains living spores in great abundance.

When rain falls, a very large proportion of the floating dust-particles is washed out of the air and falls upon the foliage of plants. When the drops reach the leaves, the water is carried down to the petioles and stems by a series of grooves and gutters or flat surfaces which differ almost in every particular type of leaf.

These ingenious contrivances for carrying off rain-water are much too complicated to describe, but the result is to deposit all dust contained in the rain on certain well-defined lodging-places, usually about the base of the lamina or of the petiole.

I examined this dust microscopically, collecting it from about 26 species of plants. The results were too monotonous for it to seem worth while to go further into this side of the question.

In every case I found such easily recognised objects as lichen soredia, spores of rust-fungi, algal cells, pollen, yeast cells; in every case bacteria were to be seen. The proportion of these organic particles seemed to me extraordinarily high, at least in all cases when the leaf was more than 18 inches above the ground.

The point which most impressed me was the extraordinarily high manurial value of this plant-dust.

Not only does the inorganic part consist of very fine particles of the most varied mineral character, but the organic part not only forms a large proportion of the dust, but consists mainly of spores, etc., which must contain the most concentrated nutritive material.

Not only so, but there are grazing animals, the mites, to devour this combined nitrogenous matter, and, as I have pointed out, bacteria are available to break up and transform the waste products.

If this material, when dissolved in rain-water, enters the leaves, then it seems that a whole series of complex adaptations have been prepared to utilise all this rich air-food.

But here I am on very delicate and dangerous ground. Is it possible for rain-water with dissolved salts to enter the leaf?

That question has been debated, often with great violence, for something like 179 years. Naturally, I do not wish to dogmatise on this difficult point. But several of the best authorities on vegetable physiology admit that such absorption does take place. Both Sachs and apparently Vines agree that this is possible. Pfeffer remarks as follows: "Dem Gemäss können sehr wohl kleine Quantitäten von gelösten Stoffen mit Regen und Thautropfen in die Blätter gelangen." I do not find Kny's (21) experiments in the least conclusive. They have been often quoted as showing that no such absorption takes place, but the following extract seems to me to show that such absorption can take place even under very heroic treatment: "Die in Oel steckenden besprengten Zeigten beginn des Welken; die in Oel steckenden nicht besprengten waren stark welk." Neither Liebig nor indeed anyone supposes that such absorption can be large in amount. It is probably only a very minute proportion of the water that enters by the roots.

Nevertheless, when one remembers the rich manurial value of this dust, that it is carefully strained out of the rain by a whole series of elaborate contrivances, and also that there are neat arrangements for encouraging mites to reside permanently on the leaves, one can only draw the conclusion that mites, bacteria, and rain-gutters in the leaves form together one of the most interesting cases of symbiosis that has yet been discovered.

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(21) Kny.—Ber. d.d. Bot. Ges., Bd. iv., 1886.

On Some British Hybrid Roses. By J. R. Matthews. (Plate XII.)

Although within recent years considerable attention has been given to the genus *Rosa*, much still remains to be done in way of systematic classification. This is perhaps more true of the section of *Pimpinellifoliæ* hybrids than of any other section of the genus. The difficulty obviously arises from the hybrid origin of these roses; and until their exact parentage is known, it seems to me impossible to expect a satisfactory classification of the individual species which go to form the three groups of the section. Especially is this true of the group Pimpinellifoliæ × Villosæ, where too much stress has been laid on technical characters, such as size and serration of leaflets, glandularity, hairiness, etc., and little or no reference has been made to the characters of the possible parents.

The position of the sepals appears to be a very important consideration, but the determination of this point is frequently rendered difficult owing to the fact that in most of these hybrids the fruit aborts before the real position of the sepals can be ascertained. But if this matter could be determined from observation of the *living* plants (herbarium specimens are not always to be depended upon), a great advance would be made in determining the second parent, and, as a consequence, the classification of the species would be rendered easier and, at the same time, more natural.

It is not my intention to give a detailed description of all the hybrid roses that have been found in Britain. That has already been done in "Journ. Bot.," 1910. I propose merely to indicate the three groups which are represented in this country, with occasional reference to the forms which are found in the neighbourhood of Edinburgh, and to give some idea of the work which has already been done on this section of the genus.

On the whole the hybrids are easily recognisable. Their foliage generally, but not always, recalls that of *R. pimpinellifolia* in shape and colour. There is always and often a decidedly marked admixture of acicles on the stem and branches, and the fruit is in most cases very imperfectly developed.

The largest of the three groups is Pimpinellifoliæ × Villosæ, collectively called *R. involuta*, Sm. Several varieties have been described, but these seem to run so closely into each other that it is very difficult to distinguish them, however well defined on paper.

R. involuta was first described in 1804 by Smith in "Flora Britannica," but at that time was not recognised as a hybrid. Baker, in his "Monograph of British Roses," 1869, includes *R. involuta* in the group Spinosissimæ, with which of course it must have some affinity since *R. pimpinellifolia* is one of the parents. But this is sufficient to show, I think, that Baker was not aware of the hybrid origin of the rose. It was not, in fact, for a number of years after the appearance of the monograph that Dr. Christ[1] promulgated the idea that *R. involuta* is a hybrid of *R. pimpinellifolia* and *R. tomentosa*, a member of the subsection Villosæ.

Several years after Smith's earliest description there appeared in "Trans. Linn. Soc.," 1818, an account by Woods of a variety of *R. involuta* which its author named *R. sabini*. This differs from the former in having its leaflets fully compound-glandular-serrate, its sepals pinnate, and its prickles more scattered. But since Woods' description appeared, a number of intermediate forms have been figured, and under *R. involuta*, Sm. in the "London Catalogue Ed. 10," we find a list of twelve varieties.

R. sabini, Woods, is considered by Baker to be much more common than *R. involuta*, reaching its maximum frequency

[1] "Botanisches Centralblatt," 1884.

in the north of England; but as *R. involuta* has the right of priority, that name must stand at the head of the group. The hybrid, however, is not infrequent in Scotland. In the Edinburgh district it occurs at Port Seton and at Ormiston, growing near *R. hibernica*, to be referred to in the sequel. I believe further investigation will prove its occurrence in other localities. With regard to the distribution of the hybrid in Scotland it is interesting to note that Don discovered it "on a rock on one of the mountains at the head of Clova near the limits of perpetual snow." Hence Don named it *R. nivalis*. One specimen of Don's plant, thus named, is in the herbarium of the Edinburgh Royal Botanic Garden, and on the sheet, Prof. Crépin, in his revision of the roses in the herbarium, has written "involuta."

In 1892 a very interesting and curious form of this hybrid was discovered by Mr. Barclay near Auchterarder Station, and through his kindness the plant was pointed out to me. Specimens were sent to Prof. Crépin, and regarding it he reports as follows:—"It is truly remarkable that I have seen nothing like it from the Continent or from other localities in the British Isles. Its leaflets are profusely glandular below, and have many glands on the upper surface; but what is extraordinary is that there are numerous long, stiff bristles clothing the pedicels and receptacles. At first sight one would imagine it to be the hybrid *R. pimpinellifolia* × *rubiginosa* (*R. echinocarpa*, Rip.); but this idea cannot be entertained when we look at the prickles, which are straight or but slightly curved. Moreover, *R. rubiginosa* is not found in the immediate neighbourhood. On the other hand, there is found growing beside the hybrid a form of *R. tomentosa* with leaflets glandular on both surfaces, and with pedicels and sepals thickly hispid-glandular. Let us not forget to add that the axes of this hybrid have quite the armature of the ordinary varieties of *R. sabini*, Woods, that its receptacles have ripened, quite full of achenes, and that its sepals are persistent."[1]

Every year this hybrid bears a large crop of well-developed fruit, a point on which Crépin lays considerable

[1] "Notes on Scottish Roses," W. Barclay in "Ann. of Scot. Nat. Hist.," 1896.

emphasis; and this is indeed exceptional, for in the case of most other hybrid roses the fruit is largely abortive. Probably this rose is pollinated from the *tomentosa* form which grows near it.

In order to make certain whether the seed is fertile or not, I have, this autumn, sown a quantity of it. It would be very interesting indeed to know of its germination.

In this group, as in the two following, *R. pimpinellifolia* or its variety *R. spinosissima* is always one parent, but the question arises whether the second parent be *R. tomentosa*, Sm., or *R. mollis*, Sm. The problem is a difficult one, especially with regard to hybrids found in Scotland, where *R. mollis* is at least as plentiful as *R. tomentosa*. In the south of England, as Major Wolley-Dod has pointed out, *R. mollis* cannot be the second parent, for it does not grow there. Thus some clue may be obtained by noticing what species are dominant in the locality where the hybrid occurs. In the meantime the exact parentage seems to be obscure. The one conclusive proof would be to obtain the same forms reproduced from their parents by artificial methods.

Crépin, in his "Rosae Hybridae,"[1] describes a form of *R. involuta* from Sutherland which he considers to be *R. pimpinellifolia* × *mollis*. One sheet of this hybrid is in the Botanic Garden herbarium, the specimen having been sent by Rev. E. S. Marshall, who, in a note, declares it to be from the original plant described by Crépin. The specimen certainly approaches nearer *R. mollis* than *R. tomentosa* in several of its characters, but in other forms of the hybrid, as, for instance, those found near Carnoustie, it is very difficult to decide which is the second parent.

With regard to the Auchterarder rose, it seems quite certain that the second parent is the glandular form of *R. tomentosa* which grows beside it. In many features the hybrid is nearer *R. tomentosa* than *R. pimpinellifolia*.

The second group, Pimpinellifoliæ × Eu-caninæ is a small one, and collectively is called *R. hibernica*. The main prickles are stouter and more hooked than in the first group, often quite curved as in *canina* forms. The foliage recalls that of *R. pimpinellifolia*. The leaflets are small,

[1] "Bulletin de la Soc. Roy. de Bot. de Belgique," 1894.

mostly uniserrate, quite eglandular beneath, and usually, but not always, glabrous. The amount of pubescence seems to depend on which variety of the *eu-caninæ* is the second parent.

Until recently Smith's description in "Eng. Bot.," 1810, was accepted as the earliest, but it has been pointed out in "Journ. Bot.," 1907, that the same rose had been described by Templeton in "Trans. Dublin Soc.," 1802, and so he must stand as the author of the name. At all events, Dr. Christ was again the first to express the opinion ("Journ. Bot.," 1875) that *R. hibernica* is a hybrid of *R. pimpinellifolia* and a *canina* form.

In 1866 the plant was collected by Gorrie near Ormiston, and this is probably the first record for Scotland. In "Trans. Bot. Soc.," 1867, we read: "Mr. Gorrie presented specimens of a rose which he found growing on the side of the old road which divides the counties of East and Mid-Lothian, between Melville Hall and Bellyfurd Burn, in the month of August last." Gorrie sent specimens to several botanists, but no one referred it, at the time, to any named species. It seems that Sadler, some years afterwards, had sent specimens from the same bush to Baker, who referred it to his variety *lævigata* of *R. involuta*. This simply points to the difficulty of referring these hybrids even to their proper group. On the sheet of Gorrie's plant in the Botanic Garden herbarium there is the following note by Webb:—"In 1876 I happened to be alongside Baker at Kew when he was sorting some specimens for the herbarium. Among them was a rose from Sadler to be named (a previous insufficient specimen had been sent, but not complete enough to determine), and I believe these specimens are the same. Baker called it *R. involuta* var. *lævigata* of his monograph. From the present specimens I have little hesitation in saying *hibernica*." It would appear, therefore, that Webb was the first to refer this Ormiston rose to its proper place.

The plant resembles the original Irish forms in having the under surface of the leaflets hairy, and, until two years ago, was the only form of *R. hibernica* with hairy leaflets known in Scotland. In "Ann. Scot. Nat. Hist.," 1908, it is recorded from Banffshire by Mr. Barclay. The leaflets of the Banffshire rose are less hairy than the Ormiston and Irish forms, and the fruits are abortive to such an extent that Mr. Barclay finds it difficult to decide whether the sepals become erect or not. There is, consequently, considerable difficulty in determining whether the second parent is *R. dumetorum*, Thuill., or *R. coriifolia*, Fr.

Being anxious to see the Ormiston plant, I visited the locality this autumn, and, guided by directions from Mr. Barclay, I had no difficulty in finding the bush. Unfortunately it had not flowered owing to a recent and evidently severe trimming. All I was able to obtain were portions of strong vegetative shoots which had grown most vigorously.

In "Review of British Roses," Baker describes a marked variety of *R. hibernica* which he calls var. *glabra*. He reports it from Sutherlandshire besides several English counties; but as no date is given for the Scottish record, it is difficult to say whether this or Gorrie's plant was the first *hibernica* for Scotland. In var. *glabra* the leaflets are glabrous, and this indicates that the second parent is one of the glabrous varieties of the *eu-caninæ*, probably *R. canina*, L., or perhaps *R. glauca*, Vill. The variety *glabra* has been recorded from at least three other Scottish counties—Banff, Aberdeen, and Perth, but in the last it is now extinct. In both the north of Scotland localities the sepals are reflexed, and this gives rise to the idea that the second parent must be *R. canina*, possibly of the group *lutetiana*, Léman. Yet *R. canina* is less frequent in the district than *R. glauca*, and one would have expected, as Mr. Barclay has pointed out, *R. glauca* to be the second parent. But *R. glauca* has the sepals erect.

Dr. Christ's opinion was that the Irish forms of *R. hibernica* had for their second parent a form of *R. canina* which has reflexed sepals. Crépin, in his "Rosae Hybridae," holds a different view, and believes that the second parent is *R. coriifolia*, which has erect sepals. In support of this view he refers to a specimen in Botanic Garden herbarium in which the sepals are quite erect. But others, as we have seen, have the sepals reflexed.

To summarise, it seems to me that forms of *R. hibernica* with erect sepals are likely to have for the second parent

R. coriifolia or *R. glauca*, the former if the leaflets are hairy, the latter if the leaflets are glabrous. If the sepals become reflexed either *R. canina* or *R. dumetorum* may be the second parent, the former if the hybrid has the leaflets glabrous, the latter if the leaflets are hairy.

A new variety of *R. hibernica* has been described by Mr. Barclay in "Journ. Bot.," 1910, p. 332: and since I was with Mr. Barclay when the plant was found, it may not be out of place to mention the record here. The locality is the sea-coast about one and a half miles east of Port Seton.

In all the described British forms of *R. hibernica*, the serration of the leaflets is simple or very nearly so, and the sepals and peduncles eglandular. The Port Seton plant differs in having leaflets with a decidedly compound serration, generally two but sometimes three denticles on the lower edge of each tooth and occasionally one on the upper, the majority of the denticles ending in a gland. The leaflets, like some other forms of the hybrid, are hairy on the under surface. The peduncles are sparingly glandular, sometimes naked. The sepals are nearly simple, and more or less glandular on the back.

According to Mr. Barclay, no form resembling this has been previously found either in Britain or on the Continent. *R. armatissima*, Déség., a form which occurs on the Continent, is described as having biserrate leaflets, but without hairs on the under surface, and quite eglandular. Thus the second parent in the two forms cannot be the same.

The second parent of the Port Seton rose, since the sepals become erect and since the leaflets are hairy, is probably a variety of *R. coriifolia*, Fr., with biserrate leaflets, and with peduncles and sepals glandular, *i.e.* a variety of the group *R. Watsoni*, Baker.

The third group is Pimpinellifoliæ × rubiginosæ, and so far as I know, the hybrid has not in this country received a specific name. The rose is rather rare, and it is only within recent years that its occurrence in Britain has been hinted at, although a form resembling it has been known on the Continent for some time. It occurs in only a few places in Britain. It has been found in the south of England, and till this year was known in two localities in Scotland. Mr. Barclay discovered it near Caputh in 1897, and a few years later it was noticed by Prof Trail near Turriff. It was afterwards discovered. however, that the rose was actually being cultivated in that district, the cultivators believing that they had in their gardens the true sweet-briar. It seems probable, then. that Prof. Trail's plant is an escape from cultivation. Or the reverse may be true. The plant may be a natural hybrid which has been taken into cultivation from nature. Against this view is the fact that neither *R. rubiginosa* nor *R. pimpinellifolia* was observed in the district. The Caputh bush, Mr. Barclay says, is undoubtedly a natural hybrid, for there it is growing beside its parents.

Another locality is now known where the rose grows plentifully. I refer to that part of the Haddington coast between Port Seton and Longniddry, where it was found in September last by Mr. Barclay, its occurrence being noted in "Journ. Bot.," 1910, p. 260. On October 1st, in company with its discoverer, I had the pleasure of seeing the growing plant, and of collecting specimens. It grows in large clumps, and some of the bushes are luxuriant, attaining a height of eight or nine feet. A fair quantity of fruit had ripened, though a greater quantity had aborted. On examining several receptacles, however, I found that only a few achenes had developed.

The hybrid resembles *R. rubiginosa* in possessing subfoliar scented glands, and also in having these glands distinctly stalked. The prickles are numerous and unequal, the smallest straight, the others compressed, dilated, and curiously uncinate. Two distinct forms were found as regards the fruit. One form possesses long fruit, whereas the other has it globose. The former variety is quite new to Britain. In other features the two forms are similar.

There can exist no doubt whatever that the rose at Port Seton is a natural hybrid. No better chance for hybridisation could be imagined, for both parents are growing in close proximity. In some places it was noticed that their branches were interlacing. It is more than likely that other hybrid forms are to be found in the same locality, and I am quite certain that a careful search would be well rewarded.

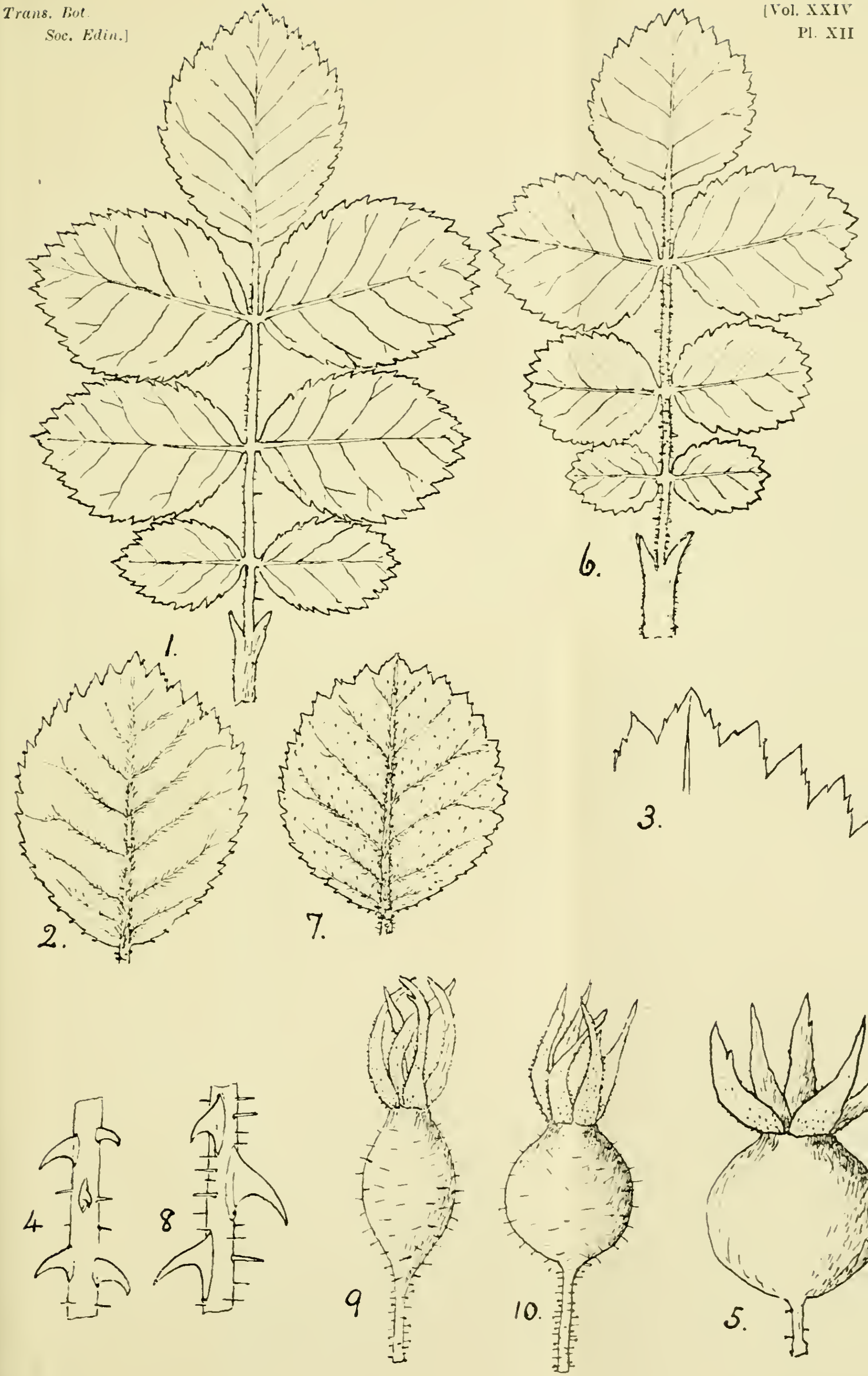
EXPLANATION OF PLATE.

FIGS. 1–5. *Rosa hibernica*, nov. var., from Port Seton.

1. Leaf, $\times 1\frac{1}{2}$. 2. Leaflet, underside, showing clothing, $\times 2$. 3. Leaf margin, $\times 5$. 4. Portion of branch, showing prickles, $\times 1$. 5. Fruit, $\times 1\frac{1}{2}$.

FIGS. 6–10. *Rosa pimpinellifolia* $\times$ *rubiginosa*.

6. Leaf, $\times 1\frac{1}{2}$. 7. Leaflet, underside, showing clothing, $\times 2$. 8. Portion of branch, showing prickles, $\times 1$. 9. Fruit, elongated form, $\times 1$. 10. Fruit, round form, $\times 1$.



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J. R. Matthews.

The Grassland of Orkney: An Œcological Analysis.

By G. W. Scarth, M.A.

Prefatory Note.

This paper is only part of a systematic œcological study, not yet completed, of all the land vegetation of the Orkney Islands, and was written with the prospect of forming a part of the complete description. It has been suggested to me, however, that, as the œcological classification of Grassland is in a very chaotic state at present, this attempt at analysis may contribute a little to its advance, and might lose in value by being kept back too long.

I have therefore decided to publish it separately, but have not greatly changed the original wording, as there is still a possibility of its being incorporated in the whole work. Some of the references may thus be rather unintelligible at present.

While it is hoped that the main features of the classification adopted are fundamental, great accuracy of detail is not claimed, for this is really only part of a primary survey of an extensive area, and there was no time for soil analysis and other operations of a detailed survey.

The division grassland is, on the whole, a natural one in œcological classification, though its extent and limitations are arbitrary. In some regions extensive tracts of natural or primitive grass vegetation may occur, but under other climatic conditions most of the grassland is of semi-cultural origin.

Grassland may be defined from the other main divisions of vegetation by the following characters:—

1. The soil, as regards moisture conditions, ranges from one which is quite dry in summer to a permanently wet soil, not, however, so wet as a marsh.

2. The soil is generally loamy. There is at least no distinct formation of peat. The soil may contain a certain amount of raw humus and may even overlie a considerable depth of peat, but in the latter case it is safe to assume that the peat was formed when some other formation occupied the field.

3. The grasses usually dominate, or plants generally associated with the grasses.

Extensive grassland, either meadow or pasture, is not common in Orkney. The climate is too favourable to the production of acid humus for these mesophytic types.

Consequently, on the low grounds, after the surface of a marsh has been raised sufficiently above the water-table for meadow to develop in a region of hotter and drier summers, the sedges continue to dominate until peat moor and heath plants appear. On drier ground again the natural vegetation is also heath or moor. We have seen that there may be a certain development of grassland on the links and by the seaside generally, which, though encouraged by grazing, is probably of natural origin. But with this exception practically all the pastures owe their existence to human influence. Specifically the following are the main factors involved in the production of grassland out of the natural formations:—

Heather-burning; grazing, treading, and manuring by domestic cattle; drainage; cultivation; spread of grass seeds from cultivated land and other grassland.

Without in the meantime attempting to classify them, I shall enumerate the chief situations where, through natural or artificial causes, the grasses dominate.

The Stations.

Stream sides.—For a short distance on either side of a stream that overflows its banks occasionally there is the requisite moisture for the formation of a meadow, and, owing to the draining influence of the channel of the stream, there is no stagnation and consequent souring of the soil. A narrow strip of meadow may thus be formed, but further from the stream sedges dominate.

Small islets in the lochs.—In this very limited type of locality somewhat similar conditions hold and similar vegetation results. Manuring by waterfowl and absence of grazing aid in encouraging the growth of tall herbs, such as Spiræa and Angelica.

Grassy banks.—On sloping sea-cliffs on sheltered coasts where there is little salt spray, and on similar inland slopes, of which there are few, the perfect drainage permits a grassy formation, as a rule, though not always, to oust the heath.

Moist grass slope.—Strips of green may sometimes be seen running down a hillside, which exhibit on closer investigation a close-cropped grass sward with a good deal of Carex panicea and C. glauca in some cases, or even a dominance of these. These grass strips seem to be due to gentle springs and rapid movement of water keeping the soil fresh. A somewhat similar grass slope may occur at the base of Alpine rocks and in the neighbourhood of Alpine rills; but there is little of Alpine conditions in Orkney.

Marsh-meadow of the lowlands.—While the evolution of a marsh never results in the production of a pure meadow in Orkney, it sometimes gives rise to a formation in which the grasses dominate over the sedges and other marsh plants. Such a type we may call a marsh-meadow, but this will be referred to again.

Wet springy hollows.—The brown colour of the moorlands is occasionally interrupted by green patches, chiefly in the valleys, where abundant movement of spring water or drainage water gives rise to a type of vegetation varying from simple marsh to a heathy pasture, but the bulk of which is akin to a marsh-meadow.

The above are all more or less natural situations as described, but can rarely be found uninfluenced by grazing, drainage, etc. They are of very limited extent.

The following are more directly due to man's influence—still not including land in regular cultivation:—

Drained marshes and wet ground formerly cultivated but long left untended.—Such areas develop into various kinds of marsh-meadow after some time.

Dry permanent pastures either on ground formerly cultivated or on very old pasture ground, such as the vicinity of farm steadings and the borders of fields, where the various factors previously mentioned, grazing, spread of seeds, etc., are most active.

Grassy heath or heath pasture, where persistent heather-burning and long-continued pasturing have resulted in the heath grasses dominating over the heather.

Besides the above there are grasslands which owe their existence to marine influence, and thus belong to the coast formations. They are probably the only types that would occur to any extent in a state of nature.

For the sake of completeness I briefly refer to them here also.

Calcareous meadow.—In the island of Sanday especially, the low ground round the fresh-water lochs has no sedge vegetation. *Equisetum limosum* swamp passes directly into grass meadow. This appears to be due to the fact that the soil consists of shell sand mostly and is continually receiving a wind-blown deposit of carbonate of lime in this form. The formation of acid humus is thus prevented.

Sand meadow and sand pasture.—The fine pasture ground that is associated with sand dunes is no doubt partly due also to the neutralising action of blown shell sand, as well as to the drainage effected by the porous nature of the soil. The pasturing of sheep and cattle, as well as the manuring by seaweed where spread out to dry for kelp-burning, have helped to develop this form of grassland. It is described under the Psammophytic Formations.

Maritime pasture.—The grassy areas near the sea on exposed coasts appear to owe their existence to the presence of wind-carried salt in the soil. Sheep pasturing and sea-fowl guano have helped to enrich the soil. Both this and sand pasture are characterised by having *Festuca rubra* as the dominant plant. In the present case, however, it tends to pass landward into a heathy pasture, with Nardus dominating.

The Formations and Associations.

In attempting to classify the various types of grassland it is not easy to employ with success the designation *meadow* and *pasture,* because there is much wet ground which, in an œcological classification, would be placed along with meadow, but which in popular speech would not receive that name. "Wet pasture" would be more suitable. *There are certainly two types of grassland, one with a wet soil due to ground water, the other with the moisture of its substratum derived mostly from direct precipitation.* The wet type may occur on a slope, depending on springs or the percolating water of drainage channels, as often as on a plain with a high water-table.

This appears to be the most fundamental character which can be used in classifying grassland. The chief difficulty is to find names to distinguish the two types. Not wishing to stretch the meaning of the term meadow, I call them tentatively *wet pasture* and *dry pasture.* The definition is more important than the name.

Another factor which profoundly influences vegetation is the acidity or otherwise of the soil. It appears clear that, although grassland is regarded as typically mesophytic, many soils with acid humus support associations which are best described as grassland. On the other hand, grassland is common on calcareous soils, which may have an alkaline reaction.

Since these variations of soil occur both with wet and dry substrata, an ideal subdivision of grassland would be as follows:—

I. Wet pasture.
   1. Acid.
   2. Neutral.
   3. Alkaline.

II. Dry pasture.
   1. Acid.
   2. Neutral.
   3. Alkaline.

The nearest approach to this that can be reached in classifying the actual associations that occur is as follows. I give simple descriptive names to the various divisions. Fuller definitions follow.

I. Wet Pasture Formation.

Sub-formation I.—Marsh-meadow and wet pasture (grass-sedge and Juncus types).

Sub-formation II.—Neutral meadow (negligible in Orkney).

Sub-formation III.—Calcareous meadow.

II. Dry Pasture Formation.

Sub-formation I.—Heath pasture.

Sub-formation II.—Neutral pasture.

Sub-formation III.—Sand pasture.

Sub-formation IV.—Maritime pasture.

Sub-formations III. and *IV.* are excluded as belonging to other formations.

Possibly calcareous pasture on limestone and chalk might form a *sub-formation III.* in other areas, but there is none such in Orkney, and I have not studied it anywhere.

FORMATION I.—WET PASTURE.

Owing to ground water from whatever cause, the subsoil is not dry even in summer. No determinations of water content were made, so I am not yet able to compare in this respect the wettest ground that I include as wet pasture with that of a marsh, but apparently in some cases the soil may be as wet as in the latter, but is less stagnant and probably richer in food salts. Of course the line of separation is purely arbitrary. The distinction that I usually employed lay in the vegetation, viz. *the dominance of the grasses.* In a few cases perhaps where they are not dominant the abundance of *Trifolium repens* suggests meadow rather than marsh.

As regards the division into sub-formations tabulated above, it can scarcely be said that the distinction "acid" and "neutral" is rigid in my grouping of the associations in I. and II.

Soils too *wet* as well as too acid for true meadow are included in the "Marsh-Meadow and Wet Pasture" division.

The distinction in the character of the vegetation is *the presence in* I. *of a large percentage of marsh plants or sometimes plants of wet heath.*

It was found that in Orkney true neutral meadow could be recognised occupying only very limited areas.

Nor was there any very characteristic association on these areas that could not be referred either to marsh-meadow or to neutral pasture (dry). I have therefore decided to omit any special description of neutral meadow, on the basis of the limited material afforded for its study in Orkney.

As a consequence some of the types described under sub-formation I., such as the *Aira cæspitosa association,* ought perhaps to be referred to sub-formation II.

Sub-formation III., *calcareous meadow*, is a very distinct type on the other hand.

Sub-Formation I.—Marsh-Meadow and Wet Pasture.

This includes two types: low-lying wet ground with a high water-table, to which the term marsh-meadow is most applicable, and sloping drainage channels or ground in the vicinity of springs, more naturally described as wet pasture. But there is no essential difference in the vegetation which would make it possible to separate them. The first type especially is closely allied to a true marsh and grades into it, but is distinguished by the dominance of the grasses as a rule, or the presence in quantity of certain distinctively meadow plants, such as Spiræa, Trifolium repens, etc. On the other hand, the distinctive marsh plants, such as sedges and species of Juncus, are never absent, and are usually prominent.

This is obviously an intermediate type between marsh and meadow, but in Orkney at least cannot be described as a transition, because it practically never does pass into meadow. It is, moreover, a common, if not extensive, type of vegetation and requires independent notice.

Just as two types of marsh are recognisable—"rich marsh" on deeper and more fertile soil, and "poor marsh" on poor ground—so there are two corresponding forms of marsh-meadow. On a firm infertile clay or sometimes peaty soil similar to that which bears a "panicetum," but further from the water-table, a grass association may occur which might correspondingly be called "poor marsh meadow" or "poor wet pasture."

In contrast to typical marsh-meadow, which has a fairly luxuriant growth, including tall herbs, such as *Spiræa* and *Angelica*, *poor marsh-meadow* has an extremely short sward with much *Carex panicea* and *glauca*, and many rosette plants. The most characteristic brightly flowering herb is *Leontodon autumnale*, the presence of which may be used to distinguish it from poor marsh, into which it grades. Like its corresponding marsh type, it may occur on sloping as well as horizontal ground. The green strips already referred to as "moist grass slope" consist of a vegetation similar to the poor marsh and poor marsh-meadow of the clayey flats. Probably the excessive movement of water in such places causes leaching of the soil, as well as comparative freedom from acid humus. The short herbage and firm soil, in spite of its wetness, make it difficult to appropriately apply the term meadow to this type of wet pasture either on the plains or hillsides. It cannot be mown. It grades imperceptibly into dry pasture on similarly poor ground, and differs in little but the presence of glaucous sedges.

Tussock (or Juncus) type of wet pasture.—A third type of wet pasture is that characterised by the presence of taller and deeper-rooting plants, such as Juncus communis, interspersed usually as tufts among a shorter vegetation. These deep rooters are more or less helophytic, but as they penetrate into the subsoil they are indifferent within wide limits as to the height of the water-table, and may thus have associated with them, and occurring as an association between the tufts, surface-rooting plants of widely different character, from semi-aquatic to inhabitants of dry soil.

Occasionally we find a closed association of Juncus and the like. It might therefore be argued that a meadow with tufts of Juncus is merely a transition, or a mixed association, passing over to a closed Juncus association. When we consider the reciprocal relationship of the grass type and Juncus type, it becomes apparent that a combination of the two gives the maximum vegetation on a given area, because they tap different layers of soil and are thus not entirely rivals. Owing to its growth form, Juncus remains in tufts instead of becoming uniformly intermingled, but nevertheless it seems better to regard the whole as a composite association, comparable to a wood with its undergrowth, rather than a mixture of associations. The varying nature of the undergrowth, however, lends difficulty to the description as a single association.

Vegetation of Marsh-Meadow.

The accessory plants vary greatly in the different types of marsh-meadow just described. (1) In the Juncus type they include many plants of wet heath. (2) In "poor marsh meadow" the species are few. Besides the dominating *Agrostis* or *Nardus* and the sub-dominant *Carex panicea* and *C. glauca*, the following are common: Molinia cærulea, Plantago maritima, Trioidia decumbens, Leontodon autumnale, Bellis perennis, Prunella vulgaris, Euphrasia officinalis, Scabiosa succisa, Parnassia palustris, Anagallis tenella, Carex pulicaris, Viola palustris, and orchids. These are mostly prostrate, stunted, or rosette forms, in keeping with the short sward of the association. They may be analysed into plants of poor marsh-meadow and of poor pasture.

(3) In the more luxuriant marsh-meadow there are two types which present a very different aspect—a wetter type, which is usually mowed regularly, and has, in consequence, a *close, regular growth of Glumifloræ*, with few tall herbs; and a drier type, *diversified by many tall plants*, many of them *with showy flowers*.

The important grasses are—Agrostis alba, A. vulgaris, Holcus lanatus, Aira cæspitosa, Anthoxanthum odoratum, Nardus stricta, Cynosurus cristatus. Others are occasionally present—Poa pratensis, Trioidia decumbens, Digraphis arundinacea. The dominant species are *Agrostis alba*, *A. vulgaris*, *Holcus*, or *Nardus*. Sub-dominant are usually sedges *Carex vulgaris*, *C. flava*, and *C. pulicaris*.

Accessory Plants.—Some are fairly characteristic of the formation — Spiræa ulmaria, Angelica sylvestris, Rhinanthus Crista - galli, Senecio aquaticus, Geum rivale, Scabiosa succisa, Achillea ptarmica, A. millefolium, Sagina nodosa. There are also marsh plants—many species of Carex, Juncus articulatus (agg.), J. conglomeratus, Equisetum palustre, Ranunculus flammula, Carduus palustris, Potentilla comarum, etc.: and pasture plants—Trifolium repens, T. pratense, Lathyrus pratensis, Prunella vulgaris, Plantago lanceolata, Primula vulgaris, etc.

The chief mosses are Hypneæ. See examples for further species.

Associations of Marsh-Meadow and Wet Pasture.

The tufted types described are peculiar in their mode of occurrence, but may be described as associations. Elsewhere the grass which usually dominates is some species of

Agrostis. The only other grass that dominates over any considerable area is *Nardus stricta.* It affects the more peaty soils, not, however, extremely wet. *Holcus lanatus* may sometimes dominate, but its dominance does not seem to be of sufficiently definite occurrence to merit rank as an association, nor in growth form is it so divergent from the Agrostis type as Nardus.

We may thus recognise two broad associations, apart from the tussock forms: one, characterised by *Agrostis,* in which *helophytic characters* are the most distinct feature, not properly belonging to meadow; the other, characterised by *Nardus,* in which *oxylophytic characters* take a similar place.

Since both grasses may dominate in other situations than marsh-meadow, the associations here found have their distinguishing character indicated by introducing the word "Carex" into the name.

1. Agrostis-Carex association.
1*a*. C. panicea variety.
2. Nardus-Carex association.
2*a*. C. panicea variety.
3. Aira cæspitosa association.
4. Juncus conglomeratus association.
5. Iris association.

1. *Agrostis-Carex association.*—The dominant grass is one or other species of Agrostis. *Agrostis alba* is more characteristic of the wet soil of this formation than *A. vulgaris,* but the latter also occurs. (The two species appear to grade into one another. I cannot always distinguish them.) *A. alba,* var. *stolonifera,* is very often dominant.

Sedges are usually sub-dominant. In soft wet soil the species is usually *Carex vulgaris*; on firm soil, clayey or peaty, it is characteristically *Carex panicea,* accompanied by *C. glauca.* The first type is allied to "rich marsh" and passes into it, the second to "poor marsh."

These glaucous sedges may occur also in the more luxuriant type of marsh-meadow, but there are other distinguishing features in the vegetation as well which mark out the Agrostis-Carex panicea association as a distinct variety, viz. the shortness of the sward and the absence of tall Dicotyledons as a rule. The central type, on the other hand, may have several storeys of vegetation.

2. *Nardus-Carex association.*—Here also there are the two types "rich" and "poor." In the first case *Carex flava* is perhaps most characteristic; in the second the glaucous sedges, as before.

Perhaps in both cases the soil is more peaty than in the Agrosto-Caricetum, but is never so wet as the latter sometimes is. The tendency is to pass into heath, and this is forecasted even in the moistest conditions in the characteristic abundance of *Scabiosa succisa.*

The *panicea* variety often occurs in tussock form, Nardus dominating on the little hummocks, and the glaucous sedges on ground between them.

3. *Aira cæspitosa association.*—This is one of the tussock forms previously discussed, which may occur as an almost pure association, but more commonly interspersed throughout some other association. The intervening vegetation may vary widely in character, from semi-aquatic, with Menyanthes and the like, to apparently dry pasture. Aira appears, however, to depend on a wet subsoil, and it is a common sight in some districts to see good pasture ground, in need of drainage, becoming worthless through the encroachments of this useless plant. The soil characters of this association place it rather in sub-formation 2, but it scarcely seems worth while detaching it from the allied associations that follow.

4. *Juncus conglomeratus association.* — Juncus resembles Aira cæspitosa in forming tufts, but does not rise into tussocks as the latter sometimes does. Abundance of Juncus tufts is specially characteristic of wet ground which has once been cultivated but allowed to lie fallow for some time—*i.e.* as a retrogressive association. After many years plants of peat moor and moist heath begin to appear, such as Eriophorum angustifolium, Calluna, Erica, etc., but this is rarely allowed to happen.

A Juncus association is also the most frequent in the station described as "wet springy hollows." In this situation it is a natural product.

5. *Iris association.*—Like Juncus conglomeratus, Iris

pseudacorus is also really a marsh plant, but owing to its deep rooting it may invade plains sufficiently high above the water-table for grasses to dominate.

Sub-Formation II.—Neutral Meadow.

Extremely local. What occurs may be regarded as a variety of marsh-meadow without sedges or as neutral pasture. This type is rich in species. See example 10.

Sub-Formation III.—Calcareous Meadow.

This, as mentioned previously, is a special type occurring locally, where there is much shell sand deposited by the wind. The effect of this constant supply of calcium carbonate is to render the soil alkaline. The result is a very marked difference in the marsh vegetation in such areas from that of the ordinary type, the most striking being the practical absence of sedges. The characteristic sedges of the alkaline Fens of England do not occur in Orkney, or they might have been found here, but the soil is evidently not suited for the indigenous species. *Equisetum limosum* is usually the dominant plant, with much *Agrostis alba*, and in passing to drier conditions the grass gradually assumes dominance. At higher levels other grasses appear and many marsh-meadow plants, but still as a rule no sedges. A Poa pratensis association was observed in one fairly dry place, but as a rule the meadow consists of little but *Agrostis alba*—with *Equisetum limosum* as it grades into marsh. To distinguish it we may call this:—

1. *The Agrostis-Equisetum limosum association.* See examples 11 and 12.

FORMATION II.—DRY PASTURE.

Grassland in which the bulk of the soil water is derived from precipitation and not added to by springs or drainage from elsewhere.

The usual aspect of the vegetation is that of an even sward, starred, it may be, with flowers of dicotylous and monocotylous herbs, which do not, however, rise to any great height. The most characteristic are in fact of more or less rosette habit, such as Bellis perennis, Leontodon autumnale, Hypochæris radicata, Ranunculus acris, Plantago lanceolata; or procumbent, as Trifolium repens, Thymus serpyllum, Luzula campestris, Scabiosa succisa.

In fact, in farm-yards where the ground is very much trodden by fowls and other animals, the rosette forms often dominate, especially *Bellis* and *Plantago major*. *Rumex obtusifolius* is also characteristic of such situations.

That this character of the vegetation is in part at least the result of the grazing and treading of animals, and perhaps of exposure to wind, is also shown by the divergent physiognomy exhibited by pasture on steep slopes and by dyke-sides along fields, etc., where these factors operate to a less extent or not at all. There the vegetation is taller, and plants of varying height go to make it up, *e.g.*—

Tall.—Heracleum sphondylium, Anthriscus sylvestris, Angelica sylvestris, Senecio aquaticus, Sonchus oleraceus, Lychnis dioica.

Intermediate.—Plantago lanceolata, Galium verum, Achillea ptarmica, A. millefolium, Leontodon autumnale, Hypochæris radicata, Lathyrus pratensis, Vicia cracca, V. sepium, Trifolium pratense.

Short.—Trifolium repens, Lotus corniculatus, Cerastium triviale, Thymus serpyllum.

In addition to this the taller grasses occur only in such places, *e.g.*—

Avena elatior, Festuca pratensis, Dactylis glomerata, Phleum pratense, Alopecurus pratensis.

These of course are grasses of the cultivated land (fodder or weeds), and it is only as strays that they occur at all outside of it.

Associations.

Sub-formation I.—Heath pasture.

1. Nardus association.
2. Agrostis-Calluna transitional association.
3. Pteris association.
4. Luzula sylvatica association.

Sub-formation II.—Neutral pasture.

1. Cynosurus-Agrostis association.
2. Poa pratensis association.

Sub-formation III.—Sand pasture.
 1. Festuca rubra association.
Sub-formation IV.—Maritime pasture.
 1. Festuca rubra association.

Sub-Formation I.—Heath Pasture.

This type of formation is also termed grass heath, and grouped along with shrub heath, etc., regard being had chiefly for soil character. Laying more stress on the physiognomy of the vegetation, it may be permissible to include it with other grassland.

It is not natural to Orkney. Only through repeated burning of the heather and long-continued pasturing of sheep or cattle has Calluna in a few places given way to Nardus or Agrostis. This has been most completely attained on a steep northern slope where direct sunshine is at a minimum, such as the north slope of Kierfea Hill, Rousay.

A certain geological formation seems also to favour Nardus. A certain section of the Rousay beds, characterised by the formation of terraced hillsides, tends throughout its range in Westray, Rousay, and Evie to bear a heath with sub-dominant Nardus.

At first sight the practical absence of grass heath in Orkney seems remarkable, since most of the Færoes is covered by it. Ostenfeld is inclined to lay more stress on the insular climate than on the geological factor—the basaltic rock—as the cause of the great development of "grass-moor" in the Færoes; but, having regard to the distribution of heath pasture and Calluna heath in the Scottish Highlands, the great importance of the chemical nature of the rocks is apparent. There, as pointed out by Robert Smith, pasture occurs on the rich schists, and heath on poor sandstones, quartzites, etc. The arenaceous and argillaceous sedimentary rocks of the Orkneys bear a somewhat similar relation in chemical constitution to the basalts of the Færoes, as do the two types above to one another.

Ostenfeld's association of Nardus along with Juncus squarrosus and Scirpus cæspitosus as "grass moor" will be discussed further in treating of the "moorlands."

Four associations may be recognised :—

1. Nardus association.
2. Agrostis-Calluna association (transitional).
3. Pteris association.
4. Luzula sylvatica association.

The third and fourth are of scanty occurrence.

1. *Nardus association.*—Occurs usually on dry soil, but, from the stunted growth of accessory plants, not apparently very rich. *Nardus* dominates. Other grasses, such as *Agrostis vulgaris* and *canina*, Aira cæspitosa, A. præcox, and A. flexuosa, Anthoxanthum odoratum, Holcus lanatus, and Trioidia decumbens, occur in varying proportions. *Calluna* is often sub-dominant. *Juncus squarrosus* may be so in places. The accessory plants are those of dry heath—Potentilla tormentilla, Erica cinerea, Empetrum, etc.

2. *Agrostis-Calluna association.*—On richer soils. Also entirely of artificial origin. Dominant, *Agrostis vulgaris*. Other grasses, *Agrostis canina*, Trioidia decumbens, Anthoxanthum, Holcus, Aira flexuosa, A. cæspitosa, etc. etc.

Calluna in vigorous clumps usually, and Erica cinerea also luxuriant. These are kept down by burning periodically. A great variety of heath and pasture plants may be present.

This is a transition to the more widespread *Cynosurus-Agrostis* association of less acid soil, and scarcely merits the rank of association.

3. *Pteris association.*—*Pteris aquilina* is not abundant in Orkney, and as a dominant plant it is rare. Its preference for a sunny southern slope is rather peculiar in view of its frequently sylvan habitat in the South. This association may be seen in Flotta, and mingled with Calluna in several places *e.g.*, Berriedale, Hoy, and Firth parish. What determines its presence I have not endeavoured to find out.

4. *Luzula sylvatica association.*—*Luzula sylvatica* often dominates on steep slopes. Calluna is frequently present : in other cases grasses are associated with the dominant plant.

Sub-Formation II.—Neutral Pasture.

When the agencies so frequently referred to have acted so long or so thoroughly as to banish all peaty character from the soil, heath plants disappear and other species take their place, such as were mentioned in describing dry pasture in general.

Two associations at least may be recognised:—

1. Cynosurus-Agrostis association (the usual one).
2. Poa pratensis association (rich old pasture).

1. *Cynosurus-Agrostis vulgaris association.*—*Cynosurus* and *Agrostis vulgaris* are the dominant grasses in the great bulk of pasture land in the islands. They usually occur together, and in some respects it is a natural coalition, because Cynosurus is as early a grass as is suitable for the late northern springs, while Agrostis is very late and may remain green all winter. This is even more marked in Agrostis alba, which is also prominent, especially in wetter situations. In the better pastures Cynosurus may dominate almost to the extinction of Agrostis, and, on the other hand, is often absent on poorer ground, especially if there is a tendency to the development of raw humus in the soil. But the individual dominance of either is so much rarer than the combination of both in more or less equal quantities, that it is better to regard the common type as a Cynosurus-Agrostis association, especially since the union gives an association with a longer vegetative period and a greater production of material. There may be differences in their food demands also; at any rate their relationship is not one of entire rivalry.

R. C. Gaut, in the "Botanical Survey of a Pasture" (*Naturalist*, 1904), concludes that Cynosurus is characteristic of poor soils. This appears contradictory to the fact that Cynosurus forms most of the best natural pasture in Orkney, but the two conclusions are not irreconcilable. In England, Cynosurus may be driven to the poorer soils by competition of the lustier grasses, Fescues, Foxtail, and Cocksfoot, but in Orkney, owing to climatic causes probably, they do not enter into competition. Meadow Fescue, in fact, grows very poorly even when sown in cultivated land.

Holcus lanatus is usually an important constituent of this association. It tends to grow in patches. It may even *dominate*, but associated with Agrostis rather than Cynosurus.

Anthoxanthum odoratum is frequently a sub-dominant.

Many varieties of the association might be distinguished, for it has a wide range.

One of the commonest forms, characteristic of rather poor pasture, has little or no Cynosurus and an abundance of *Leontodon autumnale*. On wetter ground this *Leontodon variety* contains *C. panicea*, etc., as well, and becomes "poor wet pasture." Rich pasture may, on the other hand, have little Agrostis and Leontodon—the *Cynosurus variety*.

On steep grassy banks the taller and more varied assemblage of plants described previously may usually be regarded as a third variety of the Cynosurus-Agrostis association.

The subordinate plants in this association have been largely enumerated in speaking of the formation as a whole. Others are mentioned in the examples below. On certain soils a thick springy turf of *Hypneæ* obscures the grasses in winter time.

2. *Poa pratensis association.*—In the richest old pasture, which is also sheltered from the biting spring winds, a more southern type of pasture may occur than is usual in Orkney. *Poa pratensis*, being usually abundant, may give its name to the association, but over small areas various grasses may dominate. Lolium perenne, Agrostis, Holcus, and Cynosurus are abundant, as well as Poa, while Alopecurus pratensis and Phleum pratense reproduce themselves naturally in such quarters. Rye-grass, Timothy, and Foxtail are not indigenous in Orkney.

The accessory plants with bright flowers are also different in this association from what is found in the preceding one. *Ranunculus acris* takes the place of *Leontodon*, and, along with Bellis, gives colour to the field.

Trifolium repens is very abundant in this, as in richer forms of the Cynosurus-Agrostis association.

Sub-Formations III. and IV.

"Sand Pasture" and "Maritime Pasture," as already stated, are included in another œcological section.

The Successions.

A study of the successive changes which take place in the conversion of natural formations into grassland, and the relapse of untended grassland, involves too much reference to other formations to be undertaken in this paper.

Examples.

Having personally been much assisted in arriving at a vivid conception of the vegetation of the areas described by the system of illustrative examples adopted by some œcological writers, I follow their example and append a few of actual notes taken on typical sites. The notes are rudely arranged, according to the foregoing scheme of classification.

I.—MEADOWS AND WET PASTURES.

i. *Acid to Neutral.*

1. *Boardhouse Loch, below Twatt.*—Level ground formed through lowering of the level of the loch by deepening the exit. Driest parts: *Agrostis* (2 sp.) dominates. *Anthoxanthum* sub-dominant. Holcus, Nardus, and Cynosurus are present, and *Carex glauca* abundant. Senecio aquaticus, Leontodon autumnale, Rhinanthus Crista-galli and Prunella vulgaris give colour to the meadow, while Ranunculus acris, Spiræa ulmaria, and Orchis maculata would have done so earlier in the season. Also present: Achillea ptarmica, Bellis perennis, Sagina nodosa, Mentha aquatica, Galium uliginosum, Scabiosa succisa, Caltha palustris, Plantago maritima.

A few inches lower, *Carex glauca* dominates and grasses are few.

2. *Another part of the same lochside.*—Soil a clayey deposit 6 inches to 1 foot deep. Considerable organic matter. No reaction to litmus paper. Earthworms present. Sward short and close. *Carex glauca* and *panicea* and *Nardus* dominate. Plantago maritima sub-dominant. Trioidia decumbens, Juncus articulatus, Molinia cærulea in some quantity. Agrostis and other plants occasional. Brightly flowering herbs in order of frequency: *Leontodon autumnale*, Prunella vulgaris, Bellis, Euphrasia, Scabiosa succisa, Anagallis tenella, and Parnassia palustris.

3. *Folster Meadows, Birsay.*—East end was formerly cultivated, but has long lain fallow. Dominant: *Agrostis* (2 *sp.*) and *Aira cæspitosa* in places. In other places *Nardus stricta.* Nardus in drier but perhaps sourer conditions. Spiræa abundant near streams. C. glauca is common; others are C. panicea, C. flava, C. vulgaris, C. pulicaris, and C. dioica. Other plants: Senecio aquaticus, Achillea ptarmica, Leontodon autumnale, Plantago lanceolata, Ranunculus acris, Prunella vulgaris, Luzula campestris, Scabiosa succisa, Rumex acetosa, Juncus conglomeratus, Cnicus palustris, Rhinanthus Crista-galli, Potentilla anserina.

In wetter parts Aira disappears.

4. *Flats below Ingsay, Birsay.*—Whole area on a deep clayey marsh peat. Site of a former loch. Ditched. Parts drained and cultivated.

Uncultivated parts:—

(1) *Meadow of Bea.*—The following rudely in order of frequency: Carex vulgaris, Equisetum palustre, Juncus articulatus, Trifolium repens, Holcus lanatus, Potentilla comarum, Menyanthes infoliata, Hydrocotyle vulgaris, Agrostis alba and vulgaris, Molinia cærulea,

Trioidia decumbens, Festuca ovina, Ranunculus acris, Senecio aquaticus, Triglochin palustre, Pedicularis palustris, Leontodon autumnale, Caltha palustris, Anagallis tenella, Scabiosa succisa, Lychnis flos-cuculi, Prunella vulgaris, Luzula campestris.

(2) Ditches with Glyceria aquatica and Iris.

(3) Tableland of peat with Calluna dominating. Nardus and Agrostis sub-dominant.

(4) South side. Tussocking poor marsh-meadow, with Nardus on tufts. Glaucous sedges and Molinia, etc., between.

5. *Meadow near Orquil, St Ola.*—Ditched. Holcus and Nardus dominate. Carex, chiefly flava. Also C. glauca, Juncus communis, Agrostis, *Trifolium repens*, Juncus squarrosus, Equisetum palustre, Caltha palustris, Cnicus palustris, Pedicularis palustris, Scabiosa succisa, Senecio aquaticus, Leontodon autumnale, Achillea ptarmica, Ranunculus flammula, R. acris, Potentilla anserina, Rhinanthus Crista-galli, Comarum, Spiræa, Lychnis flos-cuculi, Luzula campestris.

Other Carices, Juncus articulatus, etc., appear in the transition to the marshy depressions.

6. *Flotay, Birsay.*—In some parts a lumpy surface, with Nardus on the hummocks. Glaucous association of poor marsh between. Nardus, accompanied by Viola palustris, Prunella, etc.

7. *Hillside south of Finstown.*—The general surface of grassy heath is interrupted by green strips of short cropped pasture running down the hillside. Agrostis apparently dominates (no inflorescences). A large amount of Leontodon autumnale. Sometimes glaucous sedges, but no heath plants. These strips appear to be due to gentle springs giving a moist, non-acid soil.

8. (*a*) *Juncus pastures near Scapa.* — Once cultivated. Drained. Firm, level surface, dry in summer, but may be flooded after heavy rains in winter.

Juncus in tufts, but in places occupies greater part of surface. On firmer ground *spiral variety* of Rush dominates. Between the tufts glaucous sedges may dominate in parts, with a few grasses, Holcus and Cynosurus chiefly. Senecio aquaticus is common and the usual plants of marsh-meadow.

In other places there is a Carex vulgaris marsh between the Juncus tufts.

In others grasses dominate, especially Holcus lanatus and Agrostis stolonifera. There is an undergrowth of Hypnaceæ everywhere.

(*b*) *Permanent pasture on adjoining hillside.*—Juncus tufts extend up wet parts, with intervening Cynosurus or Holcus, etc., dominating.

9. *Wet springy valley in heather moorland, Holm Hills.*

Vegetation.—Wet heathy pasture with much Juncus. No individual plant distinctly dominates over any wide area. *Juncus communis* is most prominent in some places, *Aira cæspitosa* in others, and *Calluna* in others, this only of local occurrence. The following also struggle for supremacy: *Nardus stricta*, *Agrostis alba*, *A. vulgaris*, *Carex pulicaris*, *C. flava.*

Other grasses, especially Holcus lanatus, and other sedges, especially C. glauca, also occur. Present also: Scabiosa, Potentilla tormentilla, Senecio aquaticus, *Trifolium repens*, etc.

A dense undergrowth of *Hypneæ* and locally of Sphagnum.

The Juncus is here fairly evenly distributed and not so tufted as on firmer ground.

10. *Stream-side, Durkadale, Birsay.*—Stream flows in deep channel through valley. Succession of vegetation from stream-side :—

(1) Willows on stream bank.

(2) Strip of dry pasture.

(3) Meadow with tall herbs.
(4) Marsh-meadow.
(5*a*) Marsh.
(6) Plateaux of peat moor resting on marsh.
(5*b*) Strips of marsh at base of surrounding hills.
(7) Hillsides with heath and moor.

The meadow and pasture zone has *Agrostis vulgaris* dominant. Prominent: Cynosurus, Anthoxanthum, Holcus, Agrostis alba. Spiræa abundant.

Accessory: Iris pseudacorus, Rhinanthus Crista-galli, Scabiosa succisa, Juncus articulatus, Leontodon autumnale, Senecio aquaticus, Equisetum palustre, Ranunculus acris, R. flammula, Prunella vulgaris, Plantago lanceolata, Carex leporina, Heracleum sphondylium, Linum catharticum, Lathyrus pratensis, Trifolium repens, T. pratense, Primula vulgaris, Juncus conglomeratus, Rumex acetosa, Alchemilla vulgaris, Carduus palustris.

In wet parts a tussock association of *Aira cæspitosa*, with Spiræa, Juncus, etc. There is often water between the tussocks, with Menyanthes, Comarum, Caltha, etc.

ii. *Calcareous.*

11. *Sanday.*—North Loch. Soil shell sand largely, and in region of blown sand. Marsh, with *Equisetum limosum* and *Agrostis alba*; passes into meadow, with *Agrostis alba* dominating. Ranunculus acris, Trifolium repens, Senecio aquaticus, Rhinanthus Crista-galli, etc., accompanying it, and there are no sedges.

12. *Sandy bottom of drained part of same loch.*—Well drained owing to porosity of soil, but high water-table. *Poa pratensis* dominates. Festuca rubra, Trifolium repens, Rhinanthus, Parnassia palustris, Ranunculus acris, Agrostis alba (may dominate in wetter parts or on clay), Carex vulgaris, C. glauca, Senecio aquaticus, Potentilla anserina, Caltha palustris, Leontodon, Equisetum palustre, Lychnis flos-cuculi, Sagina nodosa.

II. Dry Pastures.

i. *Heathy.*

13. *Grassy hillside south of Finstown.*—Heather kept down by burning. Much grazed over. *Agrostis vulgaris* and *A. canina* dominate. Trioidia decumbens and Anthoxanthum odoratum occur, and in places Nardus. Calluna and Erica cinerea in vigorous clumps. Great variety of heath, pasture, and meadow plants, *e.g.* Willows, Pteris, Spiræa, Scabiosa, Primula.

14. *Rousay, steep northern slope of Kierfea Hill.*—Much of it is grassy. *Nardus and Agrostis* dominate, with tufts of *Aira cæspitosa* and an intermingling of heath plants, such as Empetrum and Calluna.

ii. *Intermediate.*

15. *Field at Berstane near Kirkwall.*—High and exposed. Fallow for many years, and tending to become heathy in places.

Cynosurus is more conspicuous than Agrostis, owing to the smaller inflorescence of the latter, which, however, is more numerous. The following table gives the number of inflorescences of the chief grasses in several small representative areas of about a square yard in extent.

	I.	II.	III.	IV.	V.	VI.	VII.	Total.
Cynosurus . . .	16	24	60	0	100	10	6	216
Agrostis . . .	40	40	16	0	0	29	100	225
Holcus	6	2	8	0	12	1	3	40
Anthoxanthum . .	20	14	20	0	0	0	60	114
Festuca ovina (vivip.) .	5	0	0	0	0	0	0	5

This shows how uneven the distribution of the various species is.

Other plants: Bellis perennis (very numerous locally), Leontodon autumnale, Euphrasia officinalis (agg.), Trifolium repens (local), Aira præcox, Calluna vulgaris, Sagina procumbens, Luzula pratensis, Plantago lanceolata, Prunella vulgaris, Hypochæris radicata, Potentilla tormentilla, Pedicularis sylvatica, Rhinanthus Crista-galli, Rumex acetosella, Gnaphalium sylvaticum, Lotus corniculatus, Thymus serpyllum.

It will be seen that there are many heath plants.

Agrostis vulgaris, var. pumila, infested by smut, is very characteristic and common on this type of pasture.

iii. *Neutral.*

16. *Steep grassy slopes near Scapa pier.*—Red sandstone.

In places Holcus lanatus dominant, with tufts of Aira cæspitosa.

In other places Cynosurus-Agrostis association.

Both species of Agrostis are present, and also Anthoxanthum, Trioidia decumbens, Poa pratensis, and Arrenathrum in small quantity. Other plants: Plantago lanceolata, P. maritima, Lathyrus pratensis, Angelica sylvestris, Spiræa ulmaria, Trifolium pratense, Primula vulgaris, Senecio aquaticus, Cnicus palustris, Scabiosa succisa, Trifolium repens, Lotus corniculatus, Thymus serpyllum, Erica cinerea, Anthyllis vulneraria, Linum catharticum, Calluna vulgaris, Hypericum pulchrum, Rhinanthus Crista-galli, Polygala vulgaris, Viola sylvatica, Carex glauca.

17. (*a*) *Walled fields near Kirkwall.*—Moist natural pasture.

Poa pratensis dominant, with Agrostis, Cynosurus, Lolium, Phleum, Alopecurus, Holcus, etc. Ranunculus acris and Bellis abundant. Trifolium repens often dominant.

(*b*) Ground much trodden by hens. Bellis perennis and Plantago major are dominant. Rumex obtusifolius also present.

Examples would have to be greatly multiplied to illustrate the diversity of neutral pasture or to add to the general description of dry pasture given above.

The Flora of the Fenland, as Compared with that of the Bogs, Marshes, and Mosses of Scotland. By Arthur H. Evans, M.A.

In spite of the extirpation of certain plants by long-continued drainage, the Fenland still remains a district of much interest to British botanists, as it was to Ray and others of the olden time; for there, in a comparatively small area, are to be found a large number of species, of which some are almost restricted to it, and some do not occur elsewhere.

The Fens proper may be taken to coincide roughly with what is termed, from its scheme of drainage, the Bedford Level, and cover a large extent of flat country reaching from near St Ives in the west to the confines of Norfolk and Suffolk on the east, and from Wisbech and Peterborough on the north to within a few miles of Cambridge on the south. The Nene, the Ouse, and the Cam are the main rivers that traverse it, but the two artificial cuts, called the Old and the New Bedford Rivers, now convey most of the waters of the Ouse in a straighter course from Earith Bridge to Denver Sluice. There are also numerous wide "dikes" or "lodes," as they are locally called, with smaller cross-channels, into which the surface waters are effectually drained by means of powerful pumping engines.

Peat, lying above gault or other clayey deposits, is characteristic of the greater part of this area, but in the northern part, from Wisbech to the south of March, the soil is chiefly of the nature of silt, a fact which must be considered in connexion with the proximity of the Wash and the former course of the river Nene. Islands of clay and greensand are prominent landmarks in various places, by far the largest being the well-known "Isle of Ely." The Kimmeridge or the Oxford clay found there must not, however, be confounded with the glacial or boulder clay which tops many of the eminences surrounding the Fens, where an entirely different flora occurs, especially noted for the true Oxlip.

Fen peat is very different in appearance and composition from that of Scottish moors and mosses, being of a black rather than of a brownish colour, and showing a decided alkaline instead of an acid reaction, while it burns with a somewhat unpleasant and by no means aromatic smell. It is composed of sedges (*Cladium* and *Carex*), reeds, grasses, hypnum, and various other plants, instead of heather, sphagnum, and the like, as in the north.[1]

Whittlesey, Ramsey, Soham, and other more ancient meres have long been drained; and the only considerable piece of true fen is that adjacent to the village of Wicken, between Cambridge and Ely. A disconnected "valley fen" lies close to the village of Chippenham, and small patches of a similar nature are still to be seen at the Firelots near March, at Soham, Quy, Sawston, and elsewhere; while Woodwalton Fen in Huntingdonshire ought perhaps to be mentioned, though it can hardly be considered to fall within our limits. Almost all the Fenland proper is in Cambridgeshire, and, unless otherwise stated, all the subsequent paragraphs refer to Wicken Fen, still in a state of nature, and extending over an area of more than a square mile.[2]

A Fen in Cambridgeshire still means, as of old, a sedge-fen; and the general aspect of Wicken Fen is that of a fairly uniform crop of brownish sedge, some three feet high, now studded with, and in parts choked by, bushes or clumps of Willow (*Salix cinerea*), the Common and Alder Buckthorns (*Rhamnus catharticus* and *R. Frangula*), Guelder Rose (*Viburnum Opulus*), and Hawthorn. The sedge proper of the Fens—and also of the Broads of Norfolk—is *Cladium Mariscus*, said to be called the "mother sedge," though this does not appear to be a Cambridgeshire name. The wide channels of Burwell Lode and Wicken Lode bound the Fen on two sides, with smaller lodes in the other directions and cross-dikes between them. The chief waterways are continually cleaned out, and produce little of interest to the botanist except species of *Potamogeton* and *Nitella*; but

[1] My friend Dr. C. E. Moss, who has been analysing the peat, tells me that there is much more ash in that of the Fens than in that of the north, and that the former contains a great amount of mineral salts, of calcium, potassium, and sodium.

[2] Strictly speaking, the Fens encroach slightly on nearly all the surrounding counties, while the south of Lincolnshire consists largely of fenland. The latter, however, is hardly reckoned as part of the Fenland proper in modern parlance, probably as not being included in the same system of drainage as the Bedford Level.

the connecting dikes and ditches are very rich in plants, such as *Sium latifolium, Hottonia, Alisma, Sagittaria, Hydrocharis*, the great Water Dock (*Rumex Hydrolapathum*), and the rarer Flowering Rush (*Butomus umbellatus*), together with masses of Water-lilies in places, while the great enemy of all such species is the Common Reed, which is apt to overgrow them periodically and would finally smother them if not removed.

In the ditches of the North we should expect to find quite a different set of water-plants. The place of *Sagittaria* and *Hydrocharis* is taken by *Alisma Plantago*, *Rumex Hydrolapathum* is rare and has *R. domesticus* (=*aquaticus*) for a substitute, *Butomus* is almost unknown; though Water-lilies and Irises are common enough, and in the drier ditches *Sium angustifolium* represents *S. latifolium* of the Fens.

The sedge-fen itself furnishes a great variety of plant-life. In ancient times, before the mouths of the rivers were silted up to the extent of blocking the drainage of the country inland, we know that the land was more or less afforested, as oaks and other trees are dug up in the heart of the Fens, which were rooted in the tenacious soil upon which the peat was subsequently deposited. Now Willows and seedling Birches are alone in evidence, if we except the strips of Poplars planted for shelter in the cultivated land, and the various kinds of trees near the villages. As we walk up the green droves which intersect the Fen at Wicken, we have on all sides of us acres of *Cladium*, generally flowerless on the comparatively dry portions, but flowering freely in the little water-channels and ditches. Mixed with this is a large quantity of *Calamagrostis epigejos* and *C. lanceolata*, which show up more particularly where the growth has been lately cut for litter. Here, too, the main grass of the Fen, *Molinia cærulea*, has a better chance of shooting up, and our characteristic rush, *Juncus obtusiflorus*, masses itself round every water-hole or disused peat-digging. A striking feature of the ditch-sides is *Carex elata* (=*stricta*), with its peculiar tufted growth, while every here and there among the vegetation, where the reeds and bushes have not encroached, we find the Marsh Pea (*Lathyrus palustris*), the Fen Violet (*Viola* *stagnina*), the Marsh Fern (*Lastrea Thelypteris*), and the Milk Parsley (*Peucedanum palustre*) on which the fine Swallow-tail butterfly feeds. Even Wicken Fen shows a tendency to dry up, though there has been very little perceptible change during the last thirty years, as the pumping-engines keep the water at about the same level; we cannot, anyhow, shut our eyes to the fact that plants of the dry land, such as *Convolvulus sepium* and *Solanum Dulcamara*, have entered the Fen from the enclosing banks and are doubtless signs of what may happen in the time to come. In the more open spaces *Ophioglossum* is not uncommon, and *Epipactis palustris* still occurs rarely, though *Menyanthes* and *Myrica* are almost wanting; on the other hand, *Valeriana dioica*, *Carduus pratensis*, *Lysimachia vulgaris*, *Lychnis Flos-cuculi*, *Orchis incarnata* and *Hydrocotyle vulgaris* are plentiful enough, as are many other species of the more ordinary marsh plants.

In Scotland the vegetation of a corresponding area cannot be so simply defined. Lowland bogs, often enclosing a piece of water, are in striking contrast with the "mosses" and "flows" of the moorlands, while swampy land on the sides of streams occurs at all kinds of elevations. Thus there is not the same uniformity of plant-life as in the Fens, which lie at or even below the level of the North Sea. A Cranberry "moss," for instance, bears little resemblance to an alpine swamp or a marshy loch-side, and all these differ widely in their characteristic flora. Yet in the limited space at our disposal we may hope to point out some important differences between the Fens and Scotland in general.

Cladium is a rare west-coast plant in Scotland, where its place is practically taken by *Carex acutiformis* (= *paludosa*) at the water-sides. The latter is not uncommon in Cambridgeshire, but *C. riparia* is much more abundant, especially near the Fen. In the whole Level *C. inflata* (= *ampullacea*) is a rare plant, while it is plentiful in the North, and becomes even more so as we ascend the hills. North and South furnish plenty of *Carex flacca* (= *glauca*), *C. panicea*, *C. fulva*, *C. flava*, and other common sedges, but the forms of *C. Goodenovii* (= *vulgaris*) are as scarce in our alkaline soil as they are common in the more acid deposits to the north of the Border, and are almost entirely replaced by *C. elata* (=*stricta*). We have no *Carex pauciflora*, *C. dioica*, *C. canescens* (=*curta*), or *C. limosa*, and very little *C. echinata* (=*stellulata*) or *C. paniculata*, though in Wicken Fen *C. paradoxa* replaces the last-named. Again, *C. disticha* and *C. lasiocarpa* (=*filiformis*) are abundant there in places, while they are decidedly local in Scotland. We have not so much as a spike of *Narthecium ossifragum*: but we can show a considerable amount of *Schœnus nigricans*, which, however, is most common at Chippenham.

As regards the Grasses, the Fens show less variety than many a Scottish moor. *Molinia cærulea*, which is our staple grass, may be equally common in both places; but we have little besides except *Agrostis vulgaris*, *A. alba*, and the two above-mentioned species of *Calamagrostis*, of which both are very rare north of the Border. *Glyceria fluitans* of the ditches is a more or less universal species, and *Glyceria aquatica* is abundant near the Fens, but is not a true fen grass.

Rushes form a large part of the vegetation of a fen, but, except on the dry banks, the only, or almost the only, species to be met with is *Juncus obtusiflorus*, where in Scotland we should find *J. acutiflorus*. *J. squarrosus*, so common on the Northern moors, is entirely absent: and even on the outskirts of the Fenland *J. glaucus*, which is comparatively scarce in Scotland, takes the place in almost every case of *J. communis*.

North and South agree in the fact that Willows and Alders are the usual concomitants of marshy spots; but the species of the former are not necessarily the same. Where *Salix alba*, *S. fragilis*, *S. pentandra*, *S. caprea*, *S. aurita*, and the alpine Willows are to be found, according to altitude, in Scotland, Wicken Fen possesses only *S. cinerea* and *S. repens*, though these are, of course, also Northern forms. The two Buckthorns, so abundant in the Fen, are hardly worth consideration in the North, where only *Rhamnus Frangula* occurs, and then but rarely. Hawthorns are becoming more and more abundant in the Fens, but they do not invade the moors or mosses of Scotland, nor, to any great extent, the low-lying marshes.

Coming to the more lowly vegetation, a striking feature of the Bedford Level is the total absence of heather or ling, which cover so many acres both of dry and wet moorland elsewhere. This may be due to the alkaline character of the soil, which probably also precludes the growth of the Cranberry (*Vaccinium Oxycoccos*) and the Bog Orchis (*Malaxis paludosa*), while permitting that of the corresponding Fen Orchis (*Liparis Loeselii*). To a similar cause we may assign the great rarity of Sphagnum, only found in minute quantity at Chippenham, while it is represented in the Level generally by a low-growing form of Hypnum.

It will be seen from what has been already said that Scotland can show a much greater variety of plant-life in general in her moors and marshes than can the Fenland, though Wicken Fen itself is richer than any one spot that we are able to name in the North. It will be well, therefore, to conclude this paper by mentioning some well-known plants, without which an account of the Fenland can hardly be considered complete.

The most notable are doubtless the two extinct Groundsels, *Senecio paludosus* and *S. palustris*, of which the former still grew at Wicken in the middle of last century. *Sonchus palustris*, generally coupled with them, and fortunately still existing in Oxfordshire and Kent, is a marsh rather than a fen plant, and may possibly be a survivor of ancient woodland country. *Selinum carvifolium*, first discovered as a British plant at Chippenham and undoubtedly native there, has only since been reported from Horncastle in Lincolnshire. *Limnanthemum peltatum* is extremely abundant in some of the water-courses, especially in the West or Old Ouse and the Bedford Rivers. *Stratiotes aloides* almost fills some of the pits and invades the neighbouring channels, while *Teucrium Scordium* still exists in a few places, though apt to disappear suddenly in a somewhat curious manner.

None of these are native Scottish plants. But we may make many comparisons in other cases. For instance, the Marsh Pea (*Lathyrus palustris*) is plentiful at Wicken, and the Fen Violet (*Viola stagnina*) not uncommon there and at Woodwalton; but *Lathyrus macrorhizus* and *Viola palustris* are absolutely unknown throughout the Bedford Level. We have already mentioned *Liparis* as representing

Malaxis, and *Sium latifolium* as being our most striking Umbellifer, but we might point to *Cicuta virosa* as an equivalent to the latter in the Borderland marshes, to *Malachium aquaticum* as taking the place with us of *Stellaria nemorum*, and *Veronica anagallis* of *V. Beccabunga*. *Cardamine amara* is a woodland plant to a great extent in the North; with us it occurs in the Fen willow-holts: but once more it behoves us to remember that the fen country was once well-wooded. We have *Utricularia vulgaris* and *U. minor* in some quantity, but no *U. intermedia*: we have *Parnassia* but little *Pinguicula* or *Drosera*, *Hippuris* is plentiful and is apt to take the place of *Equisetum*, while we have no *E. sylvaticum* or *E. hyemale* at all. *Myrica Gale* cannot be relied upon as an instance, as, though now almost extinct, it is said to have once been plentiful in the Fens: but the genus *Eriophorum* is certainly conspicuous by its absence at the present day, and was apparently always rare with us. *Lastrea Thelypteris* is, moreover, the only Fern of the Level, and in these two cases we again note a great difference from the marshes of Scotland.

The genus *Potamogeton* provides many interesting forms for the botanist to study, and has been ably worked out of late years by Mr. Alfred Fryer of Chatteris, who lives in the midst of the Fen country. We lack many of the Scottish species, notably *P. alpinus* (=*rufescens*) and *P. polygonifolius*—the place of which is entirely taken by *P. coloratus* (=*plantagineus*),—but we are rich in forms of *P. Zizii*, *P. heterophyllus*, and so forth, while *P. Billupsii*, *P. falcatus*, and *P. crassifolius* have been determined as new species by Mr. Fryer, and *P. fluitans*, *P. decipiens*, and *P. lanceolatus* are only known from a few other counties.

In conclusion, we may mention the effect of salt water in the Fen area, which extends far above the actual influence of the tide. This is shown by the presence of *Scirpus maritimus* at Upware, south of Ely, and at Sutton, on the washes of the Bedford Rivers; while *Juncus Gerardi* has been found in the latter district, and a form of *J. compressus*, possibly derived from the same stock, accompanies *Carex distans* in a field where sea-shells are commonly met with, at Waterbeach near Cambridge.

REPORT OF THE SCOTTISH ALPINE BOTANICAL CLUB, 1910. By ALEXANDER COWAN, Esq.

The Club met at the Spittal of Glenshee Hotel on July 11th, as the members were unable to find sufficient accommodation at the hotel at Clova, where it was originally proposed to hold the meeting.

The district is reached after leaving the railway at Blairgowrie by the road leading north up Glenshee, and it continues after leaving the hotel over the Devil's Elbow on the Cairnwell on to Braemar.

Leave having been very kindly granted to the President of the Club by the representatives of the proprietors, a large extent of very interesting ground was visited, where large quantities of deer were seen; but though a good number of plants were gathered, the members were unfortunate in not finding *Lychnis alpina*, which is known to grow in this district.

The weather during the week was extremely hot and dry; indeed, it was too dry for botanising or walking with any comfort, as there was practically no breeze at all, and the sun was so hot as to be quite oppressive.

On Tuesday, July 12th, the members motored about five miles up the road to within a short distance of the Devil's Elbow, from which point they commenced a long climb and tiring walk in order to visit the rocks at Caenlochan, where the following plants were found:—*Allosorus crispus*, *Alopecurus alpinus*, *Asplenium viride*, *Botrichium lunaria*, *Cerastium alpinum*, *Chrysosplenium alternifolium*, *Cochlearia alpina*, *Carex atrata*, *C. aquatilis*, *C. capillaris*, *C. curta*, *C. dioica*, *C. panicea*, *C. pulicaris*, *C. rariflora*, *C. rigida*, *C. stellulata*, *Draba incana*, *Dryas octopetala*, *Epilobium alpinum*, *Erigeron alpinum*, *Gallium boreale*, *Habenaria viridis*, *Helianthemum vulgare*, *Juncus triglumis*, *Lastrea propinqua*, *Loiseluria procumbens*, *Lysimachia nemorum*, *Lactuca alpinum*, *Parnassia palustris*, *Phleum alpinum*, *Poa alpina*, *Polystichum aculeatum*, *P. lonchitis*, *Potentilla Crantzii*, *Pseudathyrium alpestre*, *Pseud-athyrium* variety *flexile*, *Pyrola minor*, *Rhinanthus Crista-galli*, *Rubus saxatilis*, *Salix* *herbacea*, *S. reticulata*, *Sausuria alpina*, *Saxifraga hypnoides*, *S. nivalis*, *S. oppositifolia*, *S. stellaris*, *Silene acualis*, *Solidago virgaurea*, *Splachnum vasculosum*, *Thlaspe alpestre*, *Tofieldia palustris*, *Trientalis europæa*, *Trollius europæus*, *Vaccinium uliginosum*, *Veronica alpina*, *V. Saxatilis*. It will be noted that a very rare moss, *Splachnum vasculosum*, was gathered, having been found by the President to be still fairly abundant on a station where he had found it on a previous visit many years before.

The members had a long walk back to the road where they had left the motor in the morning, and they were all thoroughly tired after such a hard and fatiguing day.

On July 13th, some of the older members of the party, who were feeling the effects of their exertions on the previous day, decided to take things easily, and having motored about four miles up the valley, hunted among the ferns, of which thousands, principally *Lastrea montana* and *propinqua* were growing on the sides of the small burns on the eastern slopes of Carn Mor. One of the members was lucky enough to find a very curious crispy form of the former fern; the pinnæ being all crisped and congested so that the plant was easily distinguishable when seen growing alongside the normal form.

Two members of the party who were anxious to find *Lychnis alpina* tried to discover the station where members had found the plant when on a previous visit to Clova, but in this they were unsuccessful. Their efforts were much hampered by the presence of several hundred deer, and many of the stags appeared to resent the intrusion, so much so that it was thought advisable not to further disturb them. In addition to many of the plants found on the previous day, *Cornus seusica* and *Gentiana campestris* were gathered. The day was even hotter and more oppressive than the previous one had been.

On July 14th the members motored over Devil's Elbow towards Braemar, turning up the rough road leading to Glen Callater and Corrie Cander. In Loch Cander was found *Callitriche intermedia*, Hoffm., *Isoetes lacustris*, and *Triglochin palustre*. *Carex atrata*, *C. curta*, *C. pulicaris* and *Juncus trifidus* were also found during the day. In the Corrie was a large patch of snow, and in its immediate neighbourhood vegetation was only just commencing. Large quantities of *Pseud-athyrium alpestre* were seen, and though most of it was much disfigured through being eaten down by the deer, a few interesting sub-varieties were found, which it is hoped will remain permanent under cultivation.

The heat of the sun may be judged by the fact that two of the members of the party bathed twice during the day in Loch Cander. Two other members who did not accompany the party to Glen Callater, found *Gentiana campestris* in the Glen near the hotel.

On July 15th, the only member of the party remaining spent the day among the ferns growing on the burn sides in the valley to the north of the hotel. Here he found a dwarf erect-growing variety of *Lastrea montana* with short pinnæ, similar plants of which have already been found on two previous occasions in Westmoreland, and which is known to fern growers by the name of *angustata*. Several large clumps of it were seen on the side of a burn within a space of about fifty yards. This variety keeps perfectly permanent in cultivation, and is a most interesting sport from the normal type of the fern.

Though nothing very wonderful in regard to plants was found, the meeting will always remain memorable to the members present owing to the wonderful weather experienced, for although they have frequently had their pleasure spoilt and their botanising interfered with by rain and mist, it was quite a new experience, to most of them at all events, to have their work on the hills rendered almost unbearable owing to the extreme heat.

A New Leycesteria. By W. W. Smith.

Leycesteria Belliana, W. W. Smith, sp. nov.

Species *Leycesteria sinensis* Hems. valde affinis sed cum specimine unico ejus speciei (Henry 9692 c) in Herbario Kewensi non quadrat. Ad hoc confer Hook. Icones Plantarum, tab. 2633. Foliis stipulatis, petiolis brevissimis dense strigosis, inflorescentia brevispicata, calycis limbo

5-partito, stylo piloso ab ea specie satis distinguenda. A *Leycesteria stipulata* (Hook. f. & T.) Fritsch, habitu gracili, caule fistuloso glabrescente, stylo piloso inter alia differt.

Frutex ramosus paucipedalis, ramulis ± albo-pilosulis, mox glabrescentibus, teretibus, fistulosis ad nodos septatis. *Folia* opposita breviter petiolata, membranacea, lanceolata, 5–10 cm. longa, 1·25–4 cm. lata, acute caudato-acuminata, basi rotundata vel aliquantulum cordata, suprà subglabra vel parce strigillosa, subtus glauca, præcipue in venis ± rufescenti-strigillosa, margine obscure sinuata, rarius ciliolata, venis primariis 5–7 paribus: petiolus 1–3 mm. longus, dense strigosus; stipulæ parvæ ad 5 mm. longæ, ad 3 mm. latæ, rotundato-ovatæ, sæpe perpusillæ. *Floris* luteo-albidi 2 cm. longi, sessilis, in spicas 2-vel 4-florigeras brevissimas ramulos laterales terminantes per paria dispositi pedunculis brevissimis; bracteæ bracteolæque plures foliaceæ rotundato-ovatæ vel lanceolatæ, floribus breviores. *Calycis* dense glanduloso-pilosi tubus 5 mm. longus fusiformis; limbus fere ad imum in lobos quinque æquales, rarius subæquales, lineari-lanceolatos, acutos, 5 mm. longos, persistentes divisus. *Corolla* 15 mm. longa, subæqualiter 5-loba, hypocrateriformis, fere recta, extus glanduloso-pilosa, intus glabra, nisi infra mediam partem quā filamenta cum tubo conjuncta, lobis rotundatis 3–4 mm. longis. *Stamina* brevissime exserta summo triente glabro parte cohærente villosula. *Ovarium* 5-loculare multiovulatum stylo stamina paulo superante filiformi, summo triente glabro, reliqua parte dense glanduloso-pilosa, stigmate capitato. *Fructus* immaturus angularis albidis glanduligeris capillis dense vestitus; semina vix matura ·75 mm. longa, irregulariter ovoidea, subcompressa, minute punctulata, albida, nitentia.

Sikkim:—in monte Tonglo, 10,000 ped. alt., prope fines nepalenses 154 *Herb. Sikkimense T. Anderson* coll. anno 1862; inter montes pluviosos prope hospitium Karponang dictum, ad 9–10,000 ped. alt. 2996 *Smithi*. Typi in herbariis Kewensi et Edinburgensi et Calcuttensi conservati.

This species is rare in the Sikkim hills, and ranges higher than *Leycesteria stipulata*. The specific name is in honour of Mr A. C. Bell, I.C.S., British Resident in Sikkim, who has made botanical collections in Chumbi and elsewhere. It

Del. K P Dass

LEYCESTERIA BELLIANA, W.W. Sm.

ought to grow as well as *Leycesteria formosa* in European gardens, but, so far, seeds have not been available. I am indebted to Mr W. G. Craib, of Kew Herbarium, for kindly comparing the plant with Henry's Yunnan specimen.

BORTHWICKIA, A NEW GENUS OF CAPPARIDACEÆ.
By W. W. SMITH.

Borthwickia genus novum.

Apud *Capparidoideas-Capparideas* (Pax); maturo fructu adhuc deficiente locus dubius, interim post. *Ritchieam R. Br.* positum est sed etsi frutex, ex affinitate *Polanisiæ* esse videtur. *Frutex* foliis oppositis trifoliatis; *petala* sex æqualia in latissimum unguem et laminam minorem discreta; *stamina* in androphori brevis crassi apice inserta; *fructus* longe stipitatus 4–6 locularis. Species unica burmanica. Generis nomen honori cl. Alberti Borthwickii scientiæ doctoris et viri re botanica eruditi.

Borthwickia trifoliata, W. W. Smith, sp. nov.

Planta inermis, altitudine ignota, superior pars in scheda 40 cm. longa. *Caulis* angulatus, striatus, subcompressus præsertim apud nodos ad 10 cm. remotos, parce minute puberulus, mox glabrescens, racemo terminatus. *Folia* opposita, rarius subopposita, usque ad 8 cm. petiolata, foliolis tribus lanceolatis acuminatis, basi cuneatis, 7–15 cm. longis, 2–6 cm. latis, 1–2 mm. petiolulatis, supra glabris, infra in nervis (6–9 paribus) nervulisque rufo-pilosulis. *Flores* in terminalem racemum densum, in fructu ad 10 cm. auctum, compositi. *Bracteæ* 1 cm. longæ filiformes pilosulæ. *Pedicelli* 5 mm. longi, rufo-pilosuli, in fructu ad 15 mm. aucti. *Sepala* duo; neque in aperto flore neque in gemma aliorum interiorum sepalium vestigia vidi; 13–14 mm. longa, 5–6 mm. lata, oblonga, obtusa, valvata, in aperto flore ad basim discreta, serius decidua. *Petala* sex, æqualia, 1-seriata (ideoque duo ut interiora sepala non habenda), valvata, divisa in unguem loriformem, 5 mm. longum, 1·5 mm. latum, villosulum, et in laminam, 3 mm. longam, 1·5 mm. latam, ovatam, glabram, obtusam, minute dentatam, 6–8 nervatam. *Stamina* in apice androphori 4–5 mm.

longi inserta, 40–50, 14–16 mm. longa, omnia fertilia, libera, æqualia, filamentis filiformibus, antheris ovalibus, nec oblongis, dorso basi affixis. *Ovarium* longe stipitatum 4–6 costatum, stigmate sessili, glabrum, 7–8 mm. longum, 4–6 loculare. *Fructus* immaturus ad 4–5 cm. elongatus, 2–3 mm. latus, carnosulus, seminibus haud multis, multum compressis, reniformibus, 3 mm. longis, gynophoro ad 2–3 cm. aucto.

Burma:—Ad vicum Loi-mwe dictum apud pagos shanenses australes. circ. 1500 ped. alt. 714, 1325, R. W. MacGregor. Typi in herbario Calcuttensi conservati.

DESCRIPTION OF PLATE.

Figure A. Branch with inflorescence. × 1.
,, B. Flower dissected. × 2.
,, C. Petal. × 4.
,, D. Section or ovary; seed. × 2.

PHÆOTHAMNION CONFERVICOLUM, LAGERHEIM, AND ITS FIRST RECORDED APPEARANCE IN GREAT BRITAIN.* By F. L. M'KEEVER, F.R.M.S.

The large class of Algæ, the Phæophyceæ or Fucoideæ (in older books usually called Melanosporeæ), are almost entirely inhabitants of the sea, and only a few families of the order Syngeneticæ are found in fresh water. G. S. West (1) enumerates seven families of this order, and of these only four are represented in Great Britain. I was fortunate enough to find the only member of the fifth family, the Phæothamniaceæ, among other Algæ collected from the Elf Loch on the Braid Hills near Edinburgh, and a few remarks on this plant might be of some interest.

Phæothamnion confervicolum was first described by the Swedish botanist G. Lagerheim, who published his description, together with a very complete life-history, in 1884 (2). He had found this Alga in several localities in Sweden as an epiphyte on various filamentous Chlorophyceæ, and as

* "Annals of Scottish Natural History," No. 77, January 1911.

Del. A. N. Banerjee.

BORTHWICKIA TRIFOLIATA W. W. Smith

the brown chromatophore distinguishes it at once from all other known freshwater Algæ, he established the new genus Phæothamnion. He suggests, however, to create a subfamily, Phæothamnieæ of the Chætophoraceæ (Harv.) Wittr., the latter being a family of the Chlorophyceæ or Green Algæ.

The description of this Alga given by Lagerheim (2) is as follows:—

"Thallus confervoideus (non mucosus) monopodialiter ramosus, ramis superioribus suberectis, ramis inferioribus patentibus, algis majoribus adnatus. Cellulæ vegetativæ cylindricæ vel subclavatæ vel ovoideæ; cellulæ terminales obtusæ vel acutatæ, nunquam piliferæ; cellula basalis subhemisphærica, basi in disculum dilatata; membrana cellularum tenuis et hyalina, septis incrassatis; chromatophoræ laminæformes, parietales, fusco-virides vel olivaceæ (colore orto e chlorophyllo cum phycoxanthino mixto). Zoosporangia intercalaria e cellulis vegetativis orta, eadem forma ac cellulæ vegetativæ. Zoosporæ binæ, bipartitione contenti zoosporangii ortæ, olivaceo-virides, puncto rubro nullo, ciliis vibratoriis binis in fine anteriore zoosporæ positis præditæ, per ostiolum poriforme zoosporangii examinantes, sine conjugatione germinantes. Cellulæ vegetativæ (membrana in mucum gelatinosum mutata) bipartitione succedanea in statum palmellaceum transeuntes."

The dimensions given by Lagerheim are as follows:—

Long. cell. veg. 6–10μ ; lat. cell. veg. 4–8μ.
„ „ apic. 6–12μ ; „ „ apic. 4–6μ.
„ „ bas. 5–6μ ; „ „ bas. 9μ.
„ zoosporang. 6–10μ ; „ zoosporang. 5–8μ.
Diam. orif. zoosporang. 3μ ; diam. zoosporang. 4–5μ.
„ cell palmell. 4μ.
Total height of plant up to 100μ.

Twenty-one figures on one plate were also published in Lagerheim's paper (2).

The plant was distributed in Wittrock and Nordstedt's "Algæ aquæ dulcis exsiccatæ," fasc. 13, No. 608.

Two years later this Algæ was described by A. Hansgirg in the first volume of his "Algaflora of Bohemia" (3), and he placed the family Phæothamnieæ under the order Syngeneticæ of the Phæophyceæ or Brown Algæ. Hansgirg's description and sketch enabled me to identify the Alga I had found as an epiphyte on aquatic phanerogams in the Elf Loch, especially as it was easily distinguishable from all the other freshwater Algæ by its brown chromatophore. Professor G. S. West of Birmingham, to whom I sent some living specimens of Phæothamnion, confirmed my identification. He had already pointed out in 1904 (1) that this Alga would be found one of these days in Great Britain, and, as nearly all freshwater algæ are cosmopolitan, it is not surprising that it should be discovered in this country also. As far as I can ascertain, it was recorded after 1886, the date of Hansgirg's publication, from the following localities :—

1888. G. Lagerheim (5): Sphagnum near Halensee, and on Cladophora from Tempelhof, both places near Berlin; on Vaucheria in the Botanical Gardens of Würzburg, Bavaria, and also from Freiburg in the grand-duchy of Baden.

1892. Borzì (6) in Sicily, near Messina.

1892. A. Hansgirg (4), in the second volume of his "Alga-flora of Bohemia."

I could not find any other record of Phæothamnion except one in 1905, published again by A. Hansirg in his "Alga-flora of Lower Austria" (7). The only other investigation regarding the life-history of Phæothamnion confervicolum, besides that given by G. Lagerheim in 1884 (2), was published by Borzì of Italy in 1892 (6). There are several important points in which Borzì differs from Lagerheim, such as the position of the zoospores and the presence of a red pigment spot. Lagerheim reports bi-ciliated asexual zoospores only, without a pigment spot, while Borzì has observed gametes and a red eye spot as is usually found in the zoospores of the higher forms of Algæ. Lagerheim distinctly states that the two cilia of equal length are inserted in the anterior part of the zoospores, and Borzì describes the cilia to be directed laterally as observed among the Phæophyceæ. It would therefore be desirable to re-investigate the motile stages of Phæothamnion, as the position of the cilia is of considerable importance for the systematist.

I first observed this Alga in its younger stages growing on the rootlets of Lemna minor and the leaves of some aquatic phanerogams, but it grew later on in great profusion together with Coleochæte scutata, Bréb., on the sides of the glass vessel in which I preserved various species of Algæ collected from the Elf Loch. Although kept in cultivation for over two months during August and September 1910, I could only observe the vegetative stage of this plant. After an absence of several weeks I found Phæothamnion had entirely disappeared from the culture, and to my great regret I was unable to contribute anything to our knowledge of the life-history of this algæ.

A Palmella-stage such as is reported both by Lagerheim and Borzì I was unable to obtain even by varying the conditions under which the plant grew in "hanging-drop" cultures. Empty cells showing the characteristic circular opening by which the zoospores had escaped I found several times, and also in one instance a few zoospores, but owing to lack of time I was unable to fix and stain these in order to investigate the number and position of the cilia.

Regarding the remarkable colour of the chromatophore, I can confirm Lagerheim's and other investigators' statements as to the action of a weak alcoholic solution, which dissolves the brown colouring matter and leaves the green chlorophyll, and exactly the same effect can be obtained with the brown chromatophores of the Diatomaceæ.

The systematic position of Phæothamnion and the other lower Phæophyceæ was thoroughly investigated by A. Scherffel in 1900 (8) and 1901 (9), and also by Oltmanns in 1904 (10). De Toni in his "Sylloge Algarum," vol. iii., published in 1895 (11), places Phæothamnion, following Hansgirg, under the Phæophyceæ or Fucoideæ. N. Wille, in Engler and Prantl's "Natürliche Pflanzenfamilien" (12), however, regards this Alga, as was suggested by its discoverer Lagerheim, as a genus of the family Chætophoraceæ, and therefore one of the Chlorophyceæ or Green Algæ.

In Oltmann's great work on the Algæ (10), Phæothamnion and all the Unicellular Brown Algæ are considered apart from the class Phæophyceæ, and as being nearer related to the Flagellatæ than to the true Algæ. Phæothamnion is regarded by him as one of the Chrysomonadineæ, and described in an "Anhang zu den Chrysomonadinen" (see vol. i. pp. 12 and 15, vol. ii. pp. 18–19).

G. S. West in his "Treatise on the British Freshwater Algæ," published in 1904, as previously stated, mentions the following seven families as the most important of the freshwater Phæophyceæ:—

Fam. Hydruraceæ, with *Hydrurus*, Ag.
„ Cryptomonadinaceæ, with *Cryptomonas*, Ehrenb.
„ Chrysomonadinaceæ, with *Syncrypta*, Ehrenb.; *Synura*, Ehrenb.; *Uroglena*, Ehrenb.
„ Dinobryaceæ, with *Dinobryon*, Ehrenb.
„ Phæocapsaceæ, with *Phæocystis*, Lagerh.; *Phæococcus*, Borzì: *Phæosphæra*, West and G. S. West; *Stichoglœa*, Chodat: *Phæschizochlamys*, Lemm.; *Phæodactylon*, Bohlin.
„ Choristocarpaceæ, with *Pleurocladia*, A. Br.
„ Phæothamniaceæ, with *Phæothamnion*, Lagerh.

Up to 1910 only four of the above families were known to be represented in Britain.

In Thomé's "Kryptogamen Flora von Deutschland" (13), Migula has apparently followed Oltmanns by regarding all the lower Phæophyceæ as Flagellatæ, or rather as intermediate stages between them and the Algæ, as Phæothamnion, as well as Hydrurus, Phæocystis, and other Syngeticæ, are mentioned neither in vol. i., treating of the Myxophyceæ, Chlorophyceæ, and Bacillaricæ, nor in vol. ii., devoted to the Phæophyceæ and Rhodophyceæ. A copy of figs. 7 and 10 of Lagerheim's plate, published in 1884 (2), appears, however, on plate 38 of vol. i. in Migula, but without any description in the text.

A bibliography of Phæothamnion, as far as I have been able to ascertain, is given below.

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FURTHER RECORDS OF FLOWERING-PLANTS (PHANEROGAMS) AND FERNS FROM THE ISLE OF MAY. By WILLIAM EVANS, F.R.S.E.

The following botanists have recorded their observations on the Flora of the Isle of May, at the mouth of the Firth of Forth :—

John Sadler ("Trans. Bot. Soc. Edin.," vol. xi. pp. 390–392, 1873).

John Rattray (*ibid.*, xvi. pp. 115–121, 1884).

William Evans (*ibid.*, xxiii. pp. 348–351, 1908 ; and xxiv. pp. 91–93, 1910).

George West ("Proc. Roy. Soc. Edin.," xxx. pp. 173–177, 1910).

With the exception of my own—which are concerned entirely with the Mosses and Hepatics—these papers deal more or less with the Phanerogams and Ferns.[1] Sadler, who visited the island along with Professor J. H. Balfour

[1] A few Fungi from the May have been recorded by Mr. A. B. Steele and myself ("Ann. Scot. Nat. Hist.," 1908, p. 58, and 1910, p. 58). To these there falls to be added *Crucibulum vulgare*, Tul., which I found in Sept. 1910 growing on a piece of old wood in the south garden.

and others in August 1871, recorded eighty-three of the former, and one of the latter, namely, *Asplenium marinum*. To that list Rattray added twenty, including a fern, *Lastrea (sic) Felix-fœmina*. West mentions other eight—among them a third fern, *Asplenium Ruta-muraria*—seen by him in August 1905.

The undernoted further additions to the list have at one time or another been collected by me on the island; they comprise twenty Phanerogams and two Ferns. Some of the Phanerogams flower early, which probably accounts for their absence from previous records. A number are garden weeds, a class from which a few more additions might doubtless have been made had one cared to look specially for them.

It would seem that the Flora of the island has undergone some changes in recent years. Several of the plants previously recorded—*Mertenzia maritima*, *Lotus corniculatus*, and *Sedum acre*, for instance—I am unable to find: while others stated to have been common are, in my experience, scarce and *vice versâ*. For instance, Mr. West speaks of *Bellis perennis* (the daisy) as "scarce near the houses": this year, in June, the grassy banks by the roadside from the landing stairs to the lighthouse, and down by the harbour, etc., were literally white with daisies. On the other hand, *Galium verum*, referred to as common, I have had difficulty in finding; its congener, *G. saxatile*, however, is plentiful. Since the cropping of the enclosures (now in grass) was discontinued, a number of field weeds are quite likely to have disappeared. The introduction of a few plants of the Sea Buckthorn (*Hippophae rhamnoides*) to the engineer's garden this spring should, perhaps, be mentioned, so that its origin may be known in the event of the shrub becoming established on the island.

LIST OF ADDITIONS.

Ranunculus Ficaria, L.—Fairly plentiful in the beginning of June 1910, and again this year, immediately to the north of the lighthouse.

Fumaria officinalis, L.—In garden south of the engine-house, June 1910 and 1911.

Capsella Bursa-pastoris, Medic.—Common about the gardens and adjoining ground.

Viola sylvatica, Fries (? *Riviniana*, Reichb.).—On 2nd June this year I observed about a dozen plants of what I have been accustomed to call *Viola sylvatica* in flower on a grassy bank close to the lighthouse. The lighthouse keepers say they first noticed it there two years ago.

Lychnis dioica, L. (*diurna*, Sibth.).—A group of less than a dozen plants on steep bank on the south side of the loch, July 1910 and 1911.

Vicia lathyroides, L.—In some abundance in front of the lighthouse in beginning of June 1910, and on bank near the harbour, 2nd June 1911.

Apium graveolens, L.—Specimens collected on the May in 1879 are in my herbarium.

Chrysanthemum segetum, L.—A single plant in flower in a patch of oats, south garden, July 1911.

Anagallis arvensis, L.—Two or three plants in garden, July 1911.

Convolvulus arvensis, L.—In flower by side of path in south garden, July 1910, and again 7th July 1911. Has, I am told, been there for a number of years.

Veronica agrestis, L.—A common weed in the gardens, August 1910 and July 1911.

Lamium hybridum, Vill. (*incisum*, Willd.).—Several plants seen about the gardens in August 1910; common, July 1911.

Euphorbia Peplus, L.—A good many plants in south garden, July 1911.

Juncus Gerardi, Loisl.—In a moist spot close to the sea on the south-east of the island, July 1910; and at one higher up this year.

Koeleria cristata, Brit. auth. (? *britannica*, Domin).—Common on the higher, rocky parts, June 1910 and 1911.[1] Noted also in June 1899.

Dactylis glomerata, L.—Common about the gardens and grass enclosures.

Poa pratensis, L.—At side of garden, etc., June 1911.

Festuca duriuscula, L.—At foot of wall round south garden, etc., June 1910 and 1911.

[1] Since these notes were put together, I have submitted specimens to Mr. G. C. Druce, and he says they are *K. britannica*, but not an extreme form.

F. elatior, L.—Two or three plants on low ground south of harbour, July 1911.

Nardus stricta, L.—On 8th June this year my son drew my attention to this grass on a knoll above the harbour, and a week later I found it in abundance to the north of the lighthouse.

Lastrea dilatata, Presl.—Among grass on low rock-ledges in several places in the southern half of the island, September 1910. A small form, such as one meets with on the hills.

Polypodium vulgare, L.—A good-sized patch on steep bank, south of the loch, September 1910. It had been sadly spoiled by excursionists in the belief that it was the sea spleenwort.

The two species above recorded, and *Asplenium marinum*, which grows in several places on the cliffs and in the caves, are the only ferns I have seen on the island.

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PRINTED BY NEILL AND CO., LTD., EDINBURGH.

PROCEEDINGS

OF THE

BOTANICAL SOCIETY OF EDINBURGH.

SESSION LXXIII.

NOVEMBER 12, 1908.

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Wolverhampton—John Fraser, M.A., M.D.

The following candidate was elected a Resident Fellow:—

Mr. Cecil B. Crampton, M.B., C.M.

Mr. Bennet Clark, the newly elected President, then took the Chair vacated by the retiring President, who gave brief accounts of the losses sustained by the Society through death during the last year.

Mr. Rutherford Hill then spoke of the Majority Celebrations of the Buchan Field Club at Peterhead in October last, when this Society was represented by Mr. C. S. France of Aberdeen. Mr. Hill drew attention to the valuable original work already done by the Club in the way of regional research.

On behalf of Mr. C. S. France, who was unable to be present, a note was read concerning a strange reversion of narrow-leaved ash, *Fraxinus excelsior*, var. *angustifolia*, to the common ash at Forglen. A branch showing the two forms of leaves was shown.

Mr. Symington Grieve contributed a short paper on some sea-weeds from the island of Dominica, British West Indies. (See p. 7.)

Miss I. M. Hayward showed specimens of the following plants found as aliens on the banks of the Tweed near Galashiels: — *Senecio lautus*, *S. brachyglossus*, *Cenia turbinata*, *Helipterum corymbiflorum*, *Atriplex spongiosa*, and *Rumex Brownii*. All are first records for Great Britain, and were found in August 1908 on alluvial soil by the junction of the Gala and Tweed. Miss Hayward's remarks are incorporated in the following notes:—

Senecio lautus, Forster.—A handsome plant growing in abundance on the shingle by the Gala. The species varies very much in the shape of the leaves. Found in New South Wales, Tasmania, South and West Australia, and also in New Zealand.

Senecio brachyglossus, F. Muell. — Only three or four plants. A native of Australia.

Cenia turbinata, Pers., var. *concolor*.—A common weed throughout Cape Colony. It has been noticed that some of the marginal flowers are constantly destitute of corolla, exactly as in *Cotula*.

Helipterum corymbiflorum, Schlecht. — Native of Australia.

Atriplex spongiosa, F. Mueller, is a South Australian plant. It is a much branched herb or undershrub, with numerous ascending or erect stems, not above 9 inches high, more or less mealy-white, becoming glabrous when old. The berry-like spongy fruit of plants found at Galafoot turned from pale green to dull red. The testa came off, leaving the inner membrane with ripe seeds.

It may be at this stage that the seeds adhere to the wool.

Rumex Brownii, Campd.—This plant occurred in considerable numbers along the Tweedside, as far as Melrose. Also a native of Australia.

Mr. W. Edgar Evans, B.Sc., exhibited living specimens of *Physcomitrella patens*, B. and S., from Torduff Reservoir, Pentland Hills, Midlothian. The moss was growing abundantly in association with antheridia-bearing plants of *Funaria hygrometrica*, Sibth., and *Riccia crystallina*, Linn., on exposed mud at the upper end of the pond, the water in which has been very low for some time. In the "Census Catalogue of British Mosses," published by the Moss Exchange Club in 1907, there is no mention of *Physcomitrella patens* from any Scottish county or vice-county. Photomicrographs, taken from Torduff material, were also exhibited to show the structure of leaf and capsule; similar photographs of *Phascum cuspidatum*, Schreb., were shown for comparison.

Mr. R. L. Harrow showed the following plants in flower from the Royal Botanic Garden:—*Asparagus myriocladus, Aspidistra typica, Begonia gloire de Lorraine, B. socotrana, Cuscuta reflexa, Cypripedium insigne Sanderæ, C. insigne Harefield Hall, Cyrtanthus sanguineus, Hibiscus Huegelii, Monolema primulæfolia.*

Mr. E. M. Holmes, F.L.S., exhibited *Geaster Bryantii*, a fungus which had come up in his garden at Sevenoaks in Kent. It appeared above the soil like a white coat button with a black centre, all the rest of the fungus remaining underground until rain or wind removed the soil. The *Geaster* grew under the parlour window in dry soil to which horse manure had been added in spring. The mycelium of the fungus killed a little of the *Arabis alpina* but did not appear to injure the *Geranium sanguineum* or wallflower or other plants close to it.

DECEMBER 10, 1908.

T. BENNET CLARK, Esq., C.A., President, in the Chair.

The TREASURER, Mr. RICHARD BROWN, C.A., submitted the following Statement of Accounts for the Session 1907–1908:—

INCOME.

Annual Subscriptions for 1907–1908	£39	15	0
Do. Arrears	4	10	0
Compositions for Life Membership	16	16	0
Transactions sold	3	10	0
Subscriptions to Illustration Fund	5	3	0
Diplomas	0	12	0
Interest on Deposits in Bank	2	18	9
	£73	4	9

EXPENDITURE.

Printing (including Transactions for 1907–1908, £33, 15s. 6d.)	£46	5	2
Rooms for Meetings, Tea, etc.	6	11	4
Stationery, Postages, Carriages, etc.	2	4	7
Fire Insurance on Books, etc.	0	5	0
Honorarium to Acting Secretary	10	0	0
Excess of Income over Expenditure	7	18	8
	£73	4	9

STATE OF FUNDS.

Amount of Funds at close of Session 1906–1907				£141	12	3
Add—Increase during Session 1907–1908, as above				7	18	8
Funds as at close of Session 1907–1908				£149	10	11
Being:—Sum in Current Account with Union Bank of Scotland Ltd.	£25	14	4			
Sums in Deposit Receipt with do.	160	0	0			
Due by Treasurer	10	1	9			
	£195	16	1			
Less—Printing Accounts outstanding	46	5	2			
As above				149	10	11

Note.—Subscription in arrear, 1905–1906, 15s.; 1906–1907, £1, 10s; 1907–1908, £5, 5s.

EDINBURGH, *4th December* 1908.—I hereby certify that I have audited the Accounts of the Treasurer of the Botanical Society of Edinburgh for Session 1907–1908, and have found them correct. I have also checked the foregoing Abstract, and find it correct.

ROBT. C. MILLAR, C.A., *Auditor.*

On the motion of the PRESIDENT, a cordial vote of thanks was tendered to the TREASURER, and to the AUDITOR, Mr. ROBERT C. MILLAR, C.A., for their services to the Society.

The following candidate was elected a Resident Fellow:—

Mr. G. H. OGILVIE.

The following candidate was elected a Non-Resident Fellow:—

Mr. F. R. S. BALFOUR.

The following communications were read:—

1. NOTE ON ABNORMAL POSITION OF ARCHEGONIUM IN PINUS SYLVESTRIS. With Lantern Slides. By Miss M. BARTHOLOMEW. Communicated by Professor BAYLEY BALFOUR, F.R.S. (See "Notes Roy. Bot. Gard., Edin.," iv. p. 253.)

2. NOTE ON SPOROCARP OF SALVINIA CONTAINING BOTH MICRO- AND MEGASPORANGIA. By A. J. GRAY, M.A., B.Sc. Communicated by Professor BAYLEY BALFOUR, F.R.S. (See "Notes Roy. Bot. Gard. Edin.," iv. p. 251.)

3. EXCURSION OF THE SCOTTISH ALPINE BOTANICAL CLUB TO CRIANLARICH, 1908. By Mr. ALEXANDER COWAN. (See p. 12.)

4. EXTRA-TROPICAL TREES IN ARRAN. By Rev. DAVID LANDSBOROUGH, LL.D.

The Rev. David Landsborough, LL.D., in a note supplementing a previous communication[1] to the Society, gave the following measurements of certain extra-tropical trees of Arran:—*Choisya ternata*, height 5 feet; spread 6 feet. *Acacia decurrens*, a standard, height 19 feet 1 inch; spread 8 feet 1 inch; girth 7 inches at 5 feet. *Eucalyptus cordata*, planted (1895) when little, and now, June of 1909, its measurement is: height 44 feet 1 inch; spread 14 feet 5 inches; girth 1 foot 8 inches at 5 feet. *Lomatia ferruginea*, standard, height 14 feet 3 inches; spread 7 feet. *Cordyline australis*, var. *Veitchii*, height 32 feet; girth 2 feet 11 inches at 5 feet. The tree-fern, planted in 1867, is

[1] See "Trans. Bot. Soc. Edin.," xxiii. p. 136.

now sending up eleven new fronds, the largest measuring 8 feet 3 inches in length by 2 feet 8 inches in breadth.

FUCUS INFLATUS. Exhibited by E. M. HOLMES, F.L.S.

Fucus inflatus was first found in Shetland a year or two ago by Dr. Borgessen. The specimen now exhibited was found at Lerwick, Shetland, quite recently by a Mr. Russell, who sent it to Mr. E. M. Holmes for identification. It differs from *Fucus vesiculosus* in the absence of vesicles, and the longer, often forked and acute receptacles. The midrib also is less pronounced. In this particular specimen the receptacle is not so long or so acute as usual, but some of them may be seen to be twice forked.

Mr. E. M. HOLMES, F.L.S., exhibited *Colpomenia sinuosa*, Derbes and Sol., a brown alga belonging to the family Encœliaceæ. This alga occurs abundantly in the Mediterranean, but had never been seen in Europe further north than Cadiz, in the south of Spain, till two French observers found it in 1906 at Vannes, in the Gulf of Morbihan, on the south-west coast of Britanny, and in 1907 several collectors found it further north near Cherbourg. In the same year E. M. Holmes found it at Torquay, and Mr. A. D. Cotton, of the Cryptogamic Department at Kew, found it epiphytic on *Corallina* and *Rhodymenia palmata* at Swanage and Bournemouth. It had now apparently become thoroughly established in the English Channel. It has sometimes been confounded with *Lœthesia difformis*, but could be distinguished by the thinner and non-gelatinous walls and the cellular and not filamentous structure. This alga had an economic interest from the fact that it might do serious damage to oyster beds. When the tide receded the fronds became inflated with air, and on the return of the tide these little balloons floated, carrying many young oysters to the surface. This gave so much trouble that the fishermen adopted the plan of breaking the balloons with prickly branches and recapturing the young oysters with nets. M. Bornet had suggested that the alga had been brought to Vannes in vessels conveying living lobsters from Portugal to be cultivated in the Gulf of Morbihan. Young oysters were imported from France to be "fattened" on the British culture grounds, and thus the alga had travelled along the coast.

Mr. WM. YOUNG showed a fine series of crested forms of ferns, chiefly *Nephrodium Filix-mas*, from Crianlarich district.

Mr. RUTHERFORD HILL exhibited the horned or hooked capsule or fruit of *Martynia proboscidea*, a plant belonging to the Natural Order Pedalineæ. The specimen came from Buenos Ayres to a tweed manufacturer in Galashiels embedded in a consignment of La Plata wool in which it not infrequently occurs. This species seems to be now regarded as synonymous with *Craniolaria annua*, which is the name given in the Kew index. In the Kew "List of Hardy Plants" it is stated that *Craniolaria annua* is an East Indian plant, but this is surely a mistake. In the "Flora of Southern India" it is stated that the plant, which is American, grows freely in India, into which it has no doubt been introduced. It is a native of Mexico, but is now found all over tropical South America. It seems probable that the wide dissemination of the plant may be accounted for by the fact that the hooked capsules would readily become entangled in the hair or wool of domestic or wild animals and thus be carried from place to place. The curious shape of the capsule and horns explains the popular names, Devil's Horn, or Claws, or Toe Nails, which are applied to them. In India they are called "Elephant's Trunk," and the name "Mouse Burr" is also applied to them from their resemblance to a mouse.

Mr. RUTHERFORD HILL exhibited roots of the common garden Pea, *Pisum sativum*, one set being inoculated with nitro-bacterine, a culture of the nitrogen-fixing bacillus *Pseudomonas radicicola*. The inoculated specimen showed numerous nodules consisting of colonies of the bacillus, while the other had relatively few such nodules. The plants inoculated with the bacillus yielded a much heavier crop than those not so treated.

Mr. JAMES M'ANDREW exhibited specimens of *Juncus tenuis*, Willd., which he found upon a piece of waste ground ready to be built upon at Morningside Grove, Edinburgh. This was one of the late George Don's reputed discoveries in Scotland. Mr. M'Andrew stated that in 1887 he found this rush on a gravelly roadside at West Risk, a mile west of New Galloway, Kirkcudbrightshire, and afterwards in three other places in the same county. "Since then it has turned up in several districts in the United Kingdom, but I think this is the first time it has been found in the extreme east of Scotland. It would be difficult to say how it has been introduced into this country—probably with hay or straw from the Continent, where it is common. In the 9th edition of the London Catalogue it is recorded for six, and in the latest edition for seventeen counties, which shows that it is spreading."[1]

Mr. R. L. HARROW showed the following plants in flower from the Royal Botanic Garden:—*Bougainvillea glabra*, var. *Sanderiana*, *Capsicum annuum*, *Cypripedium insigne*, *Epiphyllum truncatum*, *Laelio-Cattleya Statteriana*, *Masdevallia Schroederiana*, *Peliosanthes humilis*, *Streptocarpus Holstii*, *Tetramicra bicolor*, *Vanda Kimballiana*.

JANUARY 14, 1909.

T. BENNET CLARK, Esq., C.A., President, in the Chair.

The following candidates were elected Resident Fellows:—

Miss MARY BARTHOLOMEW.
Miss BERTHA CHANDLER, M.A., B.Sc.
Miss JEAN G. THOMPSON.

The PRESIDENT intimated the death of JAMES R. REID, Esq., C.I.E.

The following communications were read:—

1. NAIAS FLEXILIS, ROSTK. AND SCHMIDT, AS A BRITISH PLANT. By Mr. ARTHUR BENNETT. (See p. 16.)

[1] In September 1909, near the same spot in Morningside Grove, I found two good tufts of *Juncus tenuis*, Willd., and to-day (9th October 1909) I found the same rush opposite Marchbank, by the side of the road leading from Balerno to Bavelaw. This makes two stations for this plant in Midlothian (J. M'Andrew).

2. Atriplex Calotheca, Fries, as a Scottish Species. By Mr. Arthur Bennett. (See p. 18.)

Miss I. M. Hayward showed specimens of *Sirex gigas*, *S. noctilio*, and *Trichiosoma lucorum*, together with wood bored by the larvæ of the two former. The insects had been identified by Mr. Wm. Evans, F.R.S.E.

The Rev. J. J. M. L. Aiken, B.D., showed *Carex Boenninghausiana*, Weihe, from Northumberland. Of this new county record he says:—

Carex Boenninghausiana: its Occurrence in Northumberland. By Rev. J. J. M. L. Aiken, B.D., Ayton.

Up to the summer of 1908 the subject of this note had not been reported from the Border country. In July last, however, I had occasion, along with Mr. Wm. B. Boyd, Faldonside, to be in the neighbourhood of Edlingham, the first station on the Alnwick and Coldstream railway, and while devoting attention to Sedges in particular, we came upon a belt of brushwood which bounds the eastern bank of the burn of that name as it flows northward to join the Aln near Bolton. From its nature it gave promise of proving interesting and productive, the rills from the moor beyond rendering the soil in places very marshy, and the thick cover of natural scrub conducing to the growth of various forms of plant life. On closer examination a specially damp portion of the copsewood gave evidence of an abundance of *Carex paniculata* and *C. remota* in close proximity. This noteworthy circumstance induced a more diligent search of the undergrowth, in the hope that the rare hybrid resulting from them might be discovered also, an expectation which was shortly realised, as among plants of *C. remota* was distinguished what, on comparison, proved to be *C. Boenninghausiana*.

Though fairly plentiful, the plants were confined to a very limited area; and while conspicuous in colour, their dark green stems asserted themselves through being studded at intervals with membranous, silvery-brown spikelets which extended from three to six inches along their upper ends. In length they varied from eighteen to twenty inches, and in structural features they disclosed resemblance to those of their reputed parents, their inflorescence being made up of spikelets, crowded and simple at the top, and separate and compound at the base, as in *C. paniculata*, while the lower bract invariably exceeded it in length, after the habit of *C. remota*. The latter they likewise resembled in manner of growth, springing not from stools, but from tufted roots which ramified through the soft, peaty mould. This latter feature set at rest all possible doubt as to their being only depauperated examples of *C. paniculata*, many of which had been noted there also.

Two months later, after studying a list of additional plants to the *flora* of Berwickshire, contributed by the late Dr. Johnston, Berwick-on-Tweed, in which occurred the following note regarding *C. lævigata* — "In the brushwood at the base of Yevering Bell, with *C. remota* et *paniculata*,"[1] I resolved to visit that hillside, and learn whether the record still held good. Beginning my search on the western side, I had not gone far before the occurrence of all three Sedges named convinced me of the accuracy of that careful botanist, to whom all Border naturalists are so deeply indebted. Much encouraged by this verification of a past record, I at once devoted attention to the more shaded portions of the Oak plantation, and working eastward was at length rewarded by sighting a patch of *C. Boenninghausiana* amid surroundings very similar to those prevailing at the Edlingham station. Owing to the presence of sheep the bracts were much nibbled, but in other respects all specimens excelled those already gathered, being stouter in the stem and fuller in the fruit, though these peculiarities may be in a measure accounted for by the lapse of eight weeks since the date of the first discovery.

It is not to be supposed that this rare species of Sedge is wholly confined in this district to stations south of the Tweed, and therefore a serious effort should be made to discover it, if possible, on the Scottish side. In doing so, however, it would be well to devote attention chiefly to districts favourable to the growth of the parents, and

[1] "Ber. Nat. Club," vol. i. p. 62.

especially to thoroughly damp situations surrounded by natural wood.

Mr. SYMINGTON GRIEVE exhibited two specimens identified by Mr. H. F. Tagg, F.L.S., as follows:—

1. The endocarp of *Cocos amara*, Mart., a species not uncommon in the West Indies.

2. The endosperm of a germinated coco-nut, probably of *Cocos nucifera*, L., the embryonal haustorium being quite conspicuous within it. The hard endocarp was not present, and upon this endosperm a fungus *Schizophyllum* was growing. Both exhibits were from the island of Dominica, B.W.I. With regard to the first, Mr. Grieve said this variety of *Cocos* is known to the natives of Dominica by the name of the Horse Coco-nut Palm.

"The trees I saw were not nearly so high as those of the common Coco-nut Palm (*Cocos nucifera*), and seemed to be natives of the island. I came across single trees and once or twice two or three trees together, but never any large grove or plantation. These trees seemed to grow best in moist situations and sometimes near the sides of rivulets and streams. I found them from sea-level up to about 1000 feet.

"The fruit, as you see, is small when compared to the fruit of *Cocos nucifera*. It is also of little or no value as food, and fallen fruits are found in all stages of decay beneath the trees."

The second specimen was remarkable for the presence on it of a fungus *Schizophyllum commune*, Fries, var. *multifidum*, Batsch.

Professor Bayley Balfour had kindly examined it and reported:—

"The growth of the fungus *Schizophyllum* is particularly interesting. It has evidently got hold of a coco-nut which had germinated, and then for some reason or other the shell must have been cracked or rotted off, and the endosperm (or so much of it, at any rate, as had not been absorbed by the embryo) being exposed, furnished a suitable nidus for the growth of the fungus. The embryo has reached a considerable size, and its sucker nearly fills the whole cavity of the endosperm. Altogether it is a very interesting specimen, and I am very glad to have seen it."

The late Rev. M. J. Berkeley wrote about the genus *Schizophyllum* as follows:—"A remarkable genus of gill-bearing fungi, in which the coriaceous gills are split through their whole length along the central substance or trama, the two divisions turning back and becoming involute. The pileus is white or slightly tinged with red or amber, and is more or less rough, with little bundles of short threads, the margin variously lobed, and the surface zoned. The species are few in number and essentially tropical, *S. commune*, the most universal of tropical fungi, extending, though rarely, into temperate regions. It is one of the fungi which frequently make their appearance on imported wood in hothouses, and is always in such situations a pleasing object. In a natural situation it is one of our rarest fungi, and has been seen by very few mycologists.

"The specimen before you was found upon the seashore at the mouth of a rivulet. It had evidently been quite recently washed down by the stream. It is well known how the fruit of the common Coco-nut Palm (*Cocos nucifera*) is carried by ocean currents to almost every shore in the tropics. It would be interesting if some scientist living in the tropics could ascertain if the spores of *Schizophyllum commune* would germinate after being immersed for some time in sea water.

"I sent the specimen to Mr. E. M. Holmes, who kindly got it named for me by Mr. G. C. Lloyd."

A specimen of *Agaricus* (*Lepiota*) *rhacodes* (Vittad.) from Forfarshire was sent for exhibition by Mr. Peter Fenton.

Mr. R. L. Harrow showed the following plants in flower from the Royal Botanic Garden:—*Acacia Baileyana*, *Acanthus montanus*, *Alpinia Sanderæ*, *Carissa Arduina*, *Correa speciosa*, var. *superba*, *Cypripedium Leeanum giganteum*, *Eupatorium Weinmannianum*, *Hardenbergia Comptoniana*, *Moschosma riparium*, *Oncidium leucochilum*, *Pinguicula cordata*, *Restio subverticillatus*, *Sophronites violacea*, *Trichopilia sanguinolenta*, *Thunbergia coccinea*.

FEBRUARY 11, 1909.

T. Bennet Clark, Esq., C.A., President, in the Chair.

The following communications were read:—

1. Notes on Aerial Roots of Acanthorhiza aculeata, Wendl. By Miss Bertha Chandler, M.A., B.Sc. (See p. 20.)

2. Note on Septa in Root Vessels in Tillandsia, Puya, etc. By Rev. James Waterston, B.D., B.Sc. (See p. 25.)

3. Morphological Changes induced in Roots of Bromeliaceæ by Attack of Heterodera sp. By Rev. James Waterston, B.D., B.Sc. (See p. 26.)

Dr. R. Stewart MacDougall showed *Zeuzera æsculi* on Jasmine and *Hepialus humuli* on *Pæonia magnifica*, both from England.

Mr. Alexander Cowan showed *Polystichum angulare*, Presl, a new record for Midlothian, and varieties of *Lastrea montana*, T. Moore, found in Midlothian.

Mr. W. Balfour Gourlay showed a copy of "The Agriculturist's Manual" which, on 29th June 1836, had been presented by Peter Lawson, the author, to the late Sir John Murray Naesmyth of Posso. The book contained marginal notes by Sir John referring to trees on the Dawyck estate. Against *Pinus austriaca* we read:—"This tree was first planted at Dalwich previous to any others in the kingdom by me.—J. M. N." Again we find opposite *Pinus ponderosa*:—"I have seven specimens of those first introduced into Scotland. . . ." Among trees tried, but without success, are:—*Pinus pinea*, *P. halepensis*, *P. Lambertiana*, *Picea Morinda*, and *Araucaria Cunninghamii*.

Mr. Rutherford-Hill exhibited an abnormal growth in a common carrot. The tap root had bifurcated just below the crown, and the two sections of the root had formed a beautiful and perfectly symmetrical spiral about eight inches long. The specimen seemed an interesting confirmation of Baranetzky's theory of lateral geotropism as familiarly seem in stem-climbing plants.

He also exhibited a seedling oak grown in water showing peculiar cup-shaped expansions surrounding the secondary rootlets. These had been mistaken for flowers, which they closely simulated. The specimen was handed over to Miss Chandler, who had kindly undertaken to examine it. (See p. 35.)

Mr. G. H. OGILVIE exhibited twigs of *Pinus* with shoots produced by interfoliar buds.

Mr. R. L. HARROW showed a series of plants in flower from the Royal Botanic Garden.

MARCH 11, 1909.

T. BENNET CLARK, Esq., C.A., President, in the Chair.

The following candidate was elected a Resident Fellow:—

Mr. THOS. WILSON, Ph.C.

The PRESIDENT intimated the death since our last meeting of Sir GEORGE KING, K.C.I.E., LL.D., F.R.S., who had been an Honorary British Fellow of this Society since 1895.

Mention was also made of the decease of Dr. J. BARBOSA RODRIGUES, Director of the Botanic Garden, Rio Janeiro, who was elected a Corresponding Member of this Society in 1881.

The following communications were read:—

1. EXUBERANT LENTICEL-FORMATION IN SUBMERGED ROOT OF SEEDLING OAK. By Miss BERTHA CHANDLER, M.A., B.Sc. (See p. 35.)

2. NOTES ON THE FLORA OF THE SCILLY ISLES. By W. W. SMITH, M.A. (See p. 36.)

On behalf of Dr. R. STEWART MACDOUGALL, a turnip was shown by Dr. A. W. BORTHWICK which had grown through an iron buckle, elongating and swelling considerably both above and below.

Dr. A. W. Borthwick spoke on the effect of frost on certain trees, especially on Menzies' Spruce, Douglas Fir, and *Abies nobilis*, branches of which were passed round to show the damage caused.

The following plants in flower from the Royal Botanic Garden were exhibited by Mr. R. L. Harrow:—*Agapetes buxifolia, Clerodendron infortunatum, Corylopsis pauciflora, Cœlogyne pulchella, Dendrobium nobile virginale, D. nobile nobilius, D. speciosum Bancroftianum, Galanthus nivalis*, var. *flavescens*, *Hakea ulicina, Iris reticulata*, var. *histrioides, Pentapterygium serpyllifolium, Primula malacoides, Scilla cernua, Tetratheca pilosa.*

APRIL 8, 1909.

T. Bennet Clark, Esq., C.A., President, in the Chair.

The following candidate was elected a Resident Fellow:—

Mr. Robert Craig Cowan.

The President intimated the following losses by death:—

1. Mr. James Buchanan of Oswald House, Edinburgh, elected a Resident Fellow in 1878.

2. Dr. S. H. Ramsbotham of Harrogate, who had been a Non-Resident Fellow since 1858.

3. Dr. F. W. C. Areschoug, Emeritus Professor of Botany, University of Lund, elected a Corresponding Member in 1878.

The following communications were read:—

1. Tweedside Alien Plants (with Exhibition of Specimens). By Miss I. M. Hayward. (See p. 38.)

2. Natural Woods and Plantations of Colonsay. By Mr. M. M'Neill. Communicated by the Secretary.

The PRESIDENT showed Larch and other twigs injured by the severe frost of April 1908 to illustrate their partial recovery.

On behalf of Mr. W. W. SMITH, M.A., an inflorescence with fruit of *Hyphæne indica*, Becc., a new Palm of western India, was exhibited. Mr. Smith sent the following note:—

"This palm has been known in India for many years, but has been in the past considered identical with *Hyphæne thebaica*, Mart., and an introduction. It is found chiefly on the Bombay side. Two or three trees fruiting freely are in the Calcutta Royal Botanic Garden. No mention of it is found in Hooker's 'Flora of British India,' as it was considered an introduction from Africa.

"Recently specimens of the palm were submitted to Professor Beccori of Florence, the chief authority on the palms, and he recognises in it a new species which he has named *Hyphæne indica*, Becc.

"This occurrence of an Asiatic *Hyphæne* is interesting since, I believe, the genus was previously represented by African forms only."

Mr. SYMINGTON GRIEVE showed a peculiar swelling upon a branch of a species of *Acer* which, it was explained, was due to mechanical injury.

Mr. R. L. HARROW showed the following plants in flower from the Royal Botanic Garden:—*Agapetes buxifolia*, *Androsace villosa*, *Geranium canariense*, *Linaria Cymbalaria*, var. *globosa*, *Melianthus major*, *Monolena primulæflora*, *Ourisia macrophylla*, *Primula Listeri*, *P. malacoides*, *P. oreodoxa*, *Saxifraga marginata*, *Scilla axillaris*, *Silene pharnaceifolia*, *Romulea Columnæ*.

MAY 13, 1909.

T. BENNET CLARK, Esq., C.A., President in the Chair.

Mr. J. F. JEFFREY exhibited some of Don's original specimens of his disputed Scottish plants.

Mr. J. Rutherford Hill exhibited *Phragmidium fragariastrum* on *Potentilla Fragariastrum* from roadside near Dumfries.

Mr. R. L. Harrow exhibited the following plants in flower from the Royal Botanic Garden:—*Chrysosplenium flagelliformis*, *C. rosulare*, *Pernettya* sp., *Primula auriculata*, *P. Cockburniana* × *pulverulenta*, *P. Forrestii*, *P. malacoides*, *Ranunculus insignis*, *R. Marsetinus*, *Saxifraga cervicornis*.

JUNE 10, 1909.

T. Bennet Clark, Esq., C.A., President, in the Chair.

The President intimated the death of Dr. John Fraser of Wolverhampton, who had been a Fellow of the Society since 1865.

On behalf of Mr. M. M'Neill, a paper on the Flora of the Island of Colonsay [1] was read.

Mr. J. F. Jeffrey exhibited fresh specimens of certain species of British Orchids from Kent.

Mr. R. L. Harrow exhibited the following plants in flower from the Royal Botanic Garden:—*Alsine verna*, var. *plena*, *Aster himalaicus*, *Chamæmelum Argæa*, *Craspedia uniflora*, *Dianthus frigidus*, *D. glacialis*, *Lychnis pyrenaica*, *Myosotis corsica*, *Orchis papilionacea*, *Primula Bulleyana*, *Robertia taraxacoides*, *Veronica Hulkeana*.

JULY 8, 1909.

T. Bennet Clark, Esq., C.A., President, in the Chair.

Mr. W. Balfour Gourlay showed dried specimens of Chilian plants which he had collected in the neighbourhood

[1] As Mr. M'Neill will shortly publish a work on Colonsay dealing with the subject-matter of this as well as of his paper read at the April Meeting of this Society, it has been thought desirable not to insert any part of it here.—Eds.

of Valparaiso. They included a *Mutisia*, and species of *Calceolaria*, *Schizanthus*, *Salpiglossis*, *Alonsoa*, *Tropæolum*, *Oxalis*, *Œnothera*, *Cummingia*, *Alstrœmeria*, *Leucocoryne* and *Sisyrinchium*; also specimens of *Calandrinia grandiflora*, *Triptilion spinosa* and *Pasithea cœrulea*.

The Rev. JAMES WATERSTON, B.D., B.Sc., showed a branched flowering stem of *Plantago maritima*.

Mr. JAMES FRASER exhibited specimens of *Orthocarpus purpurascens* and *Dracocephalum thymiflorum*, two new alien records from Leith Docks.

Mr. R. L. HARROW exhibited the following plants in flower from the Royal Botanic Garden:—*Æthionema armenum*, *Bloomeria aurea*, *Helichrysum frigidum*, *Lobelia* (*Pratia*) *linnæoides*, *Liparis Lœselii*, *Micropus erectus*, *Ononis cenisia*, *Potentilla saxifraga*, *Saxifraga candelabrum*, *S. Regeli*, *Scutellaria indica*, var. *japonica*.

PROCEEDINGS

OF THE

BOTANICAL SOCIETY OF EDINBURGH.

SESSION LXXIV.

NOVEMBER 11, 1909.

T. Bennet Clark, Esq., C.A., President, in the Chair.

The following gentlemen were elected Office-Bearers for the Session:—

PRESIDENT.

T. Bennet Clark, C.A.

VICE-PRESIDENTS.

Alexander Cowan, Esq.
Symington Grieve, Esq.
James Fraser, Esq.
James Whytock, Esq.

COUNCILLORS.

John W. Bews, M.A., B.Sc.
Sir Archibald Buchan Hepburn, Bart.
Robert Campbell, M.A., B.Sc.
Humphrey G. Carter, Esq.
W. Edgar Evans, B.Sc.
J. Rutherford Hill, Esq.
R. Stewart MacDougall, M.A., D.Sc.
George W. Scarth, M.A.
David W. Thomson, Esq.
Rev. James Waterston, B.D., B.Sc.

Honorary Secretary—William Craig, M.D., F.R.S.E., F.R.C.S.E.
Curator of Herbarium—W. Caldwell Crawford, M.A., F.R.S.E.
Foreign Secretary—Rev. D. Paul, M.A., LL.D.
Treasurer—Richard Brown, C.A.
Assistant-Secretary—J. F. Jeffrey.
Artist—Professor Francis M. Caird, M.B., C.M., F.R.C.S.E.
Auditor—Robert C. Millar, C.A.

LOCAL SECRETARIES.

Aberdeen—Professor J. W. H. Trail, M.A., M.D., F.R.S., F.L.S.
Bathgate—Robert Kirk, M.D., F.R.C.S.E.
Berwick-on-Tweed—Francis M. Norman, R.N.
Birmingham—W. H. Wilkinson, F.L.S., F.R.M.S., Manor Hill, Sutton Coldfield.
Calcutta—Professor S. C. Mahalanobis, B.Sc., F.R.S.E., F.R.M.S. Presidency College.
,, W. W. Smith, M.A., Royal Botanic Garden.
Cambridge—Arthur Evans, M.A.
Croydon—A. Bennett.
Dumfries—Professor G. F. Scott-Elliot, M.A., B.Sc., F.L.S.
Dundee—Professor P. Geddes, F.R.S.E.
East Liss, Hants—James Sykes Gamble, M.A., C.I.E., F.R.S.
Glasgow—Professor F. O. Bower, Sc.D., F.R.S., F.L.S.
,, Professor J. Cleland, M.D., LL.D., D.Sc., F.R.S.
London—William Carruthers, F.R.S., F.L.S.
,, J. F. Duthie, B.A., F.L.S.
,, E. M. Holmes, F.L.S., F.R.H.S.
,, Lieut.-Col. David Prain, M.D., C.I.E., F.R.S., F.L.S., Royal Botanic Gardens, Kew.
Melrose—W. B. Boyd, of Faldonside.
Otago, New Zealand—Professor James Gow Black, D.Sc., University.
Perth—Sir Robert Pullar, F.R.S.E.
Philadelphia, U.S.A.—Professor John M. Macfarlane, D.Sc., F.R.S.E.
Ryde—George May Lowe, M.D., C.M.
St Andrews—Professor M'Intosh, M.D., LL.D., F.R.S.E.
,, Robert A. Robertson, M.A., B.Sc.
,, J. H. Wilson, D.Sc., F.R.S.E.
Toronto, Ontario—W. R. Riddell, B.Sc., B.A.
,, Professor Ramsay Wright, M.A., B.Sc.

The President intimated the following losses by death:—

1. Dr. Emil C. Hansen of Copenhagen, elected a Corresponding Member in 1887.

2. Mr. Thomas Southwell, F.Z.S., of Norwich, elected a Fellow in 1853.

The President in his address reviewed the position of the Society and communicated biographical notices of Fellows who had died during the year. (See p. 45.)

The following communication was read:—

The Present Position of Botanical Survey in Britain. (With Maps.) By W. G. Smith, Ph.D. (See p. 53.)

Sir ARCHIBALD BUCHAN HEPBURN, Bart., exhibited a series of water-colour drawings by Mr. DOUGLAS M'DOUALL in illustration of the flora of Mount Ruwenzori and neighbourhood.

Mr. WM. EVANS, F.R.S.E., showed specimens of four species of *Geaster* collected by him in East Lothian in October 1909, viz.:—*G. Berkeleyi* Mass., *G. Bryantii* Berk., *G. striatus* DC., and *G. fimbriatus* Fr., of which the first named had not, it would appear, been previously recorded from Scotland. Mr. EVANS also exhibited from the same county specimens of several other fungi, viz.:—*Mutinus caninus* Fr., *Fistulina hepatica* Fr., *Sparassis crispa* Fr., *Clavaria stricta* Pers., *Hirneola auricula-judæ* Berk., *Helvella crispa* Fr., and *Leotia lubrica* Pers.

Dr. A. W. BORTHWICK exhibited cone of *Abies nobilis* attacked by *Phycis* (*Tinea*) *abietella*.

Mr. R. L. HARROW showed the following plants in flower from the Royal Botanic Garden:—*Anisotes diversifolius*, *Asparagus madagascariensis*, *Eichornea speciosa*, *Euphorbia mamillaris*, *Fuchsia parviflora*, *Nerine Bowdeni*, *Pleurothallis macroblepharis*, *Primula capitata*, *P. Forbesii*, *P. malacoides*, *Saintpaulia ionantha*, *Santalum album*.

DECEMBER 9, 1909.

T. BENNET CLARK, Esq., C.A., President, in the Chair.

The TREASURER, Mr. RICHARD BROWN, C.A., submitted the following Statement of Accounts for the Session 1908–1909:—

INCOME.

Annual Subscriptions for 1908–1909	£40	10	0
Do. Arrears	2	5	0
Compositions for Life Membership	9	9	0
Transactions sold	3	0	0
Subscriptions to Illustration Fund	4	0	0
Interest on Deposits in Bank	1	19	0
	£61	3	0

EXPENDITURE.

Printing (including Transactions for 1908–1909, say £25)	£40	19	5
Rooms for Meetings, Tea, etc.	6	11	8
Stationery, Postages, Carriages, etc.	2	2	2
Fire Insurance on Books, etc.	0	5	0
Honorarium to Acting Secretary	10	0	0
Excess of Income over Expenditure	1	4	9
	£61	3	0

STATE OF FUNDS.

Amount of Funds at close of Session 1907–1908				£149	10	11
Add—Increase during Session 1908–1909, as above				1	4	9
Funds as at close of Session 1908–1909				£150	15	8
Being:—Sum in Current Account with Union Bank of Scotland Ltd.	£19	4	5			
Sums in Deposit Receipt with do.	160	0	0			
Due by Treasurer	8	4	9			
	£187	9	2			
Less—Printing Accounts outstanding	36	13	6			
As above				150	15	8

Note.—Subscriptions in arrear, 1906–1907, 15s.; 1907–1908, £2, 5s.; 1908–1909, £6, 15s.

EDINBURGH, *2nd December* 1909.—I hereby certify that I have audited the Accounts of the Treasurer of the Botanical Society of Edinburgh for Session 1908–1909, and have found them correct. I have also checked the foregoing Abstract, and find it correct.

ROBT. C. MILLAR, C.A., *Auditor.*

On the motion of the PRESIDENT, a cordial vote of thanks was tendered to the TREASURER and to the AUDITOR, Mr. ROBERT C. MILLAR, C.A., for their services to the Society.

The TREASURER moved the following resolution, which was seconded by the PRESIDENT and unanimously agreed to:—

"That in stating the accounts of the Society in future only one-twentieth part of the compositions received for life membership should annually be credited to ordinary income; and that in order to give effect to this system as regards Life Compositions received in the past a sum of £86, 7s. 6d. out of the sum of £150, 15s. 8d. on hand be designated 'Life Compositions unapplied.'"

The following candidates were elected Resident Fellows :—

Miss Dorothy Court, B.Sc.
Wm. G. Smith, Ph.D.

The following communications were read :—

The General Aspect of Southern Abyssinia and its Vegetation. With Lantern Illustrations. By George Bryce, B.Sc.

In the absence of Mr. L. Cockayne, Corresponding Member, Professor Bayley Balfour, F.R.S., gave a lantern demonstration on New Zealand Vegetation.

Dr. Stanley L. Haynes sent leaves of *Aristolochia Sipho* to show variation in shape.

The Assistant Secretary read a letter from Mr. G. M. Horsburgh to record the fruiting of *Podophyllum Emodi* in Orkney by the Rev. D. W. Yair.

The Rev. James Waterston, B.D., B.Sc., showed specimens of *Malacosoma neustria*, Linn. (the Lackey moth), a horticultural pest supposed to be new to Scotland.

Mr. R. L. Harrow showed the following plants in flower from the Royal Botanic Garden :—*Bulbophyllum comosum, Calanthe W. Murray, Cypripedium Arthurianum*, var. *pulchellum, Elephantopus scaber, Euchlaena luxurians, Helichrysum subulifolium, Hibbertia dentata, Ligusticum antipodum, Lycopodium dendroideum, Odontoglossum crocidipterum, Oncoba aristata, Peliosanthes humilis, Scaphosepalum anchoriferum.*

JANUARY 13, 1910.

T. Bennet Clark, Esq., C.A., President, in the Chair.

The President alluded to the death of Mr. George Stabler, elected a Non-Resident Fellow in 1883.

The following communications were read :—

1. Short Note upon the Damage done to the Pois Doux Tree (*Inga laurina*) by the Hercules Beetle (*Dynastes Hercules*) in Dominica. B.W.I. By Mr. Symington Grieve.

2. NOTES ON THE BRITISH SPECIES OF UTRICULARIA. By Mr. ARTHUR BENNETT. (See p. 59).

Dr. R. STEWART MACDOUGALL exhibited specimens of *Oscinis frit*, with remarks on the damage done by this insect to oat and other crops.

Mr. R. L. HARROW showed the following plants in flower from the Royal Botanic Garden: — *Acacia Baileyana, Aphelandra aurantiaca, Coleus thyrsoideus, Combretum grandiflorum, Dombeya Wallichii, Carex baccans, Hakea gibbosa, Luculia gratissima, Quassia amara, Ranunculus cortusæfolius, Thoracostachyum bancanum.*

FEBRUARY 10, 1910.

T. BENNET CLARK, Esq., C.A., President, in the Chair.

Mrs SARAH H. GALLETLY was elected a Lady Member.

The PRESIDENT alluded to the threatened extermination of *Lychnis Viscaria* and other rare plants on Blackford Hill, owing to quarrying operations of the Midlothian County Council. The PRESIDENT concluded by moving a resolution, which was seconded by Mr. SYMINGTON GRIEVE, that a small committee be appointed to draw up a petition to be presented to the Lord Provost, the Magistrates and Town Council of the city, pointing out to them from our standpoint as botanists the injury that undoubtedly will be done to Blackford Hill if the operations of the County Council were allowed to go on; and further, with power to that committee to communicate, if so advised, with the Scottish Office or the Members for the city. The PRESIDENT, Mr. SYMINGTON GRIEVE, and Mr. J. RUTHERFORD HILL, were appointed to act on this committee.

The following communications were read:—

1. REPORT OF THE SCOTTISH ALPINE BOTANICAL CLUB 1909. By Mr. ALEXANDER COWAN. (See p. 64.)

2. NOTES ON PLANTS OBSERVED DURING A VISIT TO CHILE. With Lantern Illustrations. By W. BALFOUR GOURLAY, B.A., L.R.C.P. & S.E. (See p. 68.)

3. THE SOYA BEAN AND ITS REPUTED POISONOUS PROPERTIES. By WILLIAM MOODIE, F.R.C.V.S. Communicated by Dr. R. STEWART MACDOUGALL.

Mr. W. BALFOUR GOURLAY, B.A., showed slides of rabbit-pruned gorse from rabbit warren near Elgin.

Mr. J. RUTHERFORD HILL showed a piece of perforated quartz through which a root had grown.

Mr. R. L. HARROW showed the following plants in flower from the Royal Botanic Garden:—*Abutilon insigne*, *Begonia Gloire de Sceaux*, *Centropogon Lucyanus*, *Cotyledon fulgens*, *Coprosma rhamnoides*, *Coleus Mahoni*, *Cyclamen persicum*, *Dracontium gigas*, *Lælia harpophylla*, *Santalum album*.

MARCH 10, 1910.

T. BENNET CLARK, Esq., C.A., President, in the Chair.

Mr. F. GRAHAME MILLAR was elected a Non-Resident Fellow.

The PRESIDENT gave notice of motion on Alteration of Laws as follows:—

CHAPTER IV., SECTION 5. *Associates and Honorary Associates.*

That the present Law be deleted and the following Laws substituted:

1. The Society shall have power to elect by ballot, on the recommendation of the Council, Associates, being ladies or gentlemen who, though not desiring to become Resident or Non-Resident Fellows, are interested in the objects of the Society. The name of any candidate proposed as an Associate shall be submitted to the Council on a formal application, signed by two Resident Fellows, to one of whom at least the candidate must be personally known, and, if approved, the ballot for such candidate will take place at next Ordinary Meeting. Associates shall have no vote in elections or in the transaction of the business of

the Society, and they shall have no interest in its property. They shall pay the sum of five shillings on admission, and shall contribute five shillings annually thereafter, at the November meeting. They may also receive copies of the Transactions published subsequent to their admission, at prices to be fixed from time to time by the Council of the Society.

2. The Society shall also have power to elect as Honorary Associates, on the recommendation of the Council, ladies or gentlemen who may have acquired a claim on the Society, by transmitting specimens or botanical communications, or for other reasons at the discretion of the Society.

In the event of these new Laws being enacted:

That the following words in Chapter I., Law 3, be deleted:—

"of Lady Members elected under the rule Chapter "IV. Section 6 hereof, and of Associates elected under "the rule Chapter IV. Section 5 hereof."

And that the following words be substituted:—

"of Associates and Honorary Associates elected "under the rule Chapter IV. Section 5 hereof, and of "Lady Members elected under the rule Chapter IV. "Section 6 hereof."

The President intimated the death of Mr. Robert Pantling, elected an Associate in 1898.

The President said that the Committee appointed last month to watch the interests of the Society at Blackford Hill quarry had sent petitions to the Town Council and to the County Council of Midlothian.

The following communications were read:—

1. Plant Symbolism in Art and Literature. (With Drawings.) By Miss Bertha Chandler, M.A., B.Sc.

2. On Peat Moor in the Orkneys. By G. W. Scarth, M.A.

(This is the first portion of a more extended communication to follow.)

3. The Genus Carex in Britain. By Mr. Arthur Bennett. (See p. 77.)

Dr. R. Stewart MacDougall sent for exhibition the following:—

(1) Mud cells of *Eumenes pomiformis* on various plants.

(2) Leaves of apple mined by the larvæ of *Cemiostoma scitella*.

Mr. R. L. Harrow showed the following plants in flower from the Royal Botanic Garden:—*Acanthus montanus*, *Adiantum grossum*, *Callianthemum rutæfolium*, *Celsia orientalis*, *Dalechampia Rœzlii*, *Dendrobium Dartoisianum*, *Draba Mawii*, *Lælia Lindleyana*, *Rhododendron racemosum*, *Soldanella alpina*, *Streptocarpus Holstii*, *Thlaspi præcox*.

APRIL 14, 1910.

T. Bennet Clark, Esq., C.A., President, in the Chair.

The following candidates were elected Resident Fellows:—

Miss May F. Dibdin.
Miss Elsie Harvey.

The President moved the following motion on an Addition to the Laws regarding the election of Ordinary Members:—

Chapter IV.—That there be added the following Law to be intituled:—

Section 7. *Ordinary Members.*

1. The Society shall have power to elect, on the recommendation of the Council, Ordinary Members, being ladies or gentlemen who, though not desiring to become Resident or Non-Resident Fellows, are interested in the objects of the Society. The name of any candidate proposed as an Ordinary Member shall be submitted to the Council on a formal application, signed by two Resident Fellows, to one of whom at least the candidate must be personally known, and, if approved, the election of such candidate will take

place at next Ordinary Meeting. Ordinary Members shall have no vote in elections or in the transaction of the business of the Society, and they shall have no interest in its property. They shall pay the sum of five shillings on admission, and shall contribute five shillings annually thereafter, at the November meeting. They may also receive copies of the Transactions published subsequent to their admission, at prices to be fixed from time to time by the Council of the Society.

In the event of this new Law being enacted:
That the following words in Chapter I., Law 3, be deleted:—

> "of Lady Members elected under the rule Chapter
> "IV. Section 6 hereof, and of Associates elected
> "under the rule Chapter IV. Section 5 hereof."

And that the following words be substituted:—

> "of Associates elected under the rule Chapter IV.
> "Section 5 hereof, and of Lady Members elected
> "under the rule Chapter IV. Section 6 hereof, and
> "of Ordinary Members elected under the rule
> "Chapter IV. Section 7 hereof."

Mr. W. T. GORDON, M.A., B.Sc., gave a lantern demonstration on the relation between the *Osmundaceæ* and the *Zygopterideæ*.

Mr. SYMINGTON GRIEVE showed seeds of the Sand-box tree (*Hura crepitans*, Linn.).

Mr. J. RUTHERFORD HILL, Ph.C., exhibited *Pinus sylvestris*, Linn., showing bifoliar shoots replaced by carpellary flowers or cones.

This remarkable specimen was found by a gamekeeper in a plantation in a rather inaccessible part of the estate of Traquair, near Innerleithen. The tree on which it was found was a well-grown Scots fir about thirty feet high, which had been blown down in one of the recent gales. From the estate records it appears that this plantation was planted between 1855 and 1860, so that the tree would be probably fifty-five years old. The specimen consists of a dense cluster or crown of twenty-seven fully developed and mature cones surrounding the apex of the main axis of the tree. The apical shoot seems to have withered, so that further growth of the main axis is arrested. Evidently this interesting abnormality is due to the transformation of the lateral bifoliar shoots into carpellary flowers. This phenomenon appears to occur not infrequently, though not to so marked a degree as in the specimen. In the Museum at the Royal Botanic Garden there is a specimen very like the present one, in which the main axis is prolonged beyond the cluster. The cones, however, are smaller than in this specimen, and apparently immature. The cause of this peculiar abnormality does not appear to be known. Injury to the tree sometimes leads to such deviations, but in this case the tree was without injury or deformity of any kind.

Mr. JAMES FRASER showed specimens of *Chærophyllum aureum*, Linn., from the left bank of the Teith, below Callander, Perthshire (V.C. 87), where it grew in considerable quantity in August 1907. The previous records of this plant in Scotland were those of George Don, the Forfarshire botanist, who reported it from Forfarshire and from near the village of Kirkliston, West Lothian.

Mr JAMES WHYTOCK showed a selection of cut flowers from Dalkeith Palace Gardens.

Mr. R. L. HARROW showed the following plants in flower from the Royal Botanic Garden:—*Achillea ageratifolia*, *Androsace villosa*, *Calypso borealis*, *Cassiope tetragona*, *Hesperis humilis*, *Iris bucharica*, *Primula Bilekii*, *P. Kellereri*, *P. Kitaibeliana*, *P. Reidii*, *P. Tanneri*, *Scutellaria indica*, var. *japonica*.

MAY 6, 1910.

The Meeting to be held on this date was cancelled, owing to the death of HIS MAJESTY THE KING, the Patron of the Society.

JUNE 9, 1910.

T. BENNET CLARK, Esq., C.A., President, in the Chair.

The PRESIDENT said that in accordance with a motion of the meeting of Council of 31st May an Address of Condolence to HIS MAJESTY THE KING had been prepared by Dr. PAUL and himself. The proposed address was then read by the President, the members upstanding, and was adopted by the meeting, the PRESIDENT being requested to forward it to the proper quarter.

In the absence of Mr. R. S. ADAMSON, M.A., B.Sc., the ASSISTANT SECRETARY read a communication by him on the Relationships of *Primula elatior* and *P. vulgaris* to Soil Conditions. (See p. 84).

Dr. R. STEWART MACDOUGALL showed some insect and fungus enemies on Oat, Apple, Gooseberry, Birch, Willow, and Scots Pine, with examples of their work.

Mr. W. BALFOUR GOURLAY, B.A., showed twig of *Prunus avium* with adventitious roots.

Fresh specimens of *Hymenophyllum tunbridgense* and *H. unilaterale*, sent by Mr. SYMINGTON GRIEVE from Colonsay, were shown.

Mr. R. L. HARROW showed the following plants in flower from the Royal Botanic Garden:—*Achillea ageratifolia, Armeria multiceps, Astrocarpus sesamoides, Bidens sarmentosa, Campanula cenisia, Carex baldensis, Clintonia umbellata, Dianthus alpinus, Helichrysum frigidum, Lesquerella Kingii, Onosma echioides, Saxifraga microstigma, Wahlenbergia Pumilio.*

JULY 14, 1910.

T. BENNET CLARK, Esq., C.A., President, in the Chair.

The PRESIDENT reported that he had received from LORD PENTLAND, the Secretary for Scotland, an acknowledgment of the address of condolence to HIS MAJESTY THE KING.

The PRESIDENT alluded to the death of Mr. JOHN MONTGOMERIE BELL, W.S., elected a Resident Fellow in 1857.

The following communications were read :—

1. CAREX AQUATILIS, WAHLB., AND ITS SCOTTISH FORMS. By Mr. ARTHUR BENNETT. (See p. 86.)

2 SOME FURTHER MOSSES FROM THE ISLE OF MAY. By W. EVANS, F.R.S.E. (See p. 91.)

3. SUPPLEMENTARY NOTE ON MOSSES OF PRINCE CHARLES FORELAND, SPITZBERGEN. By H. N. DIXON, M.A., F.L.S. (See p. 93.)

The Rev. Dr. PAUL showed a fresh specimen of *Polyporus sulphureus*, Bull., found on an old elm branch at Smeaton Hepburn, Prestonkirk, East Lothian, on 1st July 1910. A summer and autumn fungus, attaining a breadth of 2 and even 3 feet, very handsome when large and fresh, owing to its delicate colouring. Not a rare, but an uncommon fungus, found here and there all over Britain, France, Sweden. etc. Occurs on the stem or stump of many kinds of leaf-bearing trees—oak, cherry, willow, alder, ash, walnut. When in fullest vigour it yields a sulphur-coloured juice. Edible when young. Crystals of binoxalate of potass gather on the dried pileus, sometimes in such quantity as to form a crust over it. Spores oval, white, minutely papillose.

The Rev. J. J. MARSHALL L. AIKEN, B.D., sent for exhibition specimens of *Carex rariflora* gathered at Caenlochan, at the head of Glen Isla : also *Lilium Martagon*, with fasciated stem.

An example of peloria in Foxglove, sent by Mr. C. S. FRANCE, was shown.

A letter was read from Mr. R. A. ROBERTSON, M.A., B.Sc.. in which he recorded the finding by him of *Corallorrhiza innata*, R.Br., in fair quantity on the Gunner's Range. Barry Camp.

Mr. R. L. Harrow showed the following plants in flower from the Royal Botanic Garden:—*Campanula Raddeana, C. Tymonsii, Hypericum polyphyllum, Potentilla Clusiana, P. Saxifraga, Ranunculus Godleyanus, Salvia Rœmeriana, Saponaria Boissieri, Saxifraga candelabrum, Scabiosa holosericea, Scutellaria indica,* var. *japonica, Senecio bellidioides, S. grandiflorus, Wahlenbergia saxicola.*

PROCEEDINGS

OF THE

BOTANICAL SOCIETY OF EDINBURGH.

SESSION LXXV.

NOVEMBER 10, 1910.

T. Bennet Clark, Esq., C.A., President, in the Chair.

The following gentlemen were elected Office-Bearers for the Session:—

PRESIDENT.

A. W. Borthwick, D.Sc.

VICE-PRESIDENTS.

Alexander Cowan, Esq.
Sir Archibald Buchan Hepburn, Bart.
James Fraser, Esq.
J. Rutherford Hill, Ph.C.

COUNCILLORS.

Miss B. Chandler, M.A., B.Sc.
T. Bennet Clark, C.A.
W. Edgar Evans, B.Sc.
Symington Grieve, Esq.
J. F. Jeffrey, Esq.
R. Stewart MacDougall, M.A., D.Sc.
George W. Scarth, M.A.
Miss J. G. Thompson, B.Sc.
David W. Thomson, Esq.
James Whytock, Esq.,

Honorary Secretary—William Craig, M.D., F.R.S.E., F.R.C.S.E.
Curator of Herbarium—W. Caldwell Crawford, M.A., F.R.S.E.
Foreign Secretary—Rev. D. Paul, M.A., LL.D.
Treasurer—Richard Brown, C.A.
Assistant-Secretary—M'Taggart Cowan, Junr., Esq.
Artist—Professor Francis M. Caird, M.B., C.M., F.R.C.S.E.
Auditor—Robert C. Millar, C.A.

LOCAL SECRETARIES.

Aberdeen—Professor J. W. H. TRAIL, M.A., M.D., F.R.S., F.L.S.
Bathgate—ROBERT KIRK, M.D., F.R.C.S.E.
Berwick-on-Tweed—FRANCIS M. NORMAN, R.N.
Birmingham—W. H. WILKINSON, F.L.S., F.R.M.S., Manor Hill, Sutton Coldfield.
Calcutta—Professor S. C. MAHALANOBIS, B.Sc., F.R.S.E., F.R.M.S., Presidency College.
,, W. W. SMITH, M.A., Royal Botanic Garden.
Cambridge—ARTHUR EVANS, M.A.
Croydon—A. BENNETT.
Dumfries—Professor G. F. SCOTT-ELLIOT, M.A., B.Sc., F.L.S.
Dundee—Professor P. GEDDES, F.R.S.E.
East Liss, Hants—JAMES SYKES GAMBLE, M.A., C.I.E., F.R.S.
Glasgow—Professor F. O. BOWER, Sc.D., F.R.S., F.L.S.
,, Professor J. CLELAND, M.D., LL.D., D.Sc., F.R.S.
London—WILLIAM CARRUTHERS, F.R.S., F.L.S.
,, J. F. DUTHIE, B.A., F.L.S.
,, E. M. HOLMES, F.L.S., F.R.H.S.
,, Lieut.-Col. DAVID PRAIN, M.D., C.I.E., F.R.S., F.L.S., Royal Botanic Gardens, Kew.
Melrose—W. B. BOYD, of Faldonside.
Otago, New Zealand—Professor JAMES GOW BLACK, D.Sc., University.
Perth—Sir ROBERT PULLAR, F.R.S.E.
Philadelphia, U.S.A.—Professor JOHN M. MACFARLANE, D.Sc., F.R.S.E.
Ryde—GEORGE MAY LOWE, M.D., C.M.
St Andrews—Professor M'INTOSH, M.D., LL.D., F.R.S.E.
,, ROBERT A. ROBERTSON, M.A., B.Sc.
,, J. H. WILSON, D.Sc., F.R.S.E.
Toronto, Ontario—W. R. RIDDELL, B.Sc., B.A.
,, Professor RAMSAY WRIGHT, M.A., B.Sc.

The TREASURER, Mr. RICHARD BROWN, C.A., submitte the following Statement of Accounts for the Session 1909–1910:—

INCOME.

Annual Subscriptions for 1909–1910	£41	5	0
Do. Arrears	4	10	0
Transfer from Life Members' Fund	8	3	9
Transactions sold	4	5	0
Subscriptions to Illustration Fund	3	15	0
Interest on Deposits in Bank	3	15	11
	£65	14	8

Expenditure.

Printing (including Transactions for 1909–1910, say £20)	£43	2	2
Rooms for Meetings, Tea, etc.	7	0	0
Stationery, Postages, Carriages, etc.	2	13	4
Fire Insurance on Books, etc.	0	5	0
Honorarium to Acting Secretary	10	0	0
Excess of Income over Expenditure	2	14	2
	£65	14	8

State of Funds.

Life Members' Fund.

Balance of Fund at close of Session 1908–1909	£86	7	6
Add—Life Compositions received	5	5	0
	£91	12	6
Deduct—Transferred to Income	8	3	9
Balance as at close of Session	£83	8	9

Ordinary Fund.

Balance of Fund at close of Session 1908–1909	£64	8	2			
Add—Increase during Session 1909–1910, as above	2	14	2			
Balance as at close of Session 1909–1910				67	2	4
Total Funds				£150	11	1
Being:—Sum in Current Account with Union Bank of Scotland Ltd.	£13	16	8			
Sums in Deposit Receipt with do.	180	0	0			
Due by Treasurer	0	16	5			
	£194	13	1			
Less—Printing Accounts outstanding	44	2	0			
As above				150	11	1

Note.—Subscriptions in arrear, 1907–1908, 15s.; 1908–1909, £2, 5s.; 1909–1910, £6.

Edinburgh, *4th November* 1910.—I hereby certify that I have audited the Accounts of the Treasurer of the Botanical Society of Edinburgh for Session 1909–1910, and have found them correct. I have also checked the foregoing Abstract, and find it correct.

ROBT. C. MILLAR, C.A., *Auditor.*

Mr. BENNET CLARK, the retiring PRESIDENT, then gave a short address, and gave accounts of the losses sustained by the Society through death during the past year.

Mr. A. W. BORTHWICK, D.Sc., the newly elected PRESIDENT, then took the Chair.

The PRESIDENT alluded to the retiral of the ASSISTANT SECRETARY, Mr. J. F. JEFFREY, and to his work which he had done for the Society, and to the election of Mr. M'TAGGART COWAN, jun., to that office.

Mr. G. W. SCARTH, M.A., made a short communication on *Scheuchzeria palustris*, Linn., as a British plant, and showed specimens of the plant found by him last summer on the Moor of Rannoch, thus restoring the plant to the British flora.

Mr. W. T. GORDON, M.A., B.Sc., showed a fine set of sections and photographs illustrating the Fossil Flora of the Pettycur Limestone.

Mr. JAMES M'ANDREW showed specimens of *Hieracium pratense*, Tansch., from Leith Docks, and *Poa palustris*, Linn., from New Galloway, Kirkcudbrightshire, and read the following notes upon them :—

"*Hieracium pratense*, Tansch., is mentioned in 'Transactions of the Edinburgh Botanic Society,' vol. x. p. 17, as having been first found in Scotland by the late Professor Balfour and his students on 27th June 1868 between Selkirk and Philiphaugh. Mr. Arthur Bennett writes me that it is recorded from Forres, Elgin, near Haddington, and near Edinburgh. It is found in Northern Europe, Sweden, Lapland, Norway, and Finmark, but is rare in Germany. This year, 1910, I found it in plenty, growing in extensive patches towards the east end of Leith Docks.

"It has a premorse root usually giving off stolons; the stem has stellate, hoary, glandular pubescence; the leaves have a floccose appearance; the phyllaries are dark green, hairy, and setose. In these respects it differs from the other British species.

"*Poa palustris*, L., is recorded in Babington's 'Manual of

British Botany,' new edition, by Messrs. H. & G. Groves, from Kew and Mortlake on the river Thames; by the river Tay below Perth; Benniebeg Pond near Crieff; and by the river Boyne near Navan. It is probably an introduction in these places. As an alien it occurs plentifully in Leith Docks and other places round Edinburgh.

"The specimens shown and named by Professor Hackel were gathered by myself in 1907 on and along the foot of a retaining wall, and at the foot of a hedge opposite, along the public road on the centre hill, north of Kenmure Castle, and near New Galloway, Kirkcudbrightshire, where there is not the slightest suspicion of this grass being an alien. Professor Hackel in his note says: 'You may perhaps find that stone walls are not a proper station for *Poa palustris*, L., but this species is really to be found not so seldom in such localities. Your plant agrees with one in my herbarium from walls near Bozen, Tyrol. It is true that the ligule is the only character that distinguishes *P. palustris*, L., from *P. nemoralis*, L.'"

Mr. Thomas Wilson, Ph.C., showed *Caucalis latifolia*, Linn., from Burntisland.

Mr. William Evans, F.R.S.E., showed a fresh specimen of *Polyporus frondosus*, Fries., from East Lothian.

Mr. R. L. Harrow showed the following plants in flower from the Royal Botanic Garden:—*Calceolaria hyssopifolia, Dendrobium eriafolium, D. pumilum, Habenaria carnea, Saccolabium bigibbum, Oncidium Walenwa, Cœlogyne Wallichiana, Seraphyta multiflora, Clerodendron calamitosum, Acanthosonchus cervicornis, Astilbe simplicifolia, Paphiopedilum concolor.*

DECEMBER 3, 1910.

A. W. Borthwick, Esq., D.Sc., President, in the Chair.

The following were elected Ordinary Members:—

Mr. James R. Matthews.

Mr. George G. Blackwood.

The following communications were read ;—

1. Mites and Acarodomatia. By Professor G. F. Scott-Elliot, M.A., B.Sc., F.L.S. (See p. 126.)

2. Some Hybrid Roses (with exhibition of specimens). By Mr. James R. Matthews. (See p. 135.)

Mr. James Fraser showed specimens of *Centaurium pulchellum*, Druce, from Orchardton Bay, and *Limonium humile*, Mill., from Auchencairn Bay, Kirkcudbrightshire, thus extending the known range of these species in that country.

Mr. M'Taggart Cowan, jun., showed specimens of *Oxalis acetosella*, Linn., var. *subpurpurascens*, D.C., from Mid-lothian (v.c. 83), a new county record.

Mr. Rutherford Hill exhibited an interesting specimen showing a remarkable flattening or fasciation of the stem and branches in the common wallflower, *Cheiranthus Cheiri*, Linn., from the garden of Mr. Fergus F. Stewart, pharmacist, Lasswade. The wallflower as cultivated in gardens is usually a biennial, but the specimen showed an unusually shrubby character, resembling a small bush. Fully eight years ago it had been placed with a little garden soil in a cleft of the garden wall, six inches deep, and about three inches in breadth at the orifice (to give it an opportunity of living up to its reputation of being a wallflower). The place was sheltered, but the plant had only a very slight foothold, and had no attention beyond a small share of manure during garden operations in the springtime. For two successive seasons the plant flowered, but for the last six years it has only been putting on fresh leaves, somewhat smaller and more pointed than usual, and the plant still continues to grow a little. The portion exhibited showed one remarkably fasciated branch, forming a flat expansion about five or six inches broad.

Mr. R. L. Harrow showed the following plants in flower from the Royal Botanic Garden:—*Dendrobium elongatum*, *Dioscorea vittata*, *Hippeastrum reticulatum*, *Lælia rubescens*, *Hibiscus rosa-sinensis* (forma), *Rodriguezia secunda*, *Polygonum capitatum*, *Zygopetalum Mackaii*.

JANUARY 12, 1911.

Mr. J. Rutherford Hill, Vice-President, in the Chair.

Miss C. M. Hawick was elected a Resident Fellow.

The Rev. Dr. Paul read a paper on the *Marattieæ* and *Schizaceæ* of the New World, referring particularly to those species native of Jamaica; he also exhibited a number of herbarium specimens of these ferns.

On behalf of Dr. L. Cockayne, F.L.S., of Christchurch, New Zealand, Corresponding Member of the Society, a paper was read on "The Peopling by Plants of the Subalpine River-bed of the Rakaia (Southern Alps of New Zealand)." (See p. 104.)

Mr. R. L. Harrow showed the following plants in flower from the Royal Botanic Garden:—*Aphelandra aurantiaca Roezlii*, *Acacia Balfouriana*, *Anriganthus breviflorus*, *Dendrobium enosmum delicatum*, *Eria bractentum*, *Epidendrum polybulbon*, *Piqueria trinerria*, *Vanda Amesiana*, *Odontoglossum hunnewellianum*, *Tainia penangiana*.

FEBRUARY 4, 1911.

A. W. Borthwick, Esq., D.Sc., President, in the Chair.

The Rev. E. S. Marshall, M.A., F.L.S., Taunton, was elected an Hon. British Fellow.

Dr. Georg Klebs, Heidelberg, and Dr. Charles Flahault, Montpelier, were elected Hon. Foreign Fellows.

Mr. W. G. Smith, B.Sc., Ph.D., read a paper upon "Arctic-Alpine Plant Associations of Scotland."

Miss Bertha Chandler, M.A., B.Sc., read a note upon "Cells containing Raphides in the pith of *Mesembryanthemum Eckloni*, Salm-Dyck."

Mr. Alexander Cowan read a report upon the excursion of the Scottish Alpine Botanical Club. (See p. 171.)

Mr. James M'Andrew showed specimens of *Bromus rubens*, Linn., gathered by him near Musselburgh (v.c. 83) in 1908 and 1910; and at Leith Docks (v.c. 83) and at Pettycur, Fife (v.c. 85), both in 1909.

Mr. R. Stewart MacDougall showed: (*a*) Galls of *Cecidomyia fagi* on beech leaves; (*b*) Galls of *Eriophyes tiliæ*, var. *liosoma*, on lime leaves; (*c*) Cocoons with live pupæ of *Gastropacha pini* on branches of Scots pine.

Mr. J. Rutherford Hill showed a follicle of *Strophanthus Emini*, also an arrow-head poisoned with *Strophanthus Emini*, and another poisoned with carrion.

Mr. R. L. Harrow exhibited a series of plants in flower from the Royal Botanic Garden.

MARCH 4, 1911.

A. W. Borthwick, Esq., D.Sc., President, in the Chair.

Mr. Arthur H. Evans read a paper upon the Flora of the Fenlands contrasted with that of the Scottish Moorlands. (See p. 164.)

Mr. G. W. Scarth read some extracts from his paper "An Œcological Analysis of the Grasslands of Orkney." (See p. 143.)

Miss B. Chandler, B.Sc., communicated some notes and photographs of "Forced Callus Formation in *Anamapægma racemosa*."

Mr. R. L. Harrow showed a series of plants in flower from the Royal Botanic Garden.

APRIL 13, 1911.

A. W. BORTHWICK, Esq., D.Sc., President, in the Chair.

The following lady was elected an ordinary member:—
MRS. CATHERINE MAXWELL, 13 Albert Terrace.

Mr. J. L. PIKE gave a lantern demonstration of Systematic Forestry in the Black Forest.

Dr. W. G. SMITH showed slides illustrating various Ecological Types.

Mr. W. W. SMITH communicated descriptions and figures of a new genus, *Borthwickia*, named in honour of the President of the Society, and of a new species, *Leycesteria Belliana*, W. W. Smith, both from India. (See p. 175.)

Mr. JAMES FRASER showed specimens of the following plants:—*Agropyrum repens*, Beauv., var. *Leersianum*, Gray, from the margins of fields at Caroline Park, Granton (v.c. 83); *A. repens* × *junceum*, forma *subrepens*, from the shore at Caroline Park, Granton (v.c. 83); *A. pungens*, Roem. and Schult., from St. David's, Fifeshire (v.c. 85); *Aira caryophyllea*, L., var. *multiculis* (Dum.), from Leith Docks (v.c. 83), all of which were observed in their localities during 1910, the last two being first records for Scotland.

Mr. R. L. HARROW showed a series of plants in flower in the Royal Botanic Garden.

MAY 6, 1911.

A. W. BORTHWICK, Esq., D.Sc., President, in the Chair.

Mr. F. L. M'KEEVER read a paper upon *Phæothamnion confervicolum*, Lagerheim, which he discovered for the first time in Britain in the Braid marshes. (See p. 176.)

Dr. BORTHWICK showed a specimen of the so-called "Brown Oak."

JUNE 8, 1911.

A. W. Borthwick, Esq., D.Sc., President, in the Chair.

Mr. J. R. Matthews exhibited specimens of *Lysimachia ciliata* and *Anemone ranunculoides* from Perthshire.

Mr. M'Taggart Cowan exhibited some new "county Records" for Edinburgh and various *Ranunculi* from that district.

JULY 13, 1911.

A. W. Borthwick, Esq., D.Sc., President, in the Chair.

Mr. Wm. Evans communicated a paper on "Further Records for Phanerogams and Ferns from the Isle of May" (See p. 181.)

Mr. J. W. M'Andrew, Edinburgh, showed plants of *Juncus tenuis*, Willd., gathered last month (June) near Lochgilphead, in Argyllshire. It grew along an old by-road running alongside of Lochgilphead cemetery, a mile from the town. He also found it on the north bank of the Crinan Canal west of Oakfield Bridge. It was in plenty.

Miss Alice Trower sent for exhibition a specimen of *Lychnis Preslii*, Seker., found by her near Tantallon Castle, Haddingtonshire, on which Mr. Arthur Bennett has kindly supplied the following note :—

Lychnis Preslii, Sekera, in "Lotus," 1853, p. 133; "Oest. Bot. Wocherbl.," iii., 1853, p. 196: "Flora," 1853, p. 569, 11. bei Münchengräz in Bohemia.

L. diurna β glaberima, Maly, "Enum. Pl. Im. Anst.," 1848, p. 310; and Neilreich, "Nach. zu Maly's En.," 1861, p. 270.

Melandyrum Preslii, Nyman, "Syll. Supp.," 1865, p. 41.

N. rubrum (Weigel), Garcke, "Fl. N. and M. Deutsch.," ed. 4, 1858, p. 55.

M. rubrum (e) glaberrium (Maly), Rohrb. in "Linneæ," xxxvi. p. 213, 1867–70. Richter, "Pl. Europ.," tim. ii., fasc. iii., 1903, p. 328.