

CYATHEACEAE (R. E. Holttum, Kew)

Caudex massive, usually erect and unbranched, where prostrate not dorsiventral in structure; fronds arranged on caudex in spiral series; vascular system of caudex a hollow cylinder with gaps corresponding with leaf-bases, in some cases small medullary bundles also present; a cylinder of very hard sclerenchyma, with gaps at leaf-bases, present both inside and outside the vascular cylinder (but absent in *Cibotium*), the surfaces of the sclerenchyma covered with cubical cells containing silica; tangentially arranged sieve-tubes present in the phloem as well as longitudinal ones. *Stipes* of *Cyathea* containing numerous small vascular strands arranged in 3 series (fig. 6), these strands more or less united in smaller axes of *Cyathea*-fronds and also in larger axes of other genera (fig. 31f, 33d); stipe-bases persistent, or sooner or later caducous leaving a pattern of scars on the caudex; pneumathodes present along each side of stipe, in a single discontinuous or almost continuous row, or in 2–3 rows close together, the row joining upwards to a similar row on the basiscopic side of the first pinna, a \pm circular pneumathode at the base of the pinna beginning the row on the main rachis to the next pinna. *Dermal appendages* on fronds: multiseptate hairs only, or both hairs and scales (*Cyathea*); if both, the hairs often confined to the adaxial surface of the fronds. *Fronds* in most cases bipinnate-tripinnatifid, with varying gradations to tripinnate, in a few cases simply pinnate, in *Culcita* 3–4-pinnate; pinnules almost symmetrical at the base except in *Culcita*; veins normally free except in *Cyathea capitata* and in the genus *Cnemidaria* (trop. America). *Sori* either terminal on veins and protected by an inner indusium as well as by the more or less reflexed edges of a small lobe of the lamina (outer indusium), or apparently not terminal on veins and not near the edge of the lamina, with indusia of various form or without indusia; receptacle of various shape, in all cases containing vascular tissue which in the case of *Cyathea* represents the termination of a short vein; stalks of sporangia short or long, 4 or more cells in transverse section, annulus more or less oblique, with a more or less clearly defined stomium; spores trilete, surfaces smooth or variously sculptured; multiseptate paraphyses, of a single row of cells (terminal cell glandular or not) or scale-like at the base, present with sporangia.

Distribution. Throughout the wetter parts of the tropics, especially on mountains; a few species just north of the tropics, more south of the tropics especially in Australasia. As here construed, 9 genera, of which 5 are Malaysian: *Cyathea* (pantropic, at least 600 spp.); *Cnemidaria* (limited to species with simply pinnate fronds, anastomosing veins and distinctive spores, tropical America, 10 spp.); *Lophosoria* (tropical America, monotypic); *Dicksonia* (tropics and southern subtropics in Malaysia, Australasia, America, St Helena, c. 25 spp.); *Cystodium* (Malaysia, monotypic); *Thyrsopteris* (Juan Fernandez, monotypic); *Culcita* (*subg. Culcita* in Azores and tropical America; *subg. Calochlaena* in Malaysia and Australasia; in all c. 7 spp.); *Cibotium* (SE. Asia, Malaysia, Hawaii, Central America, c. 12 spp.); *Metaxya* (tropical S. America, monotypic).

Fossils. SEWARD gave a summary of knowledge to 1920 (Fossil Plants 2, 365–375). T. M. HARRIS has recently published a fully illustrated account of some Jurassic frond-fossils which he includes in the family *Dicksoniaceae* (The Yorkshire Jurassic Flora, 1, 1961, 140–181), referring them to the genera *Dicksonia*, *Coniopteris* and *Kylikipteris*. Owing to the fragmentary nature of the fossils it is very difficult to judge how they compare with existing ferns. In my judgement, the fossil most like living *Dicksonia* is *Coniopteris hymenophylloides* (BRONGN.) SEWARD; *C. murrayana* BRONGN. is perhaps more like *Culcita*. The Jurassic fossils most resembling *Cyathea* in form of sterile leaflets are placed in the genus *Kylikipteris*; their fertile leaflets have sori at the ends of veins on a reduced lamina, and seem more like those of *Thyrsopteris* than *Dicksonia*. *Kylikipteris* looks like a possible *Cyathea*-ancestor. Though no fossils with *Cyathea*-like sori have been found in the Yorkshire Jurassic, HARRIS described a genus *Aspidistes* which has sori and sporangia resembling *Dryopteris* or *Thelypteris*, spores trilete (known in a few species of

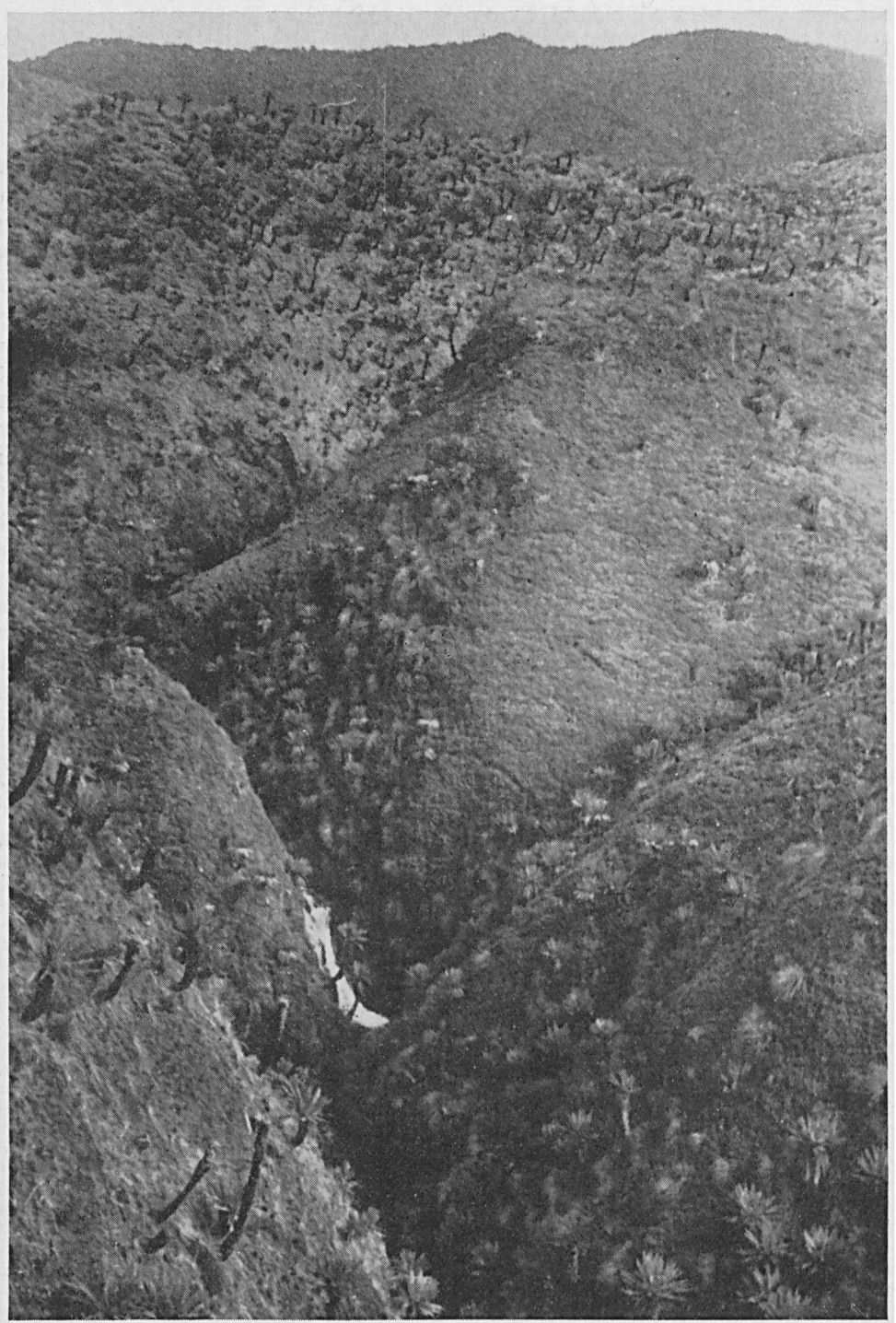


Fig. 1. *Cyathea gleichenioides* C. CHR. and *C. atrox* C. CHR. growing on steep slopes deforested by fire. Murray Pass, Wharton Range, Central Division, Papua, 2840 m (L. J. BRASS, 1933).



Fig. 2. *Cyathea gleichenioides* C. CHR., same locality as fig. 1. Trunks have been blackened by a recent grass fire (L. J. BRASS).

Thelypteris but not in *Dryopteris*) and spherical unicellular glands (common in *Thelypteris*). *Aspidistes* looks like an early *Thelypteris*, and *Thelypteris* has several features in common with *Cyathea*; but one would have expected *Cyathea* to have existed prior to *Thelypteris*. Fossil tree-fern trunks of Lower Cretaceous have also been called *Coniopteris*; they have leaf-scars and vascular system comparable with those of *Cyathea* and *Dicksonia*. OGURA described fossil tree-ferns from Upper Jurassic and Cretaceous rocks of Japan and Korea (J. Fac. Sc. Univ. Tokyo III, 1, 1927, 351–380, pl. 2–8). BANCROFT, describing a fossil Cyatheoid stem from the late Tertiary of East Africa (New Phytol. 31, 1932, 241–253) pointed out that OGURA's fossils differed in some respects from existing *Cyatheaceae*. K. JACOB described impressions of parts of a tree-fern stem from middle Jurassic of NE. India, but the pattern of vascular strands in the leaf-scars is not clearly preserved. He gives references to other descriptions of fossils of presumed Cyatheaceous affinity (Proc. Ind. Ac. Sc. 6, sect. B, 1938, 73–90).

Ecology. Most species are forest plants, with varying degrees of tolerance of exposure to direct sunlight and to drying wind. In Western Malaysia *Cyathea moluccana*, *C. squamulata* and *C. glabra* occur only in quite shady forest and will not tolerate exposure; *C. latebrosa* is most vigorous where it has more light and will tolerate almost full exposure of its crown to the sun; *C. contaminans* is only vigorous where its crown is fully exposed, though its roots need shade. It is probably significant that *C. contaminans*, flourishing in clearings in the forest, is more widely distributed than any other Malaysian species. On high mountains in New Guinea a few species (notably *C. macgregorii*) can tolerate the full exposure of open grassland and will tolerate periodic burning of the grass (fig. 1, 2).

Vegetative morphology. The majority of species are arborescent, and the habit of growth very similar in all genera. The height to which the trunk will grow varies from species to species; full records of this are not available. The lower part of the trunk has many adventitious roots, which become entangled and form a rigid covering of increasing thickness, supporting the base of the trunk; the cover of roots at the base of an old tree-fern is many times thicker than the original trunk. Some species produce branches, either near the base of the trunk or higher up; in the former case there will be a small cluster of trunks, in the latter the main trunk will have lateral crowns of small leaves upon it (fig. 3–4).

SCHOUTE reported an exceptional case in which 33 such lateral branches on one plant formed many roots which coalesced with those of the main trunk, each lateral branch growing upwards and forming a separate trunk; the result was a cluster of trunks all growing out from one great mass of roots, and the nature of the branching could only be seen by removing the roots (Ann. Jard. Bot. Btzg 20, 1906, 198–207).

SCHOUTE also published a detailed study of four cases in which trunks of tree-ferns appeared to branch by bifurcation, remarking that this condition is rare and may be due to injury (Rec. Trav. Bot. Néerl. 11, 1914, 95–192, t. 5–21). He noted that at each bifurcation is an 'Angularblatt', as in ferns with dichotomously branched rhizomes, and he suggested that perhaps there is no sharp distinction between such bifurcation and lateral branching in which the branch occurs on one side of a leaf-base.

Some species of *Cibotium* and *Culcita*, and also *Cystodium sorbifolium*, have prostrate stems with

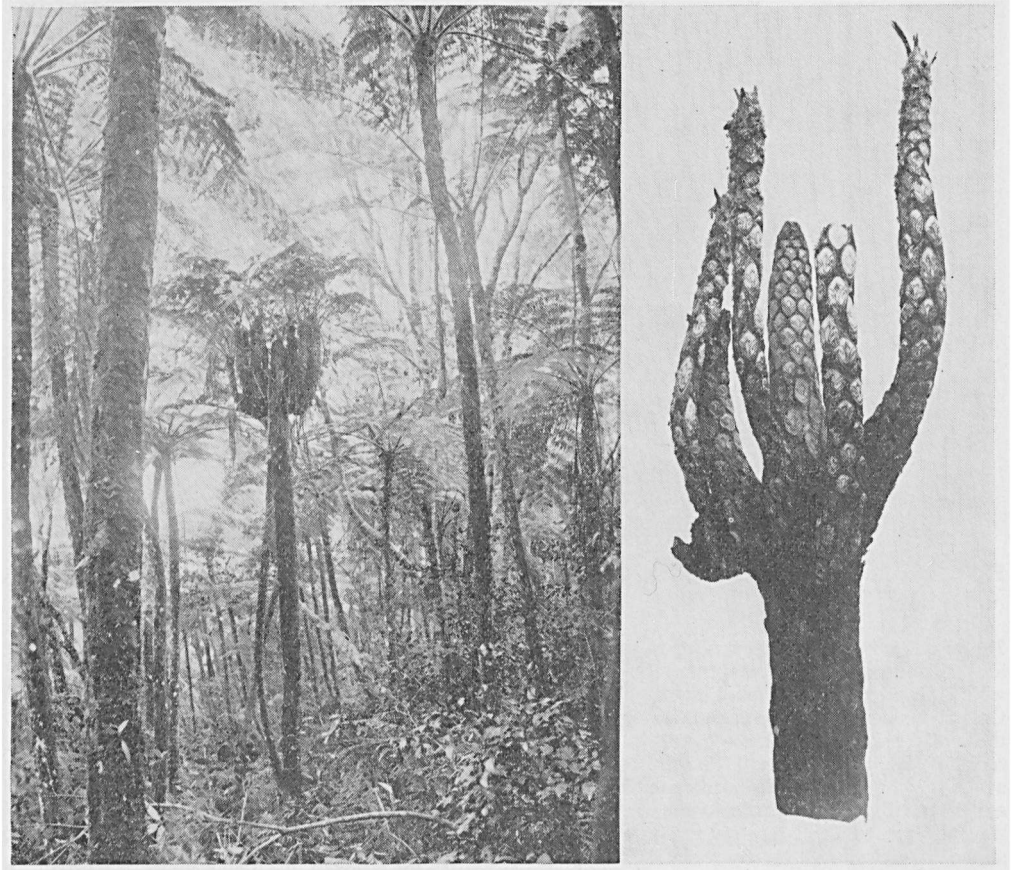


Fig. 3. *Cyathea contaminans* (WALL.) COPEL. with branching of upper part of trunk. Mt Telemojo, Central Java (P. ARENS). —Fig. 4. The branched trunk shown in fig. 3 with fronds removed.

indefinite apical growth; these prostrate stems are massive, with leaves close together, never long-creeping which is a distinction from *Dennstaedtia*, a genus united to *Dicksonia* by HOOKER. The indefinite horizontal growth of these stems contrasts with the vertical growth of the arborescent species, which sooner or later outgrow their mechanical strength if they do not earlier succumb to other injuries. *Cyathea bififormis* has a very slender trunk which supports itself by adventitious roots clinging to a tree-trunk; its fronds are more widely spaced than in arborescent species.

The diameter of the trunk varies considerably, from the very slender *C. bififormis* just mentioned to the massive *C. contaminans* and allied species. The fronds usually break near the base when they are old, their bases persisting for a longer or shorter period; in many cases they are ultimately shed, leaving distinctive scars on the trunk (the scars sometimes later covered by roots). The shape and arrangement of the scars depends on various factors, one being rate of growth of the trunk. A fast-growing trunk will have rather widely spaced frond-scars which are vertically elongated; a slow-growing trunk will have frond-scars closely placed and almost circular (fig. 6). Frond-scars seem always to be in vertical orthostichies, and in several spiral parastichies. SCHOUTE (*l.c.*) described the arrangement of leaf-scars on the branching trunks he examined, and especially the way in which the pattern on the branches is related to that on the parent trunk. In the uniform conditions of the forest of Western Malaysia, new fronds appear singly, but probably they are more abundant following wetter periods. At Tjibodas, West Java, JAAG made observations on seven young plants of *Cyathea contaminans* (*Alsophila glauca*) and found that the average time between development of successive fronds varied from 25 to 28 days, and the life of a single frond from 165 to 200 days; the number of fronds on a single plant varied from 6 to 10, and the time taken for a complete renewal of the whole crown of fronds from 182 to 243 days. An old plant with trunk 10 m tall bore about 12 fronds and the mean time between unfolding of new fronds was 21 days (Mitteil. Naturf. Ges. Schaffhausen 12, 1943, 211–217). It is remarkable that fronds thus ap-

pearing singly leave ultimately the scars of their bases in regular alternate whorls. In New Guinea, HOOG-
LAND has observed that some species produce their fronds in whorls, those of one whorl being simul-
taneous. More observations on phyllotaxis and on rate of growth are needed. There is also the con-
sideration that plants of the same species growing under more or less favourable conditions may vary
considerably in the size of trunk and of fronds. Few Malaysian species have such massive trunks as the
Australian *C. australis* (R. BR.) DOMIN and *Dicksonia antarctica*, which both have fronds in many
orthostichies. JAAG observed three plants of *Dicksonia blumei* at Tjibodas. Each crown usually consisted
of 16-18 fronds, each new frond appearing at an average interval of 22-27 days, the life of a single frond
being 185-191 days.

The pneumathodes which occur along each side of the stipe and rachis often afford distinctive char-
acters in *Cyathea* (fig. 7) but are usually not seen in herbarium specimens, which shrink along the line
of thin-walled tissue. In young fronds the pneumathode has a continuous epidermis containing stomata;
later the epidermis ruptures and the cells of the underlying tissue become more or less separated from
each other, sometimes having peg-like outgrowths.

In shape of frond, shape of leaflets and external form of rachis-branches, *Culcita* and *Thyrsopteris*
differ from the other genera. These differences are summarized as follows. *Fronn-form*: in *Culcita* and
Thyrsopteris broadly deltoid, 3-4-pinnate, stipe always long; in other genera elliptical, usually bipinnate-
tripinnatifid, lower pinnae always somewhat reduced, sometimes much so and then the stipe very short.
Shape of leaflets: in *Culcita* and *Thyrsopteris* very asymmetric at base (broad on adaxial side), with a
gradual reduction from largest to smallest; in other genera nearly symmetrical at base, usually with
many leaflets (pinnules) on each pinna of approximately equal size. *External form of rachis-branches*:
in *Culcita* and *Thyrsopteris* upper surface grooved (fig. 34c), the groove open to admit grooves of smaller
branches and of midribs of leaflets (which are similarly grooved), edge of lamina separately decurrent
on side of rachis-branch; in other genera upper surfaces raised (or at most slightly grooved), midribs of
leaflets also raised (fig. 18b). It may be noted that in all these characters there is more or less complete
agreement between *Culcita* and the *Dryopteris-Athyrium* group of genera, and between the other genera
and the Thelypteroid ferns.

Dermal appendages. In *Dicksonia*, *Cystodium*, *Culcita* and *Cibotium* the dermal appendages are
all simple septate hairs, the longest often quite thick at the base; the characters of the hairs (rigid or
flaccid, long or short, varied colour) especially on the stipe, are always important diagnostically. In
Cyathea there are always septate hairs (sometimes branched near the base) on the upper (adaxial) surface
of stipe and rachises, these hairs rather crisped and antrorse; in most species there are no hairs on the
lower surfaces. All species of *Cyathea* have scales on the lower surfaces, in size decreasing from those on
the base of the stipe to those on costules of pinnule-lobes. The genus may be divided into two subgenera,
subg. Cyathea having flabelloid, *subg. Sphaeropteris* setiferous scales (fig. 8). Where hairs occur on lower
surfaces in *subg. Sphaeropteris* they are rather thick and straight, much as in *Dicksonia*; in *subg. Cyathea*
they are crisped and more or less appressed. For further notes on scales, see *Cyathea*.

Sori. In *Dicksonia*, *Cystodium*, *Culcita* and *Cibotium* the sorus is at the end of a vein (or of the acros-
copic branch of a vein) near the margin; it is protected by a small reflexed marginal lobe (the outer in-
dusium) and by an inner indusium which shows varying degrees of difference from the outer indusium.
The inner indusium is more or less fused to the side of the receptacle remote from the margin (fig. 31b, c).
The surface of the receptacle is not very prominent, but spreads at right angles to the end of the vein.

In *Cyathea* the sorus is usually seated at the fork of a vein, well away from the margin; or where the
veins are not branched, it is apparently in the middle of a vein. There is always vascular tissue in the
receptacle, and this is the end of a short branch-vein. The receptacle is prominent, more or less spherical
or clubshaped. The indusium is of very varied form, with also varying degrees of reduction, and is
sometimes lacking. The *Cyathea* sorus may be compared to *Dicksonia* by considering the form called
Hemitelia (fig. 9c), which has an indusium attached to the base of the receptacle on the side remote from
the margin (there is never an indusium attached only on the marginal side). The beginning of the de-
velopment of such a sorus and of a sorus of *Dicksonia* are identical; the receptacle appears to be on
the true leaf-margin, with an outgrowth on upper and lower sides. In *Dicksonia* the two outgrowths
develop almost equally, in *Cyathea* very unequally so that the sorus is ultimately far from the margin, and
new veins are needed to supply the additional marginal area of leaf-lamina. The derivation of the other
types of *Cyathea* sorus from this one is described under *Cyathea*.

In *Dennstaedtia*, formerly included in *Dicksonia*, the receptacle is more or less columnar and free,
at the end of the vein, and is surrounded by almost completely fused outer and inner indusia; it thus
differs from both *Dicksonia* and *Cyathea*.

Sporangia and spores. Sporangia are not very large, having in most cases 64 spores. The annulus
is in all cases more or less oblique and usually indurated at the base where it passes the stalk. For details,
see BOWER, The Ferns 2 (1926) 266, 282, 301 and fig. 5. The stalk is in all cases rather massive, consist-
ing of 4-7 rows of cells. In genera with the *Dicksonia* type of sorus, where the receptacle is not prominent,
sporangia have rather long stalks; in *Cyathea* and *Thyrsopteris*, where the receptacle is prominent, spo-
rangia-stalks are short. Spores are in all cases trilete, and the sculpturing of the surface varies consid-
erably, though it is always slight in *Cyathea*. The spores of *Cnemidaria* (confined to *C. horrida* and re-

lated species with simply pinnate fronds and anastomosing veins) have an almost spherical cavity in the thickened lateral walls (alternating with the trilete ridges). This tropical American group have the most distinctive spores in the family, and should rank as a separate genus.

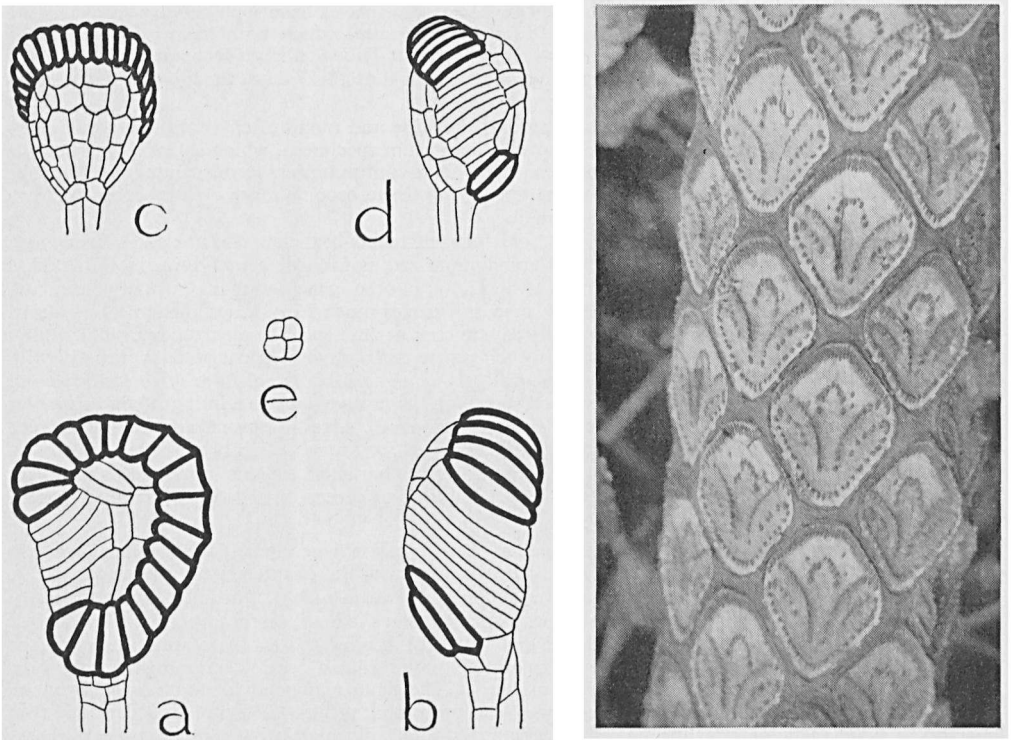


Fig. 5. *Cyathea capensis* (L. f.) Sm. a. Sporangium, outer face showing complete annulus and short stalk, b. same, lateral view to show stomium.—*C. brownii* DOMIN (*Alsophila excelsa* R. Br.). c. Sporangium, inner face, d. same, lateral view, e. transverse section of stalk. All $\times 100$ (after F. O. BOWER, The Ferns, 2, fig. 563).—Fig. 6. *Cyathea contaminans* (WALL.) COPEL. Trunk showing scars after abscission of stipes. Mt Bukit Tungul, W. Java (L. VAN DER PIJL).

Gametophyte. STOKEY gave a comparative account of gametophytes of all genera except *Metaxya* and *Cystodium* (Bot. Gaz. 90, 1930, 1-45). Mature prothalli are longer, with more massive cushion, and with greater tendency to fork, than prothalli of the majority of more specialized ferns. Multicellular hairs of peculiar origin occur abundantly in *Cyathea*, rarely and late in *Lophosoria*, not in the other genera. These hairs are in origin like those only of *Gleichenia* and *Loxsona* (see STOKEY & ATKINSON, Phytomorphology 6, 1956, 260); they are longer in *Cyathea* than in *Gleichenia* and lack terminal glandular cells. Antheridia in all cases are relatively primitive, with wall of 5 cells; those of *Thyrsopteris* are largest and least symmetrical. Archegonia have rather long necks, longer in the *Dicksonia* group of genera than in *Cyathea*.

Cytology. Chromosome numbers in the genera *Dicksonia*, *Culcita* and *Cibotium* have been recorded by MANTON (J. Linn. Soc. Bot. 56, 1958, 84) and in *Cyathea* by MANTON & SLEDGE (Phil. Trans. R. Soc. B, 238, 1953, 137) and by MANTON (Appendix to HOLTUM, Rev. Fl. Malaya 2, 1954, 623); Prof. MANTON also permits me to report unpublished observations on *Culcita* and Dr T. G. WALKER on *Cnemidaria*. No observations are yet available for *Thyrsopteris*, *Lophosoria*, *Metaxya* and *Cystodium*. The numbers are: *Dicksonia*, $n = 65$ (3 spp.); *Cibotium*, $n = 68$ (2 spp.); *Cyathea*, $n = 69$ (several spp.); *Cnemidaria horrida*, $n = 69$; *Culcita macrocarpa*, $n = 66$ approx.; *Culcita dubia*, $n = 58$.

Anatomy. The first critical account of anatomy in this family was by METTENIUS, in the course of his study of *Angiopteris* (Abh. M.-Ph. Kl. K. Sächs. Ges. Wiss. 6, 1863, 525-531, t. V.) The most recent full account of the anatomy of members of *Cyatheaceae* is by OGURA (J. Fac. Sc. Imp. Univ. Tokyo, Bot. 1, 1927, 141-350).

U. SEN has recently completed a new anatomical study of the family, summarized in HOLTUM & SEN

(Phytomorphology 11, 1961, 406-420). The vascular structure, with its accompanying sclerotic tissue, is very similar in all Malaysian genera except *Cibotium*; it is most fully developed in *Cyathea*, to which the following notes apply. As seen in a transverse section of the trunk, there are several meristeles, with gaps between them, together forming a hollow cylinder, the gaps corresponding to leaf-bases. On the outer and inner sides of each meristele are plates of very hard sclerotic tissue. Small vascular strands arise from the margins of the gaps and supply the leaves, and in *Cyathea* there are also small medullary bundles which anastomose with each other and with the meristeles. Distinctive 'cubical cells' form a more or less continuous layer surrounding each mass of sclerenchyma; their walls adjacent to each other and to the sclerenchyma are much thickened, and they contain crystals which appear to be silica. The sclerotic tissue, with its cubical cells, is lacking in *Cibotium*. In the phloem are tangentially elongated cells, in structure like the longitudinal sieve-tubes; such cells are only otherwise known to occur in *Osmunda*. The pattern of arrangement of the numerous vascular strands in the stipe of *Cyathea* is distinctive; in other genera they are more or less joined. In the smaller axes of the frond the pattern is progressively simplified. The stomata of *Cibotium* show more complex developmental stages than those of the other genera.

Economic importance. OCHSE & BAKHUIZEN VAN DEN BRINK reported the use of coiled young fronds of *Cyathea contaminans* and *C. junghuhniana* (mis-named *C. latebrosa*) as food, also the pith of young parts of the trunk of the former species (Vegetables D. E. I., 1931, 212-215). Other species (perhaps all) are similarly edible; HOOGLAND notes this of some from the mountains of New Guinea. The pith of trunks was formerly eaten by Maoris in New Zealand. The common name in Java and Sumatra for the larger tree-ferns, *Pakis* (or *Paku*) *tiang* (*tiyang*, *teehang*), indicates the use of the trunks as posts; this name does not seem to have been noted in the Malay Peninsula. The sclerenchyma of most tree-fern trunks is exceedingly hard and durable, and provides nearly all the mechanical strength when they are used as posts. It also provides an interesting pattern when cut in different ways, and this effect is used in the construction of ornamental objects in various parts of the world. In North Borneo I noted old tree-fern trunks, hollowed out, in use as bee-hives around Dusun houses. On Mt Patuha, W. Java, hollowed tree-fern trunks are filled with carbide gas for making booms on New Year's eve. The masses of adventitious roots at the bases of *Cyathea* trunks are used in orchid culture, either as solid slabs (cut with a saw) or broken, in potting mixtures.

Taxonomy. BERNHARDI (in Schrader, Neues J. Bot. 1, ii, 1806, 1-204) attempted a classification of ferns according to the form and position of the annulus of a sporangium, proposing a division into *Helicogyrateae* (including *Cyathea* and *Dicksonia*), *Cathetogyrateae* (majority of leptosporangiate ferns), *Pseudogyrateae* (including *Gleichenia* and *Agyrateae*). PRESL (Tentamen, 1836) varied this by associating *Gleichenia* and *Cyathea* (*sens. lat.*) in *Helicogyrateae* and placing *Dicksonia* (under the name *Balantium*) in *Cathetogyrateae*. HOOKER (Sp. Fil., 1844 and Syn. Fil., 1868) arranged all ferns in seven suborders, all genera here treated being included in suborder *Polypodiaceae*; they are divided as tribe *Cyatheae* (*Cyathea*, *s.l.*) and tribe *Dicksoniae* (all other genera, also some additional ones). METTENIUS (Fil. Hort. Bot. Lips., 1856) arranged all ferns in eight orders, of which the second was *Cyatheaceae*, which corresponded exactly with the present arrangement with the addition of *Matonia* (METTENIUS used the name *Balantium* in place of *Dicksonia*). CHRIST (Farnkr. d. Erde, 1897), DIELS (in Engl. & Prantl, Pflanzenfam. 1, Abt. 4, 1899, 113-139) and CHRISTENSEN (Ind. Fil., 1905) adopted a family *Cyatheaceae* with the same content as the order *Cyatheaceae* of METTENIUS, with omission of *Matonia*. BOWER, however, believed that *Cyathea* and its near allies should be associated closely with *Gleicheniaceae*, as one of the more primitive elements of the series *Superficiales*, while he placed *Dicksonia* and allies in the series *Marginales*, regarding the separation of the two as 'long overdue' (The Ferns 2, 1926, 326). This idea was followed by CHRISTENSEN in 1938 (in Verdoorn, Man. Pterid., 532, 533), where he recognized two families, *Dicksoniaceae* and *Cyatheaceae*. BOWER's arrangement involves the assumption that primitive *Cyathea*, like *Gleichenia*, was exindusiate, so that indusia in his *Cyatheaceae* are a new development, not homologous with the inner indusium of *Dicksonia* (*l.c.* 304). In this he disagreed with GOEBEL (Flora 105, 1913, 45), who regarded the indusium of *Hemitelia* (now included in *Cyathea*) as strictly homologous with the inner indusium of *Dicksonia*. COPELAND (Gen. Fil., 1947) included *Dicksonia* and allies in a family *Pteridaceae*, associating with them *Lindsaea*, *Dennstaedtia*, etc., while maintaining *Cyathea s.l.* in a separate family *Cyatheaceae*. HOLTUM & SEN have published a discussion of the whole question (Phytomorphology 11, 1961, 406-420), with the conclusion that GOEBEL's contention was correct; they give a new subdivision of the family *Cyatheaceae*, as here constituted, based partly on new evidence. This subdivision is summarized as follows.

CONSPECTUS OF THE FAMILY

Subfamily Cyatheoideae.

Fronds normally bipinnate with lower pinnae more or less reduced; pinnules almost symmetrical; upper surfaces of costae and pinna-rachis raised (or, if grooved, the groove of a major axis not open to admit that of a minor one borne upon it); sori terminal on veins or on lower surface of veins, indusiate or not; dermal appendages hairs or scales or both; cubical cells present in association with sclerenchyma; stomata with single subsidiary cell.

Tribe **Cyathea**.

Scales and hairs present as dermal appendages; sori superficial, indusiate or not; cubical cells in continuous layer on surfaces of sclerenchyma.

Fronds mostly bipinnate; veins almost always free; spores with thin walls of uniform thickness, smooth or papillose; indusium various or lacking 1. *Cyathea*

Fronds simply pinnate with anastomosing veins; spores with wall much thickened, a spherical hollow in the middle of each face; indusium hemitelioid (c. 10 spp., tropical America) (*Cnemidaria*)

Tribe **Lophosorieae**.

Hairs only as dermal appendages; sori superficial, no indusia; cubical cells singly in association with sclerenchyma (1 sp., tropical America) (*Lophosoria*)

Tribe **Dicksonieae**.

Hairs only as dermal appendages; sori marginal, protected by slightly modified marginal lobe of lamina (outer indusium) and a thinner inner indusium; receptacle of sorus fused to inner indusium.

Fronds bipinnate with deeply lobed pinnules, or tripinnate; stem usually a thick erect trunk; cubical cells as in *Cyathea* 2. *Dicksonia*

Fronds bipinnate with simple pinnules; stem prostrate; condition of cubical cells not known.

3. *Cystodium*

Subfamily **Thyrsopteridoideae**.

Fronds 3-4-pinnate, lowest pinnae largest; leaflets asymmetric; upper surface of axes and of leaflet-midribs grooved, grooves of major axes open to admit those of minor ones; sori at ends of veins; cubical cells present; stomata with single subsidiary cell.

Tribe **Thyrsopterideae**.

Fertile and sterile parts of frond strongly dimorphous (lamina much reduced in fertile part); receptacle of sorus columnar with sporangia all round it, indusium ultimately a shallow uniform cup; stem massive, erect; cubical cells scattered (1 sp., Juan Fernandez Is) (*Thyrsopteris*)

Tribe **Culciteae**.

Fertile and sterile parts of frond not greatly dimorphous; receptacle of sorus fused to inner indusium (as in *Dicksonia*); inner indusium thinner than outer, the two slightly joined together at the base; stem prostrate or erect; cubical cells in a continuous layer as in *Dicksonia* 5. *Culcita*

Subfamily **Cibotioideae**.

Fronds normally bipinnate; pinnules almost symmetrical; upper surfaces of pinna-rachises and costae raised; sori terminal on veins, shape much as in *Dicksonia* but with outer and inner indusia both unlike the lamina of the frond, lacking chlorophyll and lacking intercellular spaces; sclerenchyma and cubical cells lacking; stomata with 3 subsidiary cells 4. *Cibotium*

Subfamily **Metaxyoideae**.

Fronds simply pinnate, pinnae lobed on young plants only; upper surface of rachis and of midribs of pinnae grooved, groove of rachis open to admit grooves of pinna-midribs; sori superficial on lower surface of veins, usually more than one to a vein, no indusium; sclerenchyma and cubical cells lacking; stomata with 3 subsidiary cells (1 sp., tropical America) (*Metaxya*)

ARTIFICIAL KEY TO MALAYSIAN GENERA

- 1. Upper surface of costae of ultimate leaflets raised; fronds ± elliptical, mostly bipinnate.
- 2. Young parts of plant protected by scales and hairs 1. *Cyathea*
- 2. Young parts of plant protected by hairs only.
- 3. Outer indusium not distinct from rest of lamina.
- 4. Pinna-rachis raised on upper surface; fertile pinnules deeply lobed. 2. *Dicksonia*
- 4. Pinna-rachis grooved on upper surface; fertile pinnules not lobed. 3. *Cystodium*
- 3. Outer indusium quite distinct from lamina of leaflet 4. *Cibotium*
- 1. Upper surface of costae of ultimate leaflets grooved, the groove decurrent into the groove of the supporting rachis; fronds deltoid in outline, 3-4-pinnate 5. *Culcita*

1. **CYATHEA**

SMITH, Mem. Ac. Turin 5 (1793) 416; SWARTZ, Syn. Fil. (1806) 139, 364; KAULF. En. Fil. Chamisso (1824) 254; PRESL, Tent. Pterid. (1836) 54; HOOK. Gen. Fil. (1839) t. 23; Sp. Fil. 1 (1844) 14; Syn. Fil. (1865) 16; J. SMITH, Lond. J. Bot. 1 (1842) 659-668; Hist. Fil. (1875) 244; CHRIST, Farnkr. Erde (1897) 10, 317; DIELS in E. & P. Pfl. Fam. 1, 4 (1899) 123; COPEL. Philip. J. Sc. 3 (1909) Bot. 353; Gen. Fil. (1947) 95.—*Sphaeropteris* BERNH. in Schrader, J. Bot. 1800, ii (1801)

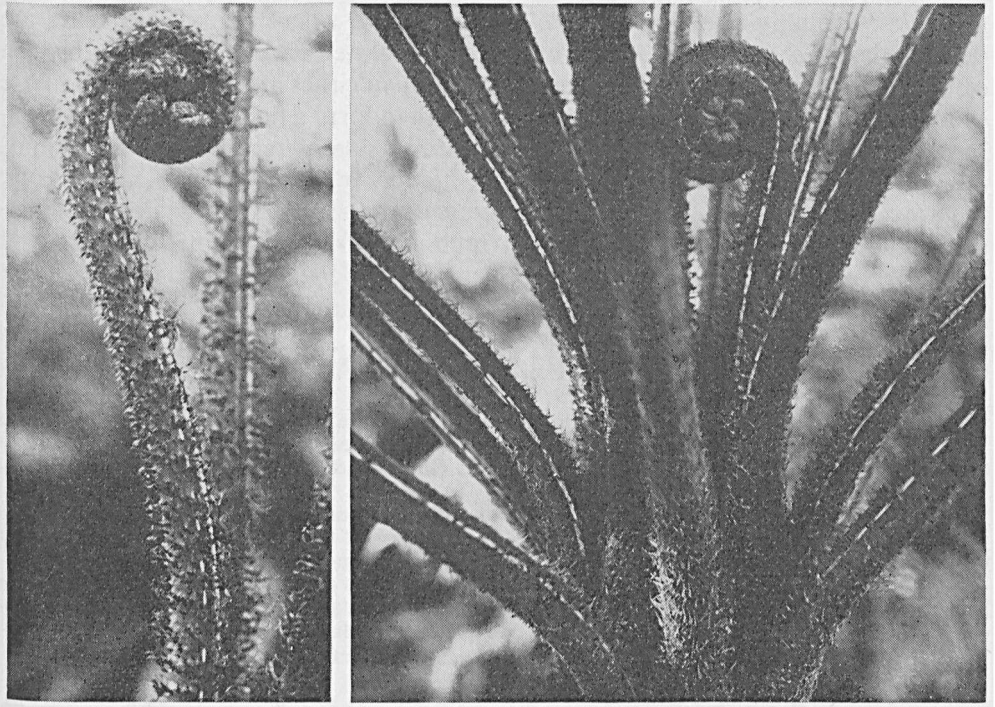


Fig. 7. On left *Cyathea orientalis* (KUNZE) MOORE, young frond showing widely-spaced short pneumathodes. On right *C. incisoserrata* COPEL., bases of stipes showing almost continuous and often double rows of pneumathodes. Cult. R. B. G. Kew (R. VAN CREVEL, 1961).

122.—*Hemitelia* R. BR. Prod. (1810) 158, *p.p.* (*excl. H. horrida*).—*Alsophila* R. BR. *l.c.*—*Chnoophora* KAULF. En. Fil. Chamisso (1824) 250.—*Gymnosphaera* BL. En. Pl. Jav. (1828) 242; COPEL. Gen. Fil. (1947) 98.—*Disphenia* PRESL, Tent. Pterid. (1836) 55.—*Schizocaena* J. SM. in Hook. Gen. Fil. (1838) t. 2; COPEL. Gen. Fil. (1947) 99.—*Amphicosmia* GARDNER, Lond. J. Bot. 1 (1842) 441.—*Dichorexia* PRESL, Abh. K. Böhm. Ges. Wiss. V, 5 (1848) 55.—*Fourniera* BOMMER, Bull. Soc. Bot. France 20 (1873) xix.—*Eatoniopsis* BOMMER, *l.c.*—*Thysanobotrya* V. A. v. R. Bull. Jard. Bot. Btzg II, n. 28 (1918) 66.—Fig. 1-30.

Trunk always erect, short or tall. *Scales* present on lower (abaxial) and lateral surfaces of axes of frond, at least in early stages of growth, larger ones on stipe and rachis sometimes borne on spine-like outgrowths; *hairs* always on upper surfaces of all but smallest axes, antrorse, sometimes branched; hairs of various kinds sometimes on lower surfaces of axes and veins, rarely on lamina between veins. *Pneumathodes* present in a discontinuous line (or 2-3 lines close together) along each side of stipe and rachis, in *subg. Cyathea* converging downwards on each side of base of stipe and there often deeply excavated at maturity (fig. 7, 12). *Fronde* ± elliptical, lower pinnae always smaller than middle ones, sometimes gradually much reduced and then the stipe short; *pinnae* normally pinnate-bipinnatifid, in a few cases simple, in a few cases fully bipinnate; *pinnules* almost symmetrical at the base, many on each pinna subequal, distal ones more or less abruptly decreasing; upper surface of *pinna-rachis* and costa raised; *veins* simple or branched,

lower ones usually once forked, sometimes pinnate where pinnule-segments are deeply lobed. *Sori* usually at the fork of a vein, or seated on a simple vein, a branch of the vein always entering the receptacle; *indusium* either attached all round base of receptacle and covering young sorus, opening to form a firm-edged cup or opening by irregular rupture, or attached on costular side of receptacle (hemiteloid) and of varying size, in some cases quite hidden by mature sorus, or lacking; *receptacle* erect, \pm club-shaped to spherical; *sporangia* many, always short-stalked; *paraphyses* usually present as multicellular hairs, sometimes flat and several cells wide at base; in some species of *subg. Sphaeropteris* scales present round base of receptacle, more or less covering young sporangia; *spores* thin-walled, smooth or papillose.

Type-species: *Cyathea arborea* (L.) SM. (tropical America).

Distr. & Ecol. See under the sections.

Morph. *Dermal appendages*. Scales on the stipes of *Cyathea* are of two kinds, and these appear to provide the best subdivision of the genus, at least in Malaysia. The two types of scale are called *flabelloid* and *setiferous* (see HOLTUM, Kew Bull. 1957, 41-45; HOLTUM & SEN, Phytomorphology 11, 1961, 406-420).

Flabelloid scales (fig. 8a, b) have a broad median portion consisting of longitudinally elongated cells with all walls thickened, and edges, of varying width, consisting of thin-walled cells diverging fan-wise outwards, with irregularly projecting marginal cells, some of them sometimes thick-walled and dark, often flexuous (fig. 9a, b). The scales develop at the apex of more or less massive (multicellular) outgrowths from the surface of the stipe and at right angles to these outgrowths (thus parallel to the surface of the stipe); the base of a scale is peltate, with a narrow part encircling the supporting outgrowth on the

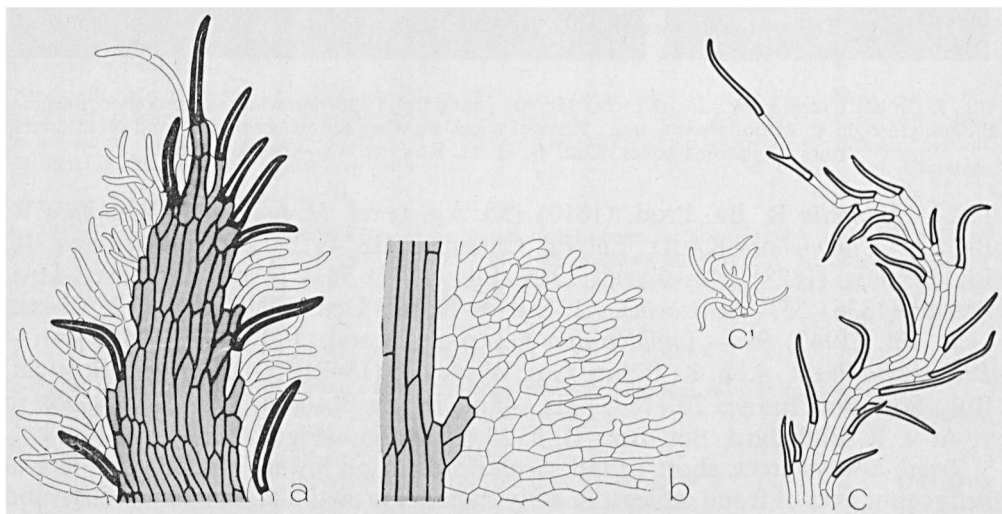


Fig. 8. *Cyathea oinops* HASSK. a. Scale from costa of pinnule, showing median band of dark thick-walled cells and flabelloid margins of thin-walled cells with a few very thick-walled setae, $\times 70$.—*C. incisoserata* COPEL. b. Part of flabelloid margin of scale from stipe, $\times 100$.—*C. squamulata* (BL.) COPEL. c. Apical part of scale from costa of a pinnule, showing setiferous (not flabelloid) edge, $\times 70$, c'. two very small scales from costa, $\times 70$.

basiscopic side. The outgrowths become very large and spine-like in some species, in others they are quite small. As one proceeds from the base of the stipe to the ultimate axes, the scales become progressively smaller, and their character changes in ways characteristic of individual species. These scales provide some of the most important diagnostic characters in *Cyathea*.

Setiferous scales (fig. 8c, c') also develop at the apex of outgrowths from the surface of the stipe, but not at right angles to the outgrowths; the base of a scale widens more or less abruptly from the apex of the outgrowth, and in *C. sangirensis* may be seen transitions from stout erect hairs (like those of *Dicksonia*) to setiferous scales. All cells in setiferous scales are longitudinally elongate and all have walls

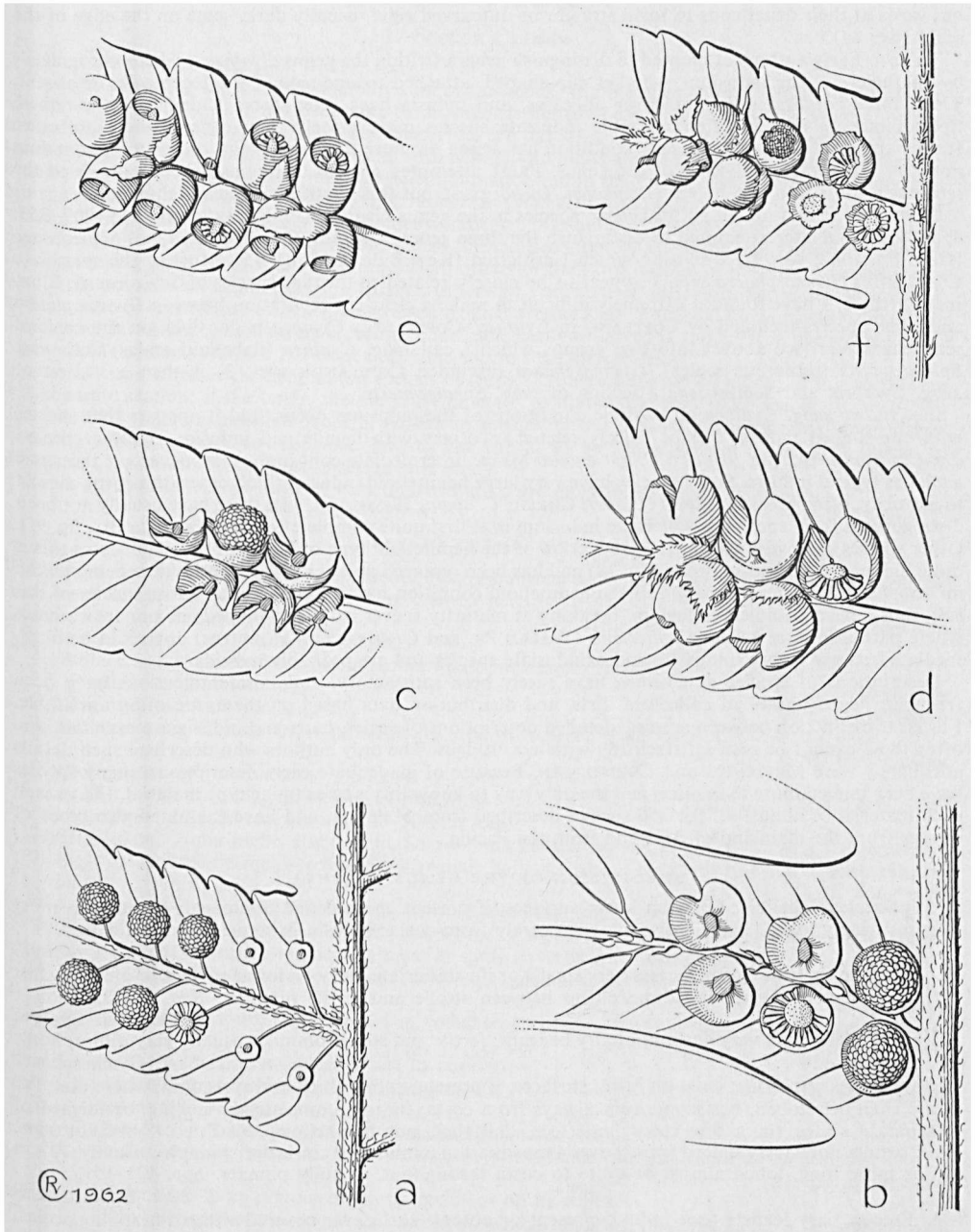


Fig. 9. Different types of indusia in subg. *Cyathea*. *a. C. batjanensis* (CHRIST) COPEL.; indusium a small disc covered by mature sorus.—*b. C. javanica* BL.; indusium saucer-shaped, often asymmetric.—*c. C. heterochlamydea* COPEL.; indusium attached on costular side of receptacle, covering part of base of mature sorus.—*d. C. oinops* HASSK.; indusium covering sorus almost to maturity, but open on side remote from costule (two indusia cut to show receptacle, costular scales also shown).—*e. C. orientalis* (KUNZE) MOORE; indusium a complete rather deep cup.—*f. C. crenulata* BL.; indusium very fragile, covering sorus completely to maturity, then breaking irregularly and in part disappearing (*a*, $\times 6$; *b-f*, $\times 10$; *a* DE VRIESE 323, *c* ELMER 11634, *d* MATTHEW *s.n.*, *e* KOORDERS 37469, *f* MEIJER 119).

of equal thickness (they are rarely so thick as in flabelloid scales); some marginal cells grow obliquely outwards at their distal ends to form straight or outcurved rigid, usually dark, setae on the edge of the scale (fig. 8a).

Taxon. Early authors attempted to distinguish genera (within the genus *Cyathea* as here recognized) by characters of the indusium, whether cup-shaped, attached to one side of the receptacle, or absent. These three conditions do not cover all cases, and indusia have often been inadequately described. Species lacking indusia often resemble indusiate species more closely than other exindusiate ones. It thus appears that the exindusiate condition has arisen on more than one evolutionary line, and it does not give a natural subdivision of the genus. PRESL attempted also to distinguish species in which the receptacle splits into two halves (*Disphenia*, *Dichorexia*), but this is not a significant character.

COPELAND at first united all Malaysian species in the genus *Cyathea* (Philip. J. Sc., Bot. 3, 1909, 353; 4, 1909, 28) but later attempted to distinguish the three genera *Cyathea*, *Gymnosphaera* and *Schizocaena* (Gen. Fil. 1947, 94-99), a division which I criticized (Kew Bull. 1957, 41-45). Most of the species of COPELAND's *Gymnosphaera* sect. 3 appear to be closely related to the type species of *Schizocaena*. Eliminating these, I have found it extremely difficult to make a clear-cut separation between *Gymnosphaera* and some species included by COPELAND in *Cyathea*. COPELAND's *Cyathea* is divisible, on the basis of scale-characters (see above) into two groups which I call *subg. Cyathea* (flabelloid scales) and *subg. Sphaeropteris* (setiferous scales). *Gymnosphaera* (excluded COPELAND's sect. 3) is then a section of *subg. Cyathea*, and *Schizocaena* a section of *subg. Sphaeropteris*.

In *Cyathea* *subg. Cyathea* all possible conditions of the indusium occur, and it appears that species with cup-shaped indusia can be closely related to others with hemiteloid indusia; in some species, e.g. *C. javanica* BL. (fig. 9b) and *C. hymenodes* METT., intermediate conditions may occur on the same leaflet as typical indusia. Some species have very large hemiteloid indusia which cover the sorus almost to maturity, often breaking later (*C. loheri* CHRIST, *C. oinops* HASSK., fig. 9d); these have usually not been distinguished from species in which the indusium is at first quite complete (e.g. *C. crenulata* BL., fig. 9f). Other species show various stages of reduction of the hemiteloid type of indusium; in many cases this is quite hidden by the mature sorus (fig. 18) and has been reported as lacking (the species thus being placed in *Alsophila*). In *subg. Sphaeropteris* the hemiteloid condition has not been found. Most species of this subgenus have a complete indusium, breaking at maturity (never truly cup-shaped) or none; two cases where partial indusia occur (*C. alternans* (WALL.) PR. and *C. discophora* HOLTUM) appear to be intermediate between fully exindusiate and exindusiate species and are probably hybrids.

Descriptions of species of *Cyathea* have rarely been satisfactory, and misidentifications have been frequent; hence names in collectors' lists, and distribution data based on them, are often unreliable. For clear distinction between species, detailed descriptions of scales, hairs and indusia are essential, and often these cannot be seen satisfactorily with a $\times 10$ lens. The only authors who described such details adequately were METTENIUS and CHRISTENSEN. Because of inadequate early descriptions, many species have been named more than once, and the only way to know this is to examine type material. I have seen such material of almost all the 350 species described from Malaysia, and have examined also types of species from the mainland of Asia and from the Pacific.

SUBDIVISION OF THE GENUS CYATHEA

1. Stipe-scales flabelloid; hairs on lower surfaces, if present, crisped and appressed; pinnules in most cases deeply lobed, basal basicopic vein rarely from costa; indusia in some cases hemiteloid.
 - SUBG. CYATHEA.
 1. *Sect. Cyathea*
 2. Exindusiate; axes very dark, not hairy beneath; fertile and sterile pinnules usually very dimorphous. *Spp.* 104-120 2. *Sect. Gymnosphaera*
 1. Stipe-scales setiferous; hairs on lower surfaces, if present, rather thick and spreading; where pinnules are shallowly lobed, basicopic vein always from costa; indusia complete, or lacking, or formed of separate scales (in a few cases imperfect, and then not hemiteloid). SUBG. SPHAEROPTERIS.
 3. Costules not widely spaced (rarely over 4 mm apart in pinnules 10 cm long); pinnules usually 10 cm or more long, lobed almost or quite to costa throughout, or fully pinnate. *Spp.* 121-151.
 3. *Sect. Sphaeropteris*
 4. Free tertiary leaflets few; indusia present or absent; sori never covered with overlapping scales. *Spp.* 121-143 3a. *Subsect. Sphaeropteris*
 4. Free tertiary leaflets many; no indusia; sori covered with overlapping scales. *Spp.* 144-151.
 - 3b. *Subsect. Fourniera*
 3. Costules widely spaced (at least 4 mm apart except where pinnules are under 4 cm long); pinnules mostly less than 10 cm long, not lobed to within 1 mm of costa except near base; basal basicopic vein always from costa; indusiate or not. *Spp.* 152-191. 4. *Sect. Schizocaena*
 5. Scales of stipe 1 cell thick throughout. *Spp.* 152-178 4a. *Subsect. Schizocaena*
 5. Scales of stipe thick and fleshy at base, tapering and flat distally (fig. 30). *Spp.* 179-191.
 - 4b. *Subsect. Sacropholis*

Subgenus *Cyathea*

1. Section *Cyathea*

Distr. Pantropic.—Fig. 1-2, 7-18.

Taxon. This is by far the largest subdivision of the genus, and includes species with all forms of indusia and with none. I have not been able to distinguish sharply defined groups which could appear as main divisions of the key. The main key-characters are based on indusia, and allied species are sometimes separated by this method. The species with hemitelioid indusia are the most difficult to characterize clearly; this group is particularly polymorphic in Sumatra and in the Philippines. There may be hybrids, but the remarkably uniform characters of *C. latebrosa* (WALL.) COPEL., a common species in Malaya of which I have seen a large number of specimens, indicates that quite small differences can be constant. Size of pinnules is not a reliable character, unless one can see ample material; plants growing in exposed conditions may have much smaller pinnules than others of the same species in the shade. However, the very large pinnules of *C. incisoserrata* COPEL., otherwise very near *C. latebrosa*, appear to be constant, and are exactly reproduced in new plants raised from spores at Kew. For local floras it will probably be possible to devise keys based on macroscopic characters easily observed in the field; in preparing keys to cover all Malaysian species, I have not been able to use such characters.

I am not sure whether the hemitelioid species of tropical America should be placed in this section, or in a separate section; if the latter, the name *Hemitelia* is available for them (type-species *H. multiflora* (SM.) R. BR.). Some exindusiate tropical American species appear distinct in their dermal appendages. These have been referred to *Alsophila*, but do not appear to be nearly related to the type-species of *Alsophila*, *A. australis* R. BR.; they need further study.

Ecol. All species, except those of very high altitudes, are more or less shade-demanding.

KEY TO THE SPECIES

- 1. Pinnules not over 30 mm long; segments mostly constricted at base or the lower ones quite free.
- 2. Lower surface of pinna-rachis bearing crisped hairs.
- 3. Sori lacking indusia 1. *C. lepidoclada*
- 3. Sori indusiate; indusium cup-shaped.
- 4. Bullate scales present on pinna-rachis and/or costae; stipe-scales to 2 mm wide.
- 5. Pinnules to c. 30 mm long 2. *C. microphylloides*
- 5. Pinnules to c. 15 mm long 3. *C. perpelvigera*
- 4. Bullate scales lacking from pinna-rachis and/or costae; stipe-scales to 3½ mm wide. 4. *C. hunsteiniana*
- 2. Lower surface of pinna-rachis not hairy.
- 6. Longest pinna 8½ cm, pinnules to 11 mm long 5. *C. arfakensis*
- 6. Longest pinna 22-26 cm, pinnules 23-30 mm long.
- 7. Stipe 30 cm. Pinna-rachis glabrescent. Sori 4-5 to each tertiary leaflet 6. *C. ledermannii*
- 7. Stipe 10 cm. Pinna-rachis covered with small bullate scales. One sorus at base of each tertiary leaflet 7. *C. hooglandii*
- 1. Pinnules longer, or if under 30 mm long without free basal segments.
- 8. Indusium an entire cup with even edge at maturity of sorus, if fragile sometimes breaking later.
- 9. Lower surface of lamina-segments almost or quite covered with scales and hairs.
- 10. Small scales abundant on lower surface of veins; costal scales mostly bearing dark setae. 8. *C. percrassa*
- 10. Crisped hairs on lower surface of veins; costal scales bearing many slender crisped marginal hairs. 9. *C. vandeusenii*
- 9. Lower surface of lamina-segments not so covered.
- 11. Lower surface of lamina strongly glaucous 10. *C. pruinosa*
- 11. Lower surface of lamina not glaucous.
- 12. Bullate-based scales present on pinna-rachis and/or costae.
- 13. No fine crisped hairs on lower surface of pinna-rachis nor on edges of its scales. 11. *C. pycnoneura*
- 13. Fine crisped hairs present on pinna-rachis or on its scales.
- 14. Indusial cup shallow. Small scales on pinna-rachis bearing very fine hairs; no coarse crisped hairs; bullate scales only on distal part of pinna-rachis 12. *C. rigens*
- 14. Indusial cup deep. Crisped hairs, not small fringed scales, also bullate scales, present on pinna-rachis 13. *C. everta*
- 12. Bullate-based scales lacking on pinna-rachis and/or costae (at most convex ovate brown scales on costa).
- 15. Lower surface of pinna-rachis covered with crisped hairs 14. *C. cincinnata*
- 15. Lower surface of pinna-rachis lacking such hairs.
- 16. Pinna-rachis almost glabrescent on lower surface.
- 17. Larger pinnules bearing c. 6 pairs of free tertiary leaflets 15. *C. subtripinnata*

17. Larger pinnules bearing at most one pair of free leaflets.
 18. Pinnules commonly to 100 mm long, basal lobes not free. Long brown scales lacking on costae 16. *C. orientalis*
 18. Pinnules commonly to 65 mm long, basal pair of lobes free. Long dark scales abundant on costae 17. *C. apoensis*
16. Pinna-rachis persistently scaly on lower surface.
 19. Scales on pinna-rachis mostly narrow, 4–5 mm long, with long flexuous marginal setae. Stipe over 20 cm 18. *C. costalisora*
 19. Scales on pinna-rachis mostly very small, some or all bearing short setae. Stipe c. 10 cm.
 20. Scales on pinna-rachis dark, all setiferous. 19. *C. pallidipaleata*
 20. Scales on pinna-rachis thin, short-fringed, mostly not setiferous, forming a continuous felt. 20. *C. coactilis*
8. Indusium otherwise or lacking.
 21. Indusium at maturity an almost flat disc, symmetric or not, in some cases hidden by mature sorus, in some cases the residual part of a complete indusium of which the thin apical parts falls away at maturity.
 22. Indusium a very narrow ring round base of receptacle.
 23. On lower surface of pinna-rachis and costae very small scales bearing long crisped hairs, or single crisped hairs.
 24. Scales on costae bullate-based to bullate 21. *C. parva*
 24. Scales on costae flat or lacking, not bullate.
 25. Broad flat pale scales with a few marginal setae on costae 22. *C. wengiensis*
 25. Broad flat setiferous scales lacking on costae. 23. *C. batjanensis*
 23. On lower surface of pinna-rachis small scales with short fringe of hairs. 24. *C. ternatea*
 22. Indusium ultimately a regular or irregular disc, almost or quite as big as base of sorus; if irregular, usually the base of a formerly complete indusium.
 26. Indusium at maturity a disc with fairly even edge (except in *C. patellifera*).
 27. Pinna-rachis hairy on lower surface, at least distally.
 28. Pinna-rachis bearing copious bullate-based scales on lower surface . 25. *C. albidosquamata*
 28. Pinna-rachis lacking such scales.
 29. Pinnules to at least 85 by 20 mm, veins 8–10 pairs.
 30. Pinna-rachis and costae densely hairy on lower surface; costae glabrous or nearly so on upper surface 26. *C. javanica*
 30. Pinna-rachis hairy towards apex only; costae with few hairs on lower surface, many on upper surface. 27. *C. hymenodes*
 29. Pinnules c. 30–70 by 12–15 mm, veins 4–6 pairs.
 31. Lower 3–4 pairs of segments on each pinnule free and deeply lobed. Indusium irregularly lobed 28. *C. patellifera*
 31. Lowest segments not free, crenate. Indusium an entire disc. . 25. *C. albidosquamata*
 27. Pinna-rachis not hairy on lower surface.
 32. Distal part of pinna-rachis covered with scales.
 33. Lowest pinna c. 6 cm long, stipe short 29. *C. negrosiana*
 33. Lowest pinna much longer, stipe not very short.
 34. Scales on stipe dark; scales on pinna-rachis bullate 30. *C. catillifera*
 34. Scales on stipe pale; scales on pinna-rachis not bullate, larger ones having marginal setae. 31. *C. horridula*
 32. Distal part of pinna-rachis glabrescent, never covered with bullate scales. 43. *C. bunnemeijerii*
26. Indusium at first covering sorus, apical part very thin and caducous, an irregular disc remaining on old sorus.
 35. Pinna-rachis hairy on lower surface, at least distally.
 36. Pinnules c. 50 by 15 mm, pinnae to 21 cm long 32. *C. tenuicaulis*
 36. Pinnules to 95 by 18 mm, pinnae to 50 cm long 33. *C. sumatrana*
 35. Pinna-rachis not hairy on lower surface.
 37. Frond simply pinnate, pinnae to 7 by 1¾ cm, lobed to 2 mm from costa. 34. *C. klossii*
 37. Frond bipinnate.
 38. Small pale fringed scales abundant at least on costae.
 39. Spines on stipe 2–3 mm long; rachises ± covered beneath with small fringed scales as on costae 35. *C. trachypoda*
 39. Spines on stipe less than 1 mm long; rachises not so covered. 36. *C. crenulata*
 38. Small pale fringed scales lacking or very few.
 40. Stipe bearing spines 3–5 mm long.
 41. Larger scales on costae bearing dark setae. 37. *C. macropoda*
 41. Larger scales on costae not bearing dark setae.
 42. Small scales on costae bearing long crisped hairs 38. *C. saccata*
 42. Small scales on costae lacking such hairs.

43. Largest pinnules 150–175 by 30–40 mm 39. *C. magnifolia*
 43. Largest pinnules c. 90 by 18 mm 40. *C. acanthophora*
 40. Stipe not spiny, or spines under 1 mm long.
 44. Stipe-scales less than 1 mm wide above the base, edges when young setiferous; abundant narrow scales bearing long setae on pinna-rachis 41. *C. rubiginosa*
 44. Stipe-scales otherwise; pinna-rachis scales rarely setiferous.
 45. Stipe densely scaly throughout 42. *C. apiculata*
 45. Stipe persistently scaly near base only.
 46. Stipe long; lowest pinnae not greatly reduced.
 47. Stipe dark, scales firm, shining; bullate scales abundant on costules.
 43. *C. bünnemeijerii*
 47. Stipe green, scales thin, dull; no bullate scales on costules 44. *C. excavata*
 46. Stipe short; lowest pinnae c. 5 cm long 45. *C. christii*
 21. Indusium otherwise or lacking.
 48. Indusium covering sorus to maturity, then breaking and persistent.
 49. Pinna-rachis conspicuously hairy and scaly on lower surface 46. *C. geluensis*
 49. Pinna-rachis not hairy, though sometimes scaly on lower surface.
 50. Lamina very rigid, the small tertiary leaflets with edges much reflexed so that the sori are almost enclosed.
 51. Largest tertiary leaflets lobed, each with 3–5 sori 47. *C. macgregorii*
 51. Tertiary leaflets not lobed, each with 1–2 sori 48. *C. gleichenioides*
 50. Lamina not very rigid with strongly reflexed edges.
 52. Pinnules to 2½ cm long, less than 10 mm wide.
 53. Pinna-rachis and costae persistently brown-scaly; scales entire, smaller ones bullate.
 49. *C. havilandii*
 53. Pinna-rachis and costae glabrescent; scales small, not bullate 50. *C. imbricata*
 52. Pinnules to at least 45 by 10 mm, in most cases much larger.
 54. Largest pinnules more than 100 by 20 mm; costules 5 mm or more apart.
 55. Bullate scales present on costules. Pinnules distinctly stalked; several pairs of free segments on larger pinnules.
 56. Stipe long, slender, very spiny. Pinnules commonly with stalks 3–6 mm long, to 10 mm on lowest 51. *C. longipes*
 56. Stipe not known. Pinnule-stalks not over 4 mm 52. *C. acuminata*
 55. Bullate scales lacking on costules. Pinnules sessile or on stalks to 2 mm; at most 1–2 pairs of free segments 53. *C. insulana*
 54. Largest pinnules not over 100 by 20 mm; costules 3–4½ mm apart.
 57. Pinnules c. 45 by 10 mm, very rigid. Stipe-scales rigid, 40 by 1 mm.
 54. *C. pseudomuelleri*
 57. Pinnules commonly more than 65 by 15 mm. Stipe-scales otherwise.
 58. Costae and costules densely scaly; scales mostly setiferous, not bullate; pinna-rachis persistently covered with very small setiferous scales.
 59. Veins bearing scales on lower surface.
 60. Stipe 50 cm or more 55. *C. archboldii*
 60. Stipe 5–15 cm, lowest pinna 5–12 cm.
 61. Larger scales on pinna-rachis pale. Veins dark and raised on lower surface.
 56. *C. foersteri*
 61. Larger scales on pinna-rachis with dark median band. Veins concolorous, not raised below 57. *C. nigrolineata*
 59. Veins lacking scales on lower surface.
 62. Large scales on stipe and rachis light red-brown. 58. *C. inquinans*
 62. Large scales not red-brown.
 63. Larger scales on pinna-rachis pale 56. *C. foersteri*
 63. Larger scales on pinna-rachis with dark median band. 57. *C. nigrolineata*
 58. Costae and costules bearing scales which are mostly not setiferous; pinna-rachis glabrescent or its scales mostly not setiferous.
 64. Stipe-scales pale; pinna-rachis rather persistently covered with small scales beneath; veins bearing some scales 56. *C. foersteri*
 64. Stipe-scales dark; pinna-rachis glabrescent; veins not scaly.
 65. Costae and/or costules bearing bullate scales.
 66. Pinnules at base of larger pinnae distinctly stalked (stalks 2–4) mm; costules 4–4½ mm apart 59. *C. ferruginea*
 66. Pinnules sessile; costules usually not over 3½ mm apart.
 67. Indusium firm, brown 60. *C. oosora*
 67. Indusium pale, fragile 45. *C. christii*
 65. Costae and/or costules lacking bullate scales 61. *C. halconensis*

48. Indusium hemitelioid (sometimes almost covering sorus to maturity, sometimes very small) or lacking.
68. Indusium lacking.
69. Fronds simply pinnate, or bipinnate with small pinnules lobed halfway to costa.
70. Fronds simply pinnate 62. *C. ascendens*
70. Fronds bipinnate, pinnules c. 30 mm long 63. *C. recurvata*
69. Fronds bipinnate, pinnules more deeply lobed.
71. Pinna-rachis densely covered with long tangled pale crisped hairs and narrow scales on lower surface 64. *C. eriophora*
71. Pinna-rachis rather sparsely hairy on lower surface.
72. Sori near costules. Dark hairs present on costae beneath 65. *C. gregaria*
72. Sori medial or nearly so. No dark hairs on costae beneath. See *sect. Gymnosphaera*.
116. *C. macgillivrayi*
68. Indusium hemitelioid, of varying size, sometimes hidden by sorus.
73. Pinna-rachis densely hairy throughout on lower surface.
74. Bullate scales abundant on costae.
75. Raised median part of upper surface of pinna-rachis and costae hairy 66. *C. modesta*
75. Raised median part of upper surface of pinna-rachis and costae glabrous.
67. *C. doctersii*
74. Bullate scales absent, or a few distally on costae.
76. Pinnules to 40 by 10 mm. Scales on costae setiferous 68. *C. cucullifera*
76. Pinnules much larger. Scales on costae not setiferous 69. *C. setulosa*
73. Pinna-rachis hairy at most on distal part.
77. Indusium entirely brown and rather firm, quite covering sorus to maturity, breaking only when old.
78. Stipe-scales 50 mm long, shining brown. Costae almost glabrous. Pinnules c. 50 mm long.
70. *C. muelleri*
78. Stipe-scales 20–35 mm long, pale. Costae very scaly. Pinnules to 100 mm long.
79. Larger scales on costae uniformly brown, rather thin, edges with some setae.
80. Bullate scales lacking. Lower pinnae not gradually reduced (sometimes a pair 5 cm long near base of stipe) 71. *C. oinops*
80. Bullate scales on costules. Lower pinnae gradually reduced to 7 cm long.
81. Pinna-rachis densely covered with overlapping scales. Indusium firm, shining. 72. *C. loheri*
81. Pinna-rachis sparsely covered with very small pale fringed scales. Indusium dull, thinner.
73. *C. cinerea*
79. Larger scales on costae with narrow very dark median band and broad pale edges, or entirely pale 74. *C. pachyrrhachis*
77. Indusium in part pale and fragile, breaking at maturity, or not entirely covering sorus.
82. Pinnules 20–40 mm wide; costules 5–6 mm apart; lowest basicopic vein from costa or base of costule 75. *C. latipinnula*
82. Pinnules rarely over 2 cm wide; costules not over 5 mm apart; basicopic vein always from costule.
83. Indusium visible as a scale backing the costule, not entirely hidden by sorus.
84. Pinnules conspicuously stalked; stalks to 7 mm long.
85. Stipe bearing spines 3–4 mm long. No bullate scales on costules.
76. *C. masapilidensis*
85. Stipe not spiny. Bullate scales present on costules. 77. *C. loerzingii*
84. Pinnules not conspicuously stalked.
86. Indusium more than a semicircle, concave towards sorus and sometimes covering part of sorus to maturity.
87. Pinna-rachis densely and persistently scaly. 78. *C. rufopannosa*
87. Pinna-rachis not densely and persistently scaly.
88. Indusium fragile, breaking and often in part disappearing. 79. *C. callosa*
88. Indusium firm throughout.
89. Frond almost fully tripinnate; tertiary leaflets with strongly reflexed edges.
80. *C. dicksonioides*
89. Frond bipinnate with at most 1–2 pairs of tertiary leaflets; edges of segments not strongly reflexed.
90. Pinnules c. 100 mm long. Segments of lamina mostly not constricted at base on acroscopic side; bullate or convex pale scales on costules 81. *C. heterochlamydea*
90. Pinnules c. 60 mm long. Segments of lamina mostly constricted at base on acroscopic side; no bullate scales 82. *C. edanoi*
86. Indusium not more than a semicircle, reflexed against costule at maturity.
91. Bullate scales abundant and rather persistent on pinna-rachis (at least distally); pinna-rachis closely and finely warty after fall of scales.

92. Stipe-scales dark with thin pale edges. Basal 1-2 segments of pinnules almost free. 83. *C. fuliginosa*
92. Stipe-scales (at least larger ones) pale. Basal 6 pairs of segments almost free, separately adnate to costa 84. *C. semiamplexens*
91. Bullate scales lacking on pinna-rachis.
93. Basal scales on costae bearing some marginal setae.
94. Bullate scales abundant on costules. Stipe long, basal pinnae not much reduced.
95. Costules $4\frac{1}{2}$ - $5\frac{1}{2}$ mm apart. Pinnules 100 mm or more long. 85. *C. alleniae*
95. Costules 3- $4\frac{1}{2}$ mm apart. Pinnules to 60 mm long. 86. *C. costulisora*
94. Bullate scales absent. Stipe short, basal pinnae gradually reduced, lowest very short. 87. *C. caudata*
93. Basal scales on costae without setae.
96. Bullate scales present (if at all) towards apex of costa; costal scales few. Pinnules to 100 mm long.
97. Scales on costules distinctly bullate; pinna-rachis slightly hairy towards apex on lower surface 88. *C. borneensis*
97. Scales on costules mostly flat or convex, or distal ones bullate; pinna-rachis not hairy on lower surface.
98. 1-2 pairs basal segments on larger pinnules almost or quite free. 89. *C. fenicis*
98. Basal segments not free 90. *C. junghuhniana*
96. Bullate scales abundant to base of costae and on costules. Pinnules to 65 mm long. 91. *C. raciborskii*
83. Indusium very small, hidden by sporangia.
99. Pinnules commonly more than 20 mm wide.
100. Pinnules cut to 3-4 mm from costa 92. *C. glaberrima*
100. Pinnules cut almost to costa throughout.
101. Lower pinnules distinctly stalked. Sinuses between segments narrow. 93. *C. punctulata*
101. Lower pinnules sessile or nearly so. Sinuses between segments wide. 94. *C. incisoserrata*
99. Pinnules commonly not more than 20 mm wide.
102. Pinna-rachis densely covered with bullate scales; pinnules *c.* 32 by 10 mm. 95. *C. physolepidota*
102. Pinna-rachis not so covered; pinnules larger.
103. Scales on costae and costules all flat.
104. Lower pinnules stalked. No hairs on pinna-rachis and costae.
105. Lowest 1-2 pairs of segments quite free and articulate. Lamina thick, rigid. 96. *C. kanehirae*
105. Lower segments, several pairs, contracted at base but not free. Lamina not thick. 97. *C. nigropaleata*
104. Lower pinnules sessile. Hairs present on pinnae-rachis and costae.
106. Sori near costules (Luzon) 98. *C. microchlamys*
106. Sori medial (New Guinea) 22. *C. wengiensis*
103. Scales on costules bullate; some bullate scales often on costae.
107. Pinnules articulate to pinna-rachis. 99. *C. perpunctulata*
107. Pinnules not articulate.
108. Paraphyses conspicuous, longer than sporangia, 2-3 cells wide at base.
109. Stipe-spines 3-4 mm long. Pinna-rachis hairy towards apex on lower surface. 100. *C. alderwereltii*
109. Stipe-spines $1-2\frac{1}{2}$ mm long. Pinna-rachis not hairy on lower surface.
110. Lamina-segments strongly crenate-serrate. Indusium minute. Bullate scales throughout costae.
111. Stipe over 50 cm; lowest pinnae little reduced. 101. *C. amboinensis*
111. Stipe 20-25 cm; lowest pinna 8-12 cm long. 102. *C. media*
110. Lamina segments shallowly crenate. Indusium distinct, 2-lobed; bullate scales only on distal part of costa 103. *C. latebrosa*
108. Paraphyses shorter than sporangia, slender.
112. Pinna-rachis hairy towards apex on lower surface. Lower pinnae much reduced and spaced 88. *C. borneensis*
112. Pinna-rachis not hairy on lower surface. Lower pinnae not greatly reduced.
113. One to two pairs of basal segments on larger pinnules almost or quite free. 89. *C. fenicis*
113. No free segments at base of pinnules.
114. Stipe-thorns 5 mm or more long. 40. *C. acanthophora*
114. Stipe-thorns to $2\frac{1}{2}$ mm long. 90. *C. junghuhniana*

1. *Cyathea lepidoclada* (CHRIST) DOMIN, Acta Bot. Bohem. 9 (1930) 130; C. CHR. Brittonia 2 (1937) 278; COPEL. Philip. J. Sc. 77 (1947) 120.—*Alsophila lepidoclada* CHRIST in K. SCH. & LAUT. Nachtr. (1905) 37; v. A. v. R. Handb. (1908) 37; Handb. Suppl. (1917) 62.

Trunk slender, to 2 m; fronds to 150 cm. *Stipe* 10–24 cm; scales to 20 by 4–5 mm, shining brown with dull thin edges; scales on upper part of stipe and on rachis paler. Lower *pinnae* gradually reduced, lowest 3–6 cm long, longest 16–22 cm. *Pinnules* to 20 by 8 mm, segments *c.* 6 pairs, distinctly oblique, entire or slightly crenate, lowest free or contracted on acroscopic base; costules little over 2 mm apart; veins 3–4 pairs, simple. *Sori* near costules, rather small, not indusiate, paraphyses not longer than sporangia. *Scales and hairs*: lower surface of main rachis densely covered with interlacing pale flexuous hairs which are branched at the base, with scattered flat elongate scales; pinna-rachis similarly clothed, the scales more abundant, to about 3 by $\frac{2}{3}$ mm; pale hairs on costae more sparse, the scales bullate; hairs also scattered on lower surface of costules and veins.

Type specimen: SCHLECHTER 14417, Torricelli Mts, E. New Guinea (P; dupl. at K, BM, BO).

Distr. *Malaysia*: Central and E. New Guinea (3 collections).

Ecol. At 800–1000 m, 'frequent on slope in rain forest' (BRASS).

2. *Cyathea microphyloides* ROS. in Fedde, Rep. 12 (1913) 164; v. A. v. R. Handb. Suppl. (1917) 38.—*C. peranemiformis* C. CHR. Brittonia 2 (1937) 277.

Trunk slender, to 1 m; fronds less than 100 cm long. *Stipe* 3–10 cm; scales to 15 by 2 mm, median band shining, dark or sometimes partly or entirely pale, with broad dull fragile edges. Lower *pinnae* gradually reduced, lowest 3–5 cm long, longest to *c.* 20 cm. *Pinnules* to *c.* 30 by 10 mm, lobes almost all constricted at the base (connected by a very narrow wing along the costa) but only the lowest quite free, edges slightly crenate; costules to $3\frac{1}{2}$ mm apart; veins 4–5 pairs, the lower ones forked. *Sori* to 3 or 4 pairs on each segment of a pinnule; indusium ultimately a shallow light brown cup round base of sorus; receptacle prominent, paraphyses slender, short. *Scales and hairs*: main rachis bearing many long narrow crisped spreading brown scales, and minute fringed scales, on lower surface; lower surface of pinna-rachis bearing many bullate-based acuminate brown scales, the smaller ones hair-pointed, and also crisped brown hairs; costae bearing similar small bullate scales.

Type specimen: KEYSER B71, Bolan Mts, E. New Guinea (S-PA; dupl. at B).

Distr. *Malaysia*: Eastern and Central New Guinea.

Ecol. At *c.* 1800–3000 m; BRASS notes of type of *C. peranemiformis* 'common in forests of slopes and valleys'.

3. *Cyathea perpelvigera* v. A. v. R. Nova Guinea 14 (1924) 11; COPEL. Philip. J. Sc. 77 (1947) 119, 120.

Trunk to $2\frac{1}{2}$ m by 5 cm \varnothing ; leaf-bases persistent; fronds *c.* 10, spirally arranged. *Stipe* 15–20 cm, base bearing spines 2 mm long; scales shining brown with dull fragile edges, to 10 by almost 2 mm, narrower on distal part of stipe and on rachis; rachis bearing abundant crisped short brown hairs on lower surface and some residual very narrow long twisted scales. *Lamina* of frond 40–60 by 20–25 cm, lower pinnae gradually reduced. Largest *pinnae* 10–15 cm long, lowest pinnae 4 cm. *Pinnules* close together, more than 30 pairs on larger pinnae, to 15 by 5 mm, almost fully pinnate with *c.* 6 pairs of tertiary leaflets and a lobed apex; tertiary leaflets to 3 by almost 2 mm (fertile ones 1 mm wide), edges entire or crenate; veins 3–4 pairs, lowest forked. *Sori* 1–2 (rarely 3) to a leaflet; indusium forming a firm brown entire cup about half the height of the mature sorus. *Scales and hairs*: lower surface of pinna-rachis bearing copious crisped brown hairs, also brown bullate long-acuminate scales; similar scales on lower surface of costae, with a few hairs.

Type specimen: LAM 1441, ridge near Doorman summit, W. New Guinea (BO; dupl. at L, K, S, US, UC).

Distr. *Malaysia*: New Guinea, Moluccas (Ceram), N. Celebes (doubtful; plant young and sterile).

Ecol. At 1200–1800 m both in New Guinea and in Ceram; reported by BRASS as abundant in rain-forest in absence of woody undergrowth and by SCHODDE in mixed *Nothofagus* forest.

4. *Cyathea hunsteiniana* BRAUSE, Bot. Jahrb. 56 (1920) 58 (incl. *var. acuminata*); COPEL. Philip. J. Sc. 77 (1947) 119.

Trunk 2 cm \varnothing ; fronds to 100 cm long. *Stipe* 8–16 cm; scales to 13 by $3\frac{1}{2}$ mm, dark with rather broad flabelloid edges. *Pinnae* 25–30 pairs, lower ones gradually reduced, lowest 3 cm long, longest 12 cm. *Pinnules* almost sessile, to 12 by 5 mm, segments to 7 pairs, lowest free and more or less lobed, middle ones constricted at base. *Sori* 1 or 2 to each lamina-segment; indusium a deep firm brown cup with even rim. *Scales and hairs*: lower surface of main rachis and pinna-rachis densely covered with appressed shining brown flexuous hairs; lower surface of costae with few such hairs; no scales seen.

Type specimen: LEDERMANN 11139, Hunsteinpitze, E. New Guinea.

Distr. *Malaysia*: Eastern New Guinea.

Ecol. At 1300–2000 m.

Notes. This is very near *C. perpelvigera*, but appears to lack scales on the frond. BRAUSE distinguished *var. acuminata* (at 2070 m), with fronds long-acuminate and sori always solitary; it looks like a less robust plant, possibly grown in a more shady place than usual.

5. *Cyathea arfakensis* GEPF in Gibbs, Arfak (1917) 69.—*Hemitelia arfakensis* v. A. v. R. Bull. Jard. Bot. Btzig II, n. 28 (1918) 26.

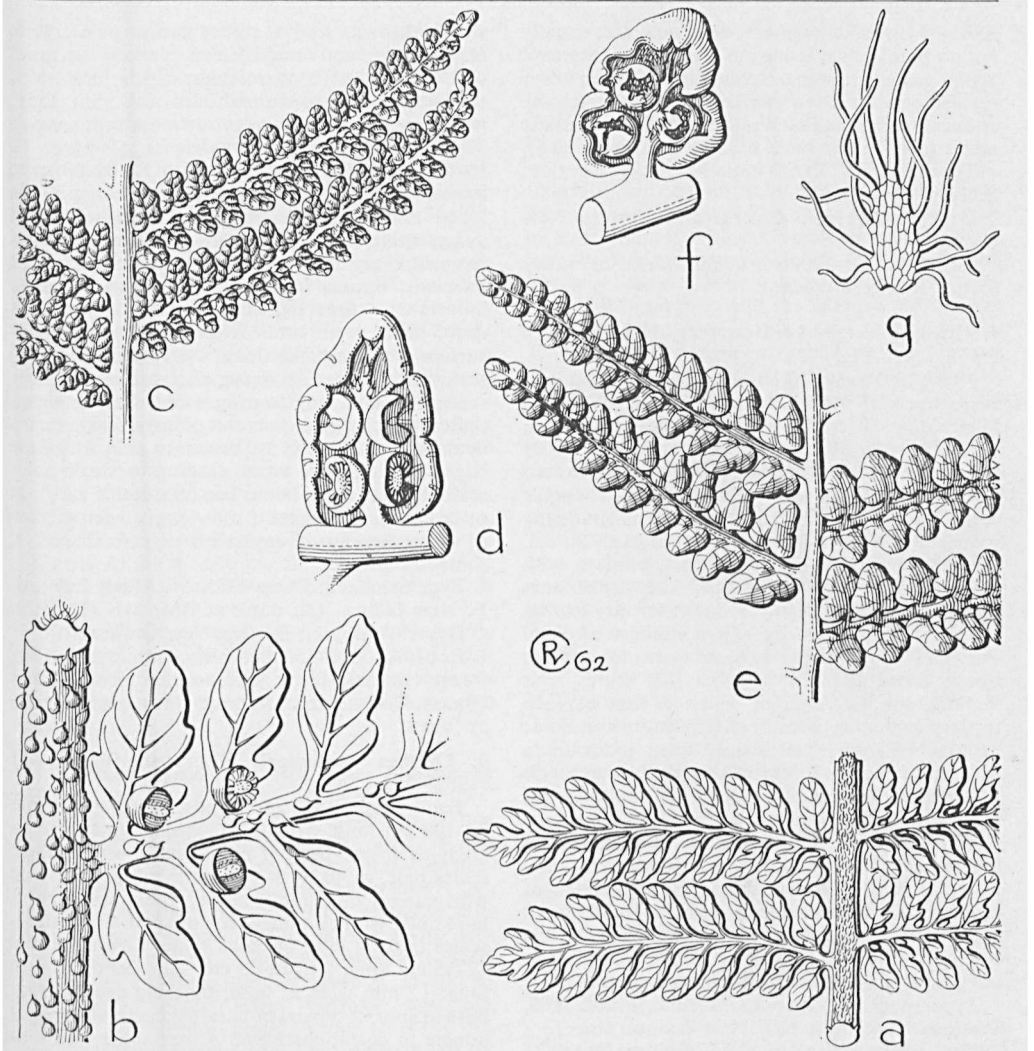


Fig. 10. *Cyathea hooglandii* HOLTUM. a. Part of pinna, upper surface; $\times 2$, b. same, lower surface, showing sori and bullate scales on pinna-rachis and costa, $\times 6$.—*C. dicksonioides* HOLTUM. c. Part of pinna, upper surface, $\times 2$, d. a single tertiary leaflet showing sori, $\times 8$.—*C. macgregorii* F. v. M. e. Part of pinna, upper surface, $\times 2$, f. one tertiary leaflet showing sori, $\times 6$, g. scale from costule, $\times 40$ (a–b HOOGLAND 7203, c HOOGLAND & SCHODDE 7506, d ditto 7171, e–g HOOGLAND & PULLEN 5745).

Stipe 12 cm, dark, warty; scales 10 by 1 mm. *Lamina* c. 70 cm long, lowest *pinnae* 5 cm long, longest *pinna* 8½ cm. *Pinnules* to 11 mm by 4 mm, apex rounded, largest with 1 or 2 basal segments free as almost circular tertiary leaflets, rest of pinnule crenate; lowest pinnules of upper *pinnae* deflexed and overlapping main rachis. *Sori* in one row on each side of costa of pinnule and close to it; indusium a broad open dark brown cup with firm even edge. *Scales and hairs*: some small bullate scales on costae; no hairs seen on lower surface.

Type specimen: L. S. GIBBS 6008, Anggi Lakes, SW. Ridge, W. New Guinea (BM; dupl. at P, K).

Distr. *Malaysia*: W. New Guinea (2 collections).

Ecol. In undergrowth of mossy forest at 2500 m.

6. *Cyathea ledermannii* BRAUSE, Bot. Jahrb. 56 (1920) 56 (incl. var. *dilatata*, l.c. 58); COPEL. Philip. J. Sc. 77 (1947) 119.

Trunk slender, to 2½ m; fronds few, to 150 cm long. *Stipe* 30 cm, base bearing blunt spines to 1 mm high and dark shining scales 10–15 by 1½–2 mm with pale edges. Largest *pinnae* 22 cm long. *Pinnules* to 23 by 8 mm, with c. 7 pairs of entire segments, lowest 2 segments free, next 2 pairs contracted at base, rest decurrent basis-copically to form a wing along the costa; costules 2½ mm apart; veins 5–6 pairs, mostly simple.

Sori 4–5 on each segment, near costules, usually not on basal veins; indusium a very firm deep cup. *Scales and hairs*: pinna-rachis glabrescent on lower surface or with a few narrow dark scales; costae and costules bearing a few rather large brown bullate scales (costae may have narrow flat scales also).

Type specimen: LEDERMANN 9651, Sepik region, E. New Guinea (B).

Distr. *Malaysia*: Central and Eastern New Guinea.

Ecol. At 200–1000 m, in rain-forest or mossy forest, locally abundant.

7. *Cyathea hooglandii* HOLTUM, Kew Bull. 16 (1962) 56.—Fig. 10a.

Trunk to 3 m by 10 cm ϕ , bearing 10 fronds in two whorls of 5 (HOOGLAND); fronds to 140 cm long. *Stipe* 10 cm, densely covered with scales, dull and warty after fall of scales; scales to 20 by 1½ mm, lower ones very dark, shining, upper ones medium brown, all with rather broad paler fragile edges, not setiferous. Lower *pinnae* gradually reduced, lowest 2–3 cm long, longest 26 cm. Largest *pinnules* 20–30 by 7–8 mm, pinnate, with 7–11 pairs of tertiary leaflets, the distal ones joined by a narrow wing to costa; tertiary leaflets ovate to elliptic, to 4 by 1½ mm, edges of distal ones entire or sinuous, of basal ones more or less deeply lobed at the base, lobes 1–3, acute; veins 4 pairs, simple. A single *sorus* at base of each tertiary leaflet, apparently seated on its costule or at base of lowest acroscopic vein; indusium a firm saucer nearly 1 mm wide with the receptacle at its centre; receptacle elongate and slightly swollen; paraphyses slender, shorter than sporangia. *Scales and hairs*: lower surface of main rachis glabrescent, dull, minutely warty, with residual irregular small brown scales; lower surface of pinna-rachis rather closely covered with small brown, bullate scales, some hair-pointed but most not obviously so; similar smaller bullate scales on costae of pinnules, not on tertiary leaflets.

Type specimen: HOOGLAND & SCHODDE 7203, Western Highlands, NE. New Guinea (L).

Distr. *Malaysia*: NE. New Guinea (3 coll.).

Ecol. In *Nothofagus* forest at 3000 m (type); 'in heavily mossed forest', 3170 m (BRASS 30216).

Note. This species appears to be related to 3. *C. perpeltigera* and 2. *C. microphyloides*, but is quite peculiar in having the sori singly at the bases of the tertiary leaflets, apparently seated directly on the costule, not on one of the lateral veins as in all other species of *Cyathea* here reported. BRASS 30216 bears the note 'leaves 7, pale, flat-spreading'; possibly the number of leaves in a whorl varies from 5 to 7.

8. *Cyathea percrassa* C. CHR. Brittonia 2 (1937) 279; COPEL. Philip. J. Sc. 77 (1947) 107.

Trunk 2–4 m by 8–12 cm ϕ , bearing 6–12 fronds 125–200 cm long; lower *pinnae* gradually reduced, or one small pair near base and then a long gap to the next. *Stipe* not spiny, lower part covered with ascending rigid twisted scales 25–40 by 1–2 mm, with shining median band (pale, streaked, or

wholly brown) and a rather broad pale fragile edge; stipe and rachis also densely covered with small dull brown scales which have dark setiform apices; pneumathodes 4–6 mm long, well spaced, in a single row. Largest *pinnae* 30–40 cm long. Largest *pinnules* of type 80 by 22 mm, of another collection 55 by 13 mm, lowest segments free or nearly so, rest of pinnule lobed almost to the costa; costules 2½–3 mm apart; veins to 10 pairs, mostly forked; lamina-segments very firm, edges finely crenate and not reflexed, sinuses narrow. *Sori* near costules; indusium a firm light-brown cup, wider than deep, with even rim. *Scales and hairs*: lower surface of pinna-rachis densely covered with small scales which bear dark setae, also scattered narrow scales 3–5 mm long bearing a few dark setae on their fragile edges; costae copiously scaly, scales near base to 2 mm long, brown to pale with pale edges bearing dark setae, grading to small paler scales fringed with hairs; costular scales as those of costae but not over 1 mm long; lower surface of veins densely covered with very small scales, some setiferous.

Type specimen: BRASS 4375, Mt Albert Edward, E. New Guinea (A; dupl. at BM, MICH, BRI).

Distr. *Malaysia*: Eastern New Guinea.

Ecol. At 3000–3500 m, fairly common in valley forest (BRASS); fairly common in mossy forest (BRASS, HOOGLAND & PULLEN) or on edge of mossy forest.

9. *Cyathea vandeusenii* HOLTUM, Blumea 11 (1962) 529.

Trunk stout, to 2 m; fronds c. 10, spreading, 80–100 cm long. *Stipe* 12–18 cm, completely covered, as lower part of main rachis, with scales; scales pale, to 40 by 1–1½ mm, firm and shining with narrow dull fragile edges, thick and dark at base only, with an under-coat of small thin brown scales bearing long flexuous setae. Lowest *pinnae* 12–15 cm long, longest 23 cm. *Pinnules* to 50 mm long, 15 mm wide at base, tapering evenly from base to apex, 2–3 pairs of basal segments separately adnate to costa; costules 3½ mm apart; veins to 7 pairs; lamina-segments very rigid, with edges reflexed when dry, edges rather deeply crenate where fertile. *Sori* almost completely embedded in scales; indusium a complete light-brown cup with smooth edge, as wide as deep. *Scales and hairs*: lower surface of all rachises, costae and costules covered with a close felt of thin flat brown scales bearing many slender crisped marginal hairs and scattered flexuous brown setae; lower surface of veins bearing crisped pale hairs.

Type specimen: BRASS 29989, Eastern Highlands Distr., NE. New Guinea (L; dupl. at K, US).

Distr. *Malaysia*: NE. New Guinea (one collection).

Ecol. At 3700 m, 'frequent in edges of patches of subalpine forest'.

10. *Cyathea pruinosa* ROSENST. in Fedde, Rep. 12 (1913) 163; v. A. v. R. Handb. Suppl. (1917) 29; COPEL. Philip. J. Sc. 77 (1947) 101.

Trunk 5 m; fronds 10–14. *Stipe* 15 cm or more, purplish with a fine glaucous covering, warty after fall of scales; scales near base of stipe to 30 by 1½ mm, stiff and twisted, dark brown, shining, with paler fragile edges. Lowest *pinnae* 15 cm long; largest *pinnae* 30–50 cm. Largest *pinnules* 50–75 by 15–17 mm, sessile, lobed nearly to costa throughout, lowest segment almost free, lower surface distinctly glaucous; costules 3–3½ mm apart; veins 9–10 pairs; lamina-segments rather rigid, segments crenate, most deeply so when fertile. *Sori* near costules; indusium at maturity a rather thin brown cup with entire rim, about as wide as deep. *Scales and hairs*: pinna-rachis rather pale, minutely warty on lower surface; scales on costae flat, broad, brown, bearing a few long dark setae; on costules imbricating flat broad scales as on costae, with ovate convex or almost bullate scales distally; a few similar smaller scales on lower surface of veins.

Type specimen: KEYSER B44, Bolan Mts, E. New Guinea (S-PA; dupl. at B, UC).

Distr. *Malaysia*: Eastern New Guinea.

Ecol. At 2400–3000 m, on edge of forest and tree-fern grasslands; also (sterile) in undergrowth of forest.

Note. The type material did not include the stipe, description of which is taken from HOOGLAND & SCHODDE 7633, which also bears the information that there were 14 fronds in two whorls.

11. *Cyathea pycnoneura* HOLTUM, *Blumea* 11 (1962) 533.

*Fronde*s to 230 cm long. *Stipe* more than 30 cm, dark, spiny throughout, spines to nearly 3 mm long; scales many, dark, to 35 by 2 mm wide near base which is thick and hairy, flabelloid edges narrow and mostly abraded with scattered long dark setae; very small dull scales, some with dark setae, also present. Lowest *pinnae* not seen, longest 65 cm long. Largest *pinnules* 75–105 by 15–17 mm, sessile, lowest segment not free; costules 3–3½ mm apart; veins to 13 pairs; lamina-segments firm, falcate, crenate-serrate. *Sori* near costules; indusium a rather pale thin cup about as wide as deep; paraphyses shorter than sporangia. *Scales and hairs*: pinna-rachis pale beneath and covered sparsely with very small pale ± bullate scales which end in dark setae, scattered narrow dark scales with long marginal setae also present; scales on lower surface of costae rather broad, more or less bullate-based, acuminate, with scattered long marginal setae, also pale small bullate scales mostly lacking setae; costular scales pale, bullate, larger ones acuminate and sometimes with setae; all scales on costae and costules leaving very short hair-like bases when they fall; veins bearing scattered small pale scales on lower surface and many very short hairs.

Type specimen: PULLEN 562, Upper Omahaiga valley Goroka District, Territory of New Guinea (CANB, type; BM, L).

Distr. *Malaysia*: N.E. New Guinea (two collections).

Ecol. At 2300–2500 m in *Podocarpus-Lauraceae* forest.

12. *Cyathea rigens* ROSENST. in Fedde, Rep. 12 (1913) 163; v. A. v. R., Handb. Suppl. (1917) 33; COPEL. Philip. J. Sc. 77 (1947) 103, 104.

Trunk 3–5 m tall; fronds numerous, spreading, 100–150(–200) cm long. *Stipe* 7–17 cm, near base bearing many spines to 2 or 3 mm long; scales pale or dark, shining, with dull edges which often have long dark setae near base, 20–50 by 3–4 mm. Lower *pinnae* gradually reduced, or a gap between the small basal ones and the next; lowest 5–8 cm long, largest *pinnae* c. 30 cm. Largest *pinnules* 40–60 by 12–14 mm, deeply lobed, lowest segment not free; costules 3–3½ mm apart; veins to 8 pairs, mostly forked; lamina-segments crenate. *Sori* near costules; indusium a firm light brown shallow cup with even rim. *Scales and hairs*: pinna-rachis very scaly when young, larger scales narrow, flat, acuminate with a few dark marginal setae, these scales mostly caducous; towards apex of pinna-rachis some more persistent bullate-based scales; also on lower surface of pinna-rachis small scales bearing very fine crisped hairs; scales on costae near base narrow, flat, pale, acuminate with a few dark setae, distally bullate with long hair-point; on costules bullate hair-pointed scales grading to very fine pale hairs.

Type specimen: KEYSER B79, Bolan Mts, E. New Guinea (S-PA; dupl. at B, UC).

Distr. *Malaysia*: Central and Eastern New Guinea, Goodenough Island.

Ecol. At 2000–2800 m on the mainland of New Guinea; on Goodenough Island at 1570–1600 m; in oak forest and mossy forest, locally abundant; also reported in undergrowth on edge of *Nothofagus* forest, and on edge of grassland.

13. *Cyathea everta* COPEL. Un. Cal. Publ. Bot. 18 (1942) 218; Philip. J. Sc. 77 (1947) 103, pl. 2.—*C. globosora* COPEL. Un. Cal. Publ. Bot. 18 (1942) 218; Philip. J. Sc. 77 (1947) 106, pl. 4.

Trunk up to 8 mm, 5–6 cm ø, bearing fronds 120–150 cm long. *Stipe* 20–30 cm, spiny throughout, spines 1–2 mm long; scales near base as in *C. rigens*; upper part of stipe bearing a thin felt of irregular small pale fringed scales; sometimes a single isolated small pinna near base of stipe. Lowest *pinnae* 12–15 cm long, longest 30 cm. *Pinnules* 35–50(–75?) by 11–15 mm, lobed almost to costa, lower segments of larger *pinnae* separated by a narrow wing along costa, not truly free; costules 3½ mm apart; veins to 8 pairs, mostly forked; lamina-segments crenate. *Sori* near costules; indusium a firm brown cup when mature, about as wide as deep. *Scales and hairs*: pinna-rachis bearing more or less abundant crisped hairs, also bullate-based hair-pointed scales, the scales often deciduous; lower surface of costae bearing pale acuminate bullate scales and sometimes crisped hairs.

Type specimen: BRASS 10712, near Lake Habema, W. New Guinea (A; dupl. at BO, UC).

Distr. *Malaysia*: Western New Guinea.

Ecol. At 1400–2800 m, in oak forest and mossy forest.

Note. Possibly this species should be united with *C. rigens*. It is sometimes difficult to distinguish minute fringed scales from separate hairs, and perhaps there are transitions between the two.

14. *Cyathea cincinnata* BRAUSE, Bot. Jahrb. 56 (1920) 52; COPEL. Philip. J. Sc. 77 (1947) 104.

Stipe 30 cm, scaly throughout; scales to 20 by 2 mm, shining brown, sometimes with a black median band, the dull flabelloid edges bearing many long setae. Lowest *pinnae* 15 cm long, longest *pinnules* 52 cm. *Pinnules* to 80 by 18 mm, sessile, lobed almost to the costa; costules 3½ mm apart; veins to 9 pairs; lamina-segments slightly toothed. *Sori* near the costules; indusium a firm brown cup with even edge, somewhat wider than deep; paraphyses short and slender. *Scales and hairs*: lower surface of pinna-rachis covered evenly with short crisped hairs, with scattered very narrow flexuous dark scales which bear a few dark flexuous marginal setae; lower surface of costae of lower pinnules bearing some crisped hairs near base; no scales seen on costae and costules.

Type specimen: LEDERMANN 11279, Sepik region, E. New Guinea (B).

Distr. *Malaysia*: E. New Guinea (one collection).

Ecol. At 1300 m.

15. *Cyathea subtripinnata* HOLTUM, Blumea 11 (1962) 534.

Trunk 2½ m, bearing 18 fronds which are not whorled. *Stipe* 12 cm, densely covered with scales throughout, warty after fall of scales; scales to 40 by 1½ mm wide at base, dark brown, shining, twisted, fragile edges narrow except near base, also under-coat of irregular small brown scales which are mostly not setiferous. *Rachis* dull, brown, glabrescent, minutely warty. Lowest *pinnae* 17 cm long, longest 40 cm. *Pinnules* to 65 by 17 mm, almost sessile, the larger ones with c. 6 pairs of quite free tertiary leaflets, remaining lamina-segments more or less broadly adnate to costa, distal ones connected by a narrow wing; costules (bases of tertiary leaflets) 4 mm apart; veins 7–8 pairs, mostly forked, middle ones sometimes twice forked, hardly raised on upper surface, impressed on lower surface; lamina-segments or tertiary leaflets rigid when dry, fertile ones lobed about half way to costule. *Sori* near costules; indusium a firm brown cup wider than deep; sporangia very numerous; paraphyses not seen. *Scales and hairs*: pinna-rachis dull, brown, glabrescent except for scattered small flat roundish entire pale or brown scales and a few very narrow dark brown scales, all lacking setae; costal scales like those of pinna-rachis but smaller ones sometimes convex; costules usually glabrous beneath.

Type specimen: SCHODDE 1763, Mt Giluwe, Southern Highlands Distr., Papua (CANB).

Distr. *Malaysia*: East New Guinea.

Ecol. Margin of alpine grassland and alpine shrubbery at 3120 m.

16. *Cyathea orientalis* (KUNZE) MOORE, Ind. Fil. (1861) 272; METT. Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 58; HOOK. & BAK. Syn. Fil. (1865) 24; RACIB. Fl. Btzig 1 (1898) 37; v. A. v. R. Handb. (1908) 21; Suppl. (1917) 29; BACKER & POSTH. Varenfl. Java (1939) 24.—*Disphenia orientalis* KUNZE, Bot. Zeit. 6 (1848) 283 (excl. *syn.*).—*C. arborea* [non (L.) SM.] var. *pallida* HASSK. Obs. Bot. Fil. 1 (1856) 15.—Fig. 7, 9e.

Stipe dark, to at least 50 cm, bearing copious spines 1½ mm long when old; scales abundant, dark, to 35 by 3 mm, pale edges narrow, bearing dark setae; basal part of scale bearing superficial outgrowths; pneumathodes 4–7 mm long, in a single row. Lower *pinnae* somewhat reduced, largest 65 cm long. *Pinnules* almost sessile, commonly 100 by 18 mm, lobed almost to the costa, lowest 1–2 segments almost free, apex rather abruptly acuminate; costules 3–3½ mm apart; veins 9–10 pairs; lamina-segments falcate, apex blunt, edges crenate towards apex. *Sori* near costules; indusium a rather thin brown cup about 1 mm ø, slightly constricted at mouth, about as wide as deep; apex of receptacle level with mouth of indusium; paraphyses slender, short. *Scales and hairs*: lower surface of main rachis shortly spiny in basal part to minutely warty distally, with residual very small scales some of which bear short dark setae; similar scales on lower surface of pinna-rachis; costae bearing very small brown short-fringed scales and flat ovate to elongate entire scales (mostly caducous); costules of sterile pinnules bearing flat to convex ovate almost entire uniformly brown scales.

Type specimen: ZOLLINGER 2538, Tengger Mts, E. Java (holotype not seen; dupl. at L, P, BM, BO).

Distr. *Malaysia*: W.–E. Java, Lesser Sunda Is (Bali, Lombok, Flores).

Ecol. In mountain forest, 1000–1800 m.

17. *Cyathea apoensis* COPEL. in Elmer, Leaf. Philip. Bot. 3 (1910) 802; v. A. v. R. Handb. Suppl. (1917) 26; COPEL. Fern Fl. Philip. 2 (1960) 213.—*C. lobata* COPEL. Philip. J. Sc. 81 (1952) 15, pl. 13; Fern Fl. Philip. 2 (1960) 214.

Stipe unknown. *Pinnae* to 40 cm long. *Pinnules* commonly to 65(–85) by 14–18 mm, lowest 1–2 segments quite free, rest of pinnule lobed almost to costa; costules 3–3½ mm apart; veins 7–9 pairs, mostly forked; lamina-segments rather deeply crenate-serrate or basal ones lobed up to ½ way to costule, each lobe bidentate. *Sori* near costules; indusium a rather thin cup with even rim (often broken when old), about as wide as deep; paraphyses slender, short. *Scales and hairs*: main rachis dark, minutely warty on lower surface, bearing residual very small irregular dull brown scales which sometimes bear a dark seta, also a few elongate dark flat scales with pale edges; pinna-rachis similarly scaly, often with very narrow brown scales 3–5 mm long; costae near base rather copiously scaly, scales to 3 mm long and ¾ mm wide, shining brown, flat, tapering evenly from base, edges with a few dark setae, distal scales similar but shorter, more ovate; no scales seen on costu-

les, but may be present on costules of sterile pinnales (none such seen).

Type specimen: ELMER 11482, Mt Apo, Mindanao (MICH; dupl. at US, FI, K, BO, P, A, SYD, L, BM).

Distr. *Malaysia*: Philippines (Mindanao, Negros, southern Luzon).

Ecol. 'In dense woods along Seriban creek, Mt Apo, alt. 1800 m' (ELMER).

18. *Cyathea costalisora* COPEL. Un. Cal. Publ. Bot. 18 (1942) 218; Philip. J. Sc. 77 (1947) 101, pl. 1.

Trunk to 4 m, branching near base. *Stipe* warty after fall of scales, c. 20 cm; scales to 25 by 1 mm, central band dark shining brown, pale dull edges bearing a few long dark setae; upper part of stipe and rachis bearing very narrow flexuous spreading scales to 10 mm long. Lowest *pinnae* c. 12 cm long, longest 20–30 cm. Largest *pinnules* 35–45 by 8–10 mm, lobed nearly to costa, lowest 1–2 segments sometimes a little constricted at base, not free, apex abruptly pointed; costules 2–2½ mm apart; veins 7–8 pairs, mostly forked; lamina-segments firm, crenate. *Sori* near costules (on type only on basal veins and so only near costa); indusium at maturity a firm dark cup with slightly contracted mouth, wider than deep, facing obliquely away from costule. *Scales and hairs*: pinna-rachis densely scaly on lower surface, scales 4–5 mm long with dark median band and broad pale edges bearing a few long setae, also smaller pale scales with some setae; costae and costules of type almost glabrous on lower surface.

Type specimen: BRASS 9488, Lake Habbema, W. New Guinea (A; dupl. at BO, BM).

Distr. *Malaysia*: Western New Guinea (2 collections).

Ecol. In forest: near Lake Habbema (3225 m) in moist hollows; in Arfak Mts (1900 m) near Lake Giji.

Note. The specimen from Arfak Mts differs from the type as follows: stipe-scales 2½ mm wide, pale or dark near apex; on lower surface of costae and costules are narrow pale scales bearing a few dark marginal setae; lamina-segments deeply serrate.

19. *Cyathea pallidipaleata* HOLTUM, Kew Bull. 16 (1962) 60.

Stipe 10 cm, medium brown, densely covered with shining pale brown scales to 32 by 1 mm, their dull edges narrow; similar smaller scales at first all along rachis but caducous. Lowest *pinna* 13 cm long, longest *pinna* 25 cm; *pinnules* at 60° to pinna-rachis. *Pinnules* to 45 by 11 mm, abruptly acuminate, lobed nearly to costa, lowest segment nearly free; costules 2½ mm apart; lamina-segments thick and rigid, edges not reflexed, deeply crenate, the larger crenations notched; veins 7–8 pairs. *Sori* near costules; indusium a complete firm dark open cup. *Scales and hairs*: on pinna-rachis many very small dark short-setiferous scales and some residual long dark scales; on costae shining dark brown flat ovate scales bearing a few setae; on costules many very small dark setiferous scales, these mostly caducous.

Type specimen: EYMA 776, Tinabang, W. side of Mt Rante Mario, Subdistr. Enrekang, SW. Celebes (BO).

Distr. *Malaysia*: SW. Celebes: Latimodjong Mts.

Ecol. Mountain forest, 3000 m.

20. *Cyathea coactilis* HOLTUM, Blumea 11 (1962) 533.

Trunk 2½ m, bearing 10 fronds in 2 whorls; fronds c. 170 cm long. *Stipe* c. 10 cm, not spiny, densely covered with scales throughout; scales to 35 by less than 1 mm wide at base, pale with darker narrow fragile edges; under-coat of small dull appressed fringed scales, some with apical seta. *Rachis* persistently covered on lower surface with a thin felt of small scales as stipe with a few long narrow pale scales. Lowest *pinna* c. 6 cm long, longest 30 cm. Largest *pinnules* sessile, abruptly acuminate, 37 by 12 mm, lowest pair of segments almost or quite free, then a few pairs joined by narrow wing along costa; costules 3 mm apart; veins 6–7 pairs; lamina-segments firm, crenate. *Sori* near costules; indusium a thin cup, wider than deep; paraphyses slender, dark. *Scales and hairs*: pinna-rachis covered completely with a felt of scales which are small, light brown, thin, copiously short-fringed, not bullate nor acuminate but sometimes with dark setiform apex, also a few long narrow pale scales with fragile non-setiferous edges; costae bearing larger dark flat scales with irregular marginal setae; costular scales flat, brown, usually not setiferous, distal ones very small; on lower surface of veins very short hairs (bases of scales?).

Type specimen: SCHODDE 1887, Mt Giluwe, Southern Highlands Distr., Papua (CANB).

Distr. *Malaysia*: E. New Guinea (once collected).

Ecol. In alpine shrubbery at 3000 m.

21. *Cyathea parva* COPEL. Un. Cal. Publ. Bot. 18 (1942) 219; Philip. J. Sc. 77 (1947) 120, pl. 13.

Trunk 1½ m tall, 3½ cm ø, bearing 4 fronds 90 cm long. *Stipe* c. 10 cm, copiously warty; scales to 15 by 1½ mm, pale or sometimes dark near apex, the thin dull edges bearing a few long dark setae. Lower *pinnae* gradually reduced, lowest 5–6 cm long, longest 17 cm, *pinnules* well spaced. *Pinnules* to 30 by 6 mm, not acuminate, lobed almost to costa, lowest segment not free; costules 1½–2 mm apart; veins to 6 pairs, lower ones forked; lamina-segments firm, the fertile ones crenate, sterile almost entire. *Sori* near costules; indusium a very narrow dark red ring round base of receptacle. *Scales and hairs*: lower surface of main rachis almost completely covered with very small dull long-fringed scales, with scattered large pale scales; on lower surface of pinna-rachis many pale thin-edged scales 5 by 1 mm, long-acuminate, sometimes bearing long dark marginal setae, these scales bullate at base near apex of pinna, also many minute scales bearing long marginal hairs; costal scales pale, narrow,

with bullate bases, grading to rather large pale bullate scales.

Type specimen: BRASS 12197, 15 km SW of Bernhard Camp, Idenburg River, W. New Guinea (UC; dupl. at MICH, BO, A, L).

Distr. *Malaysia*: Western New Guinea (one collection).

Ecol. In undergrowth of rain forest in gully, 1700 m.

22. *Cyathea wengiensis* (BRAUSE) DOMIN, Pterid. (1929) 263; COPEL. Philip. J. Sc. 77 (1947) 113.—*Alsophila wengiensis* BRAUSE, Bot. Jahrb. 49 (1912) 13, fig. 1c; v. A. v. R. Handb. Suppl. (1917) 68.—*Alsophila hieronymi* BRAUSE, Bot. Jahrb. 49 (1912) 14; v. A. v. R. Handb. Suppl. (1917) 67.—*C. brauseana* DOMIN, Pterid. (1929) 262.

Stipe to 10 cm or more, bearing spines to 2 mm long; scales not seen. Lowest *pinna* 10 cm long, longest 48 cm. Largest *pinnules* 70 by 12–18 mm (sometimes larger; see note below); lobed to *c.* 1 mm from costa, lowest segment not quite free; costules 3½ mm apart; veins 9–11 pairs; lamina-segments firm, edges more or less crenate, sinuses narrow. *Sori* medial, or distal ones near costule; indusium a dark ring less than ½ mm \varnothing round base of receptacle, sometimes not quite encircling receptacle; paraphyses longer than sporangia. *Scales and hairs*: on lower surface of pinna-rachis crisped light brown hairs, or small scales bearing such hairs, throughout but more abundant distally, also dark scales to 3 mm long with broad pale edges bearing long dark setae; on costae similar hairs or hair-bearing scales and scattered broad scales bearing few setae; on costules flat pale scales to bullate scales.

Type specimen: SCHLECHTER 16100, in forest near Wengi, NE. New Guinea (B; dupl. at P, UC).

Distr. *Malaysia*: Eastern New Guinea.

Ecol. In forest or secondary growth after cultivation, up to 600 m.

Notes. A specimen collected from 'tall garden re-growth' in Sepik District (DARBYSHIRE & HOOGLAND 8042) agrees with the type except in larger size of pinnules, largest being 120 by 23 mm with costules 5–5½ mm apart and sterile segments very deeply lobed. This large size may be due to conditions of habitat.

In position of sori *C. wengiensis* agrees with *C. macgillivrayi* (BAK.) DOMIN, but normally the latter has no indusium. Specimens with variable very small indusia which are mostly hemitelioid appear intermediate between the two species.

23. *Cyathea batjanensis* (CHRIST) COPEL. Philip. J. Sc. 4 (1909) Bot. 45.—*Alsophila batjanensis* CHRIST in Warb. Monsunia (1900) 90; v. A. v. R. Handb. (1908) 38.—*Alsophila saparuensis* v. A. v. R. Bull. Dép. Agr. Ind. Néerl. n. 18 (1908) 2; Handb. (1908) 38.—*Alsophila straminea* GEPP in Gibbs, Arfak (1917) 192.—*C. saparuensis* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 28 (1918) 13.—*C. straminea* v. A. v. R. l.c. 14 (non KARST.

1856).—*C. gepiana* DOMIN, Acta Bot. Bohem. 9 (1930) 118.—Fig. 9a.

Trunk slender. *Stipe* 15 cm or more long, bearing many warts or conical spines 1 mm high; scales dark brown with paler fragile edges. Lower *pinnae* often considerably reduced (to 10 cm long or less), longest to 45 cm. Largest *pinnules* 70–90 by 15–18 mm, lobed almost to the costa; costules 3½–5 mm apart; veins to 10 pairs; lamina-segments rather thin, edges rather strongly crenate towards apices. *Sori* medial; indusium a small ring round base of receptacle; paraphyses longer than sporangia, several cells wide at the base. *Scales and hairs*: lower surface of pinna-rachis and costae bearing flexuous pale hairs and scattered irregular small pale scales with long flexuous slender marginal hairs; no bullate scales on costae or costules.

Type specimen: WARBURG 17844, Mt Sibela, Batjan, Moluccas (B; not seen at Paris).

Distr. *Malaysia*: Moluccas (Batjan, Ceram, Tidore, Ternate, Buru, Saparua, Halmahera); Western New Guinea.

Ecol. At about 600 m.

24. *Cyathea ternatea* v. A. v. R. Bull. Jard. Bot. Btzg III, 5 (1922) 191.

Stipe bearing many spines to 2½ mm long; scales to 25 by 3 mm, shining brown with narrow dull edges. *Pinnae* to 65 cm long. *Pinnules* to 150 by 22 mm, long-acuminate, lowest on stalks 2–3 mm long, lowest segment almost free; costules 4½ mm apart; veins to 11 pairs, mostly forked (some twice forked); lamina-segments firm, rather strongly crenate throughout. *Sori* medial; indusium a small disc round base of receptacle; paraphyses long. *Scales and hairs*: pinna-rachis and costae bearing many very small irregular shortfringed scales, also on pinna-rachis a few broad thin scales having odd marginal setae; on costules sometimes brown bullate scales which are ciliate towards acuminate apices.

Type specimen: BEGUIN 1126, Ternate (BO; dupl. at L, P).

Distr. *Malaysia*: Moluccas (Ternate, 2 collections).

Ecol. At 600–1300 m.

25. *Cyathea albidosquamata* ROSENST. in Fedde, Rep. 12 (1913) 525; v. A. v. R. Handb. Suppl. (1917) 31; COPEL. Philip. J. Sc. 77 (1947) 104, 121.—*C. pumilio* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 28 (1918) 14.

Stipe to at least 20 cm, scaly throughout, scales firm, pale, shining, with dull fragile edges; on lower surface of rachis similar scales to 7 by 1 mm, bearing a few long dark setae, also a close cover of pale flexuous hairs. *Pinnae* to 35 cm long. Largest *pinnules* 32–40 by 12 mm, lobed almost to costa; costules 3–3½ mm apart; veins 4–6 pairs; lamina-segments firm, slightly crenate. *Sori* near costules; indusium an almost flat disc *c.* 1 mm wide, sometimes slightly asymmetric; paraphyses not longer than sporangia. *Scales and hairs*: on lower surface of pinna-rachis a close cover of pale hairs,

also narrow pale acuminate scales, all except the largest bullate at base; on costae similar hairs and scales, distal scales bullate; on costules small pale bullate scales and pale crisped hairs.

Type specimen: KEYSER 177, Sattelberg, NE. New Guinea (S-PA; dupl. at B, UC).

Distr. *Malaysia*: Moluccas (Ceram), New Guinea.

Ecol. At 1200–1500 m.

Note. The type of *C. pumilio*, from Ceram (RUTTEN 373) differs from the type of *C. albidosquamata* chiefly in having more sparse and hardly bullate scales on the pinna-rachis.

26. *Cyathea javanica* BL. En. Pl. Jav. (1828) 245 (incl. var. *rigida*, p.p.); METT. Ann. Mus. Bot. Lugd.-Bat. I (1863) 56; HOOK. Syn. Fil. (1865) 23; RACIB. Fl. Btzg I (1898) 35; v. A. v. R. Handb. (1908) 23; Suppl. (1917) 32; BACKER & POSTH. Varenfl. Java (1939) 24.—*Hemitelia caudipinnula* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 7 (1912) 16; Handb. Suppl. (1917) 48.—*Hemitelia barisanica* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 20 (1915) 17; Handb. Suppl. (1917) 49.—*Alsophila benculensis* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 23 (1916) 2; Handb. Suppl. (1917) 493.—*Alsophila palembanica* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 23 (1916) 4; Handb. Suppl. (1917) 493.—*C. benculensis* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 28 (1918) 14.—*C. palembanica* v. A. v. R. l.c. 13.—*C. caudipinnula* DOMIN, Pterid. (1929) 263.—*C. barisanica* DOMIN, l.c.—Fig. 9b.

Trunk to 10 m. Stipe 10–30 cm, bearing many spines to 1 mm long, and dark fragile-edged scales to 15 by 1 mm. Lower pinnae gradually reduced, lowest 5–10 cm long where stipe is 10 cm, longer where stipe is longer; longest pinnae 70 cm. Largest pinnules sessile, caudate-acuminate, 80–100 by 15–23 mm, lobed almost to costa, lowest segments not free; costules 4–5 mm apart; veins to 10 pairs; lamina-segments firm, slightly crenate or the largest fertile ones sometimes deeply so, sinuses narrow except near base of largest fertile pinnules. Sori near costules except the basal ones; indusium a rather firm disc about as wide as base of mature sorus, sometimes excentric or almost entirely on costular side of receptacle; paraphyses slender, short. Scales and hairs: lower surface of rachis and pinna-rachis closely hairy throughout, hairs short, crisped, with some residual narrow dark scales; on lower surface of costae similar hairs, also narrow scales near base grading to bullate-acuminate scales distally; on costules small brown bullate scales; upper surface of pinna-rachis and costae usually glabrous, sometimes slightly hairy.

Type specimen: BLUME, West Java (L; dupl. K).

Distr. *Malaysia*: Sumatra, Java.

Ecol. In forest, 250–1500 m.

Note. The type specimen of *Hemitelia barisanica*, from Sumatra, is unusually large, with pinnules to 120 by 28 mm, costules to 6 mm apart; the indusia are usually excentric and sometimes only on the costular side of the receptacle; hairs and scales agree with type.

Some specimens at Kew of *C. javanica* var. *rigida* so named by BLUME are *C. crenulata* BL.

27. *Cyathea hymenodes* METT. Ann. Mus. Bot. Lugd.-Bat. I (1863) 57; HOOK. Syn. Fil. (1865) 24; v. A. v. R. Handb. (1908) 24.—*C. korthalsii* METT. Ann. Mus. Bot. Lugd.-Bat. I (1863) 57; HOOK. Syn. Fil. (1865) 25; v. A. v. R. Handb. (1908) 21; Suppl. (1917) 27, p.p.—*C. amphicosmioides* v. A. v. R. Bull. Jard. Bot. Btzg III, 2 (1920) 138.—*C. arthropterygia* v. A. v. R. *ibid.* III, 5 (1922) 188.—*C. latebrosa* var. *indusiata* HOLTUM, Gard. Bull. S.S. 8 (1935) 305; Rev. Fl. Mal. I (1954) 121.

Stipe not spiny, sometimes with a pair of short pinnae near base; scales 20–35 by 1½–4 mm, dark, fragile edges soon disappearing. Lower pinnae more or less reduced; longest 50 cm long. Largest pinnules sessile, 70–100 by 15–20 mm, lowest segment (rarely several pairs of segments) almost free and often separated from next by a narrow wing along costa, rest of pinnule lobed almost to costa; costules 3–4 mm apart; veins 8–10 pairs; lamina-segments rather thin, more or less deeply crenate (lowest sometimes deeply lobed). Sori near costules; indusium an almost circular brown disc about as wide as base of sorus, its edge entire, often somewhat asymmetric about the receptacle, sometimes only on the costular side; receptacle swollen, paraphyses short, apical ones sometimes flat at the base. Scales and hairs: short crisped hairs more or less abundant on distal part of lower surface of pinna-rachis; scales near bases of costae elongate, usually entire but sometimes with a marginal seta, grading to bullate scales distally; bullate scales on costules, often deciduous from fertile pinnules; upper surface of costae always hairy.

Type specimen: KORTHALS, Sumatra (L).

Distr. *Malaysia*: Sumatra, Malay Peninsula.

Ecol. In mountain forest at 900–2000 m.

Note. METTENIUS described the indusia of both *C. hymenodes* and *C. korthalsii* as breaking (*fatisces*) but they are in almost all cases flat discs with an entire margin which gives no sign of having been formed by the breakdown of a complete indusium. In both types some of the indusia are hemitelioid, some are symmetrical about the receptacle as centre. Probably the hemitelioid indusia are more abundant in the type of *C. korthalsii*.

28. *Cyathea patellifera* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 16 (1914) 4; Handb. Suppl. (1917) 31.

Stipe to 50 cm, dark at base, red-brown upwards, spiny throughout, spines near base 2 mm long, distally less than 1 mm, scaly near base; scales to 20 by 2 mm, firm, medium brown, fragile edges early caducous. Middle pinnae 35–40 cm long. Largest pinnules 50–70 by 15 mm, abruptly pointed or short-acuminate, almost sessile, lowest pair of segments quite free, then 1 to several pairs constricted on acroscopic side at base, connected to rest by a narrow wing on costa; costules 3 mm apart; veins 6–8 pairs; lamina-segments firm, more

or less deeply crenate, free ones sometimes lobed half-way to costule. *Sori* near costules; indusium a firm brown disc hardly as wide as base of ripe sorus, its edges rather irregularly lobed; paraphyses as long as sporangia, abundant, some of them 2 cells wide at base. *Scales and hairs*: lower surface of pinna-rachis covered throughout with short crisped hairs, more copiously towards apex; scales near base of costa elongate, brown, entire, some with bullate base, grading to brown bullate scales; scattered short crisped hairs also on lower surface of costae; small entire brown bullate scales on costules.

Type specimen: MATTHEW 667, Mt Singgalang, Sumatra (BO; dupl. at K).

Distr. *Malaysia*: Central Sumatra (2 collections).

Ecol. In forest, 2200–2400 m.

Notes. The second collection (SCHIFFNER P223), from same locality, has longer pinnules than the type, with fewer free or sub-free basal segments, segments less deeply lobed, and scales paler and less rigid than those of the type. Though the indusium has in all cases an irregular margin, there is no indication that it represents the remains of a larger indusium that previously covered the sorus.

29. *Cyathea negrosiana* CHRIST, Philip. J. Sc. 2 (1907) Bot. 181; v. A. v. R. Handb. (1908) 786; COPEL. Fern Fl. Philip. 2 (1960) 214.

Stipe c. 15 cm long, warty; scales to 20 by 1½ mm, dark brown, shining, with narrow dull concolorous edges. Lowest *pinna* 5–6 cm long, longest *pinna* 35 cm. Largest *pinnules* 70 by 14 mm, sessile, acuminate, lowest 1–2 segments free or nearly so, rest of pinnule lobed nearly to costa; costules 3 mm apart; veins 8–10 pairs; lamina-segments rather thin, slightly crenate, sinuses narrow. *Sori* near costules; indusium ultimately a rather thin brown disc usually widest on the costular side, where it is conspicuous, sometimes with uneven edge and possibly the remains of a former complete indusium; receptacle very prominent; paraphyses shorter than sporangia. *Scales and hairs*: lower surface of pinna-rachis covered with very numerous small pale bullate scales, hairs lacking; lower surface of costae and costules bearing similar but smaller scales, some elongate almost flat entire scales also near base of costae.

Type specimen: WHITFORD, F. B. 1536, Mt Silay, Negros (P; dupl. at MICH).

Distr. *Malaysia*: Philippines (Negros, Leyte, Biliran).

Ecol. At 1000 m.

30. *Cyathea catillifera* HOLTUM, Kew Bull. 16 (1962) 53.

Trunk branching at base, 1 m by 10 cm ø, bearing about 6 fronds, stipe-bases persistent. *Stipe* 50 cm, base dark brown, paler upwards, closely spiny near base, minutely warty between spines, the latter rather slender, to 3 mm long; scales near base of stipe to 20 by 2–2½ mm,

shining dark brown with concolorous thinner edges; very small irregular brown scales on surface between thorns. Lowest *pinna* 23 cm long, longest *pinna* 29 cm. Largest *pinnules* 55 by 15 mm, lowest segment not free, apex acuminate; costules 3–3½ mm apart; veins to 8 pairs; lamina-segments rather rigid, edges deeply crenate when fertile. *Sori* near costules; indusium a dark brown disc c. 1 mm wide, symmetric about the receptacle or slightly wider on costular side, with thin paler edges; paraphyses slender, as long as sporangia. *Scales and hairs*: lower surface of main rachis light brown, dull, minutely warty, glabrescent; lower surface of pinna-rachis similar near base but bearing scattered very narrow long entire brown scales, distal half more or less covered with small light brown entire more or less bullate scales; costae rather densely scaly throughout lower surface, scales mostly ovate in outline, larger ones bullate, shining light brown, smaller ones of all sizes; costules bearing similar bullate scales and sometimes very narrow entire scales; veins bearing neither scales nor hairs.

Type specimen: BRASS 4549, Murray Pass, Wharton Range, Central Division, Papua (BRI; dupl. at NY).

Distr. *Malaysia*: Eastern New Guinea (one collection).

Ecol. At 2840 m.

31. *Cyathea horridula* COPEL. Un. Cal. Publ. Bot. 18 (1942) 219; Philip. J. Sc. 77 (1947) 111, pl. 8.

Trunk 3 m, slender. *Stipe* 40 cm, bearing many short spines (to 1 mm long), scaly near base; scales to 15 by 1½ mm, pale, with distinct fragile edges bearing occasional long dark setae. Lowest *pinna* 25 cm long, longest 45 cm. *Pinnules* to 55 by 13 mm, lowest 1–2 pairs of segments separately adnate to costa, rest of pinnule lobed nearly to costa; costules 3 mm apart; veins to 9 pairs; lamina-segments rather thin. *Sori* near costules; indusium a very small dark brown disc, somewhat irregular in shape, receptacle usually excentric. *Scales and hairs*: lower surface of pinna-rachis bearing elongate pale scales having long dark setae, also many very small pale fringed scales; scales on costae elongate, pale, with some long setae, grading to pale bullate scales lacking setae distally and on costules, very small scales bearing long slender hairs also present.

Type specimen: BRASS 12043, near Idenburg River, W. New Guinea (UC; dupl. at MICH, A).

Distr. *Malaysia*: Western New Guinea (one collection).

Ecol. At 1700 m.

32. *Cyathea tenuicaulis* DOMIN, Acta Bot. Bohem. 9 (1930) 165; COPEL. Philip. J. Sc. 77 (1947) 113. — *Alsophila tenuis* BRAUSE, Bot. Jahrb. 56 (1920) 71, non *C. tenuis* BRAUSE, 1911.

Trunk 1–2 m, 2 cm ø, bearing fronds 75 cm long. *Stipe* 18–40 cm, dull purplish, warty; scales to 8 by 1 mm, rigid, medium brown, fragile edges soon abraded. Lowest *pinna* 7–11 cm long, longest 21 cm. Largest *pinnules* 40–50 by 13–15 mm, lobed

to 1–2 mm from costa, no free basal segments; costules 3 mm apart (fully fertile pinnules) to 4 mm (sterile); veins 7–9 pairs; lamina-segments entire or slightly crenate. *Sori* near costules; indusium very thin and fragile, appearing as an irregular fragment on old sori; receptacle swollen, paraphyses thin and short. *Scales and hairs*: lower surface of pinna-rachis bearing rather sparse short crisped hairs, also scattered elongate dark scales bearing marginal setae, and distally pale bullate scales; lower surface of costae bearing crisped hairs and sometimes long setiferous scales near base, also small pale bullate scales throughout; bullate scales also on costules.

Type specimen: LEDERMANN 7498, Sepik region, NE. New Guinea (B).

Distr. *Malaysia*: Eastern New Guinea.

Ecol. In forest 300–1500 m.

Notes. The type specimen is from an old frond; no remnants of indusia have been seen on it. Specimens collected by CARR (13363, 14542), which agree in scaliness and form of pinnules with the type, show fragments of indusia on most sori. If the type is truly lacking in indusia, CARR's specimens should probably be regarded as representing a distinct species.

33. *Cyathea sumatrana* BAK. J. Bot. 18 (1880) 209; v. A. v. R. Handb. (1908) 23; Suppl. (1917) 32.—*C. schizochlamys* BAK. J. Bot. 18 (1880) 209; v. A. v. R. Handb. (1908) 25.—*C. subuliformis* v. A. v. R. Bull. Jard. Bot. Btzig II, n. 11 (1913) 6; Handb. Suppl. (1917) 32.—*C. tuberculata* v. A. v. R. Bull. Jard. Bot. Btzig II, n. 28 (1918) 11.

Stipe to 60 cm or more, warty, copiously scaly throughout; scales to 25 by 1–3 mm, dark to medium brown, shining, with paler fragile edges. Longest *pinnae* 50 cm long. *Pinnules* to 85 by 18 mm, lowest 1–2 segments of larger pinnules free and sometimes deeply lobed, rest of pinnule lobed almost to costa; costules 3–4 mm apart; veins 9–12 pairs, those in lobes of free segments forked twice or more; lamina-segments firm, crenate. *Sori* near costules; indusium at first completely covering sorus, thin and fragile, breaking and partly caducous at maturity; receptacle swollen; paraphyses slender, shorter than sporangia. *Scales and hairs*: lower surface of pinna-rachis covered throughout with short flexuous brown hairs, also when young with narrow flexuous brown scales 5–10 mm long often bearing long dark setae on their paler edges, those near apex of pinna with bullate base; lower surface of costae bearing bullate scales throughout, those near base of costae having long acuminate apices, some crisped hairs also present; bullate scales present on costules; upper surface of costae bearing dark antrorse hairs throughout (difference from *C. javanica*).

Type specimen: BECCARI 438, Mt Singgalang, Sumatra (K; dupl. at FI).

Distr. *Malaysia*: Sumatra, Malay Peninsula.

Ecol. In forest, 500–1500 m.

34. *Cyathea klossii* RIDL. Trans. Linn. Soc. II, Bot. 9 (1916) 251; v. A. v. R. Handb. Suppl. (1917) 489.

Trunk 1½ cm ø. *Stipe* 10 cm; scales dark, dull, thick, to 8 by hardly 1 mm, with a few long marginal setae towards apex. *Fronde* c. 60 cm long, simply pinnate; *pinnae* close and spreading throughout, several lower pairs gradually reduced, lowest 3 cm long, longest 70 by 18 mm, lobed to c. 1½ mm from costa; costules of pinna-lobes to 3½ mm apart; veins to 6 pairs, usually simple; lamina-segments entire or slightly crenate, firm. *Sori* near costules; indusium at first completely covering sorus, rather thin and pale but not translucent, breaking irregularly and in part caducous; receptacle somewhat swollen; paraphyses short, slender. *Scales and hairs*: on lower surface of main rachis throughout rather copious small pale bullate scales, with residual very narrow dark scales 3–4 mm long; costae of pinnae bearing scattered small pale bullate scales on lower surface, hairy on upper surface near base only; no scales seen on costules.

Type specimen: KLOSS, Camp III, Dec. 1912, Mt Carstensz, W. New Guinea (BM; dupl. at K).

Distr. *Malaysia*: W. New Guinea.

Ecol. At 750 m and lower.

Note. KLOSS made two collections, one labelled Camp III, one Camp III–IV; the former includes the trunk. As the trunk is well developed, this appears to be a species which always has simply pinnate fronds. It has no obvious near relatives among species with bipinnate fronds in New Guinea.

35. *Cyathea trachypoda* v. A. v. R. Bull. Jard. Bot. Btzig III, 5 (1922) 191.—*Alsophila alpina* v. A. v. R. *ibid.* II, n. 20 (1915) 4; Handb. Suppl. (1917) 62.—*C. alpina* v. A. v. R. Bull. Jard. Bot. Btzig II, n. 28 (1918) 13 (not *C. alpina* ROTH, 1800).—*C. alpicola* DOMIN, Acta Bot. Bohem. 9 (1930) 89.

Stipe at least 50 cm, bearing scattered spines to 3 mm long, more or less completely covered throughout (as also lower surface of rachis) with a thin pale woolly layer of small finely-fringed scales; larger scales scattered throughout, and also present on rachis, to 30 by 4 mm, dark, shining brown with rather broad paler fragile edges, those on main rachis commonly 10 by 1 mm. *Pinnae* to 40 cm long. Largest *pinnules* 100 by 18–20 mm, sessile, lowest segment free, then 1–2 pairs adnate and joined by a wing along costa; costules 3½ mm apart; veins 10–11 pairs; lamina-segments thin, entire or slightly crenate. *Sori* near costules; indusium at first complete, the top web-like, breaking and mostly falling away, leaving an irregular disc with lacerate edges; receptacle elongate and somewhat swollen; paraphyses short. *Scales and hairs*: lower surface of pinna-rachis at first covered with fine woolly scales as main rachis, these more or less caducous, with scattered narrow entire pale to light brown scales; lower surface of costae bearing small fringed scales and a few longer narrow ones; costules bearing ovate to elongate flat or convex pale scales, their edges fragile and lacerate, grading to very small scales.

Type specimen: BÜNNEMEIJER 10205, Mt Kerintji, Sumatra (BO; dupl. at K).

Distr. *Malaysia*: Central Sumatra.

Ecol. In forest, 2000–2750 m.

Notes. The type of *Alsophila alpina* has rachises almost completely covered on lower surface with woolly scales, but others from type locality have only remnants of such a covering. This species is very near *C. crenulata*, but differs in its spiny stipe.

A specimen from Harau-Canyon, near Pakumbuh, at 800 m (MEIJER 5282) has a spiny stipe with fine woolly covering, but costae and costules almost glabrous apart from minute long-fringed scales on costae, like those forming the woolly covering on the stipe but smaller.

36. *Cyathea crenulata* BL. En. Pl. Jav. (1828) 244; HOOK. Sp. Fil. 1 (1844) 25; Syn. Fil. (1863) 23; METT. Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 57; RACIB. Fl. Btzig 1 (1898) 36; v. A. v. R. Handb. (1908) 21; Bull. Jard. Bot. Btzig II, n. 20 (1915) 9, 10; Handb. Suppl. (1917) 27, 488, Corr. 63, 64 (excl. f. *latissima*, f. *squamulosa*, f. *subspinulosa*); BACKER & POSTH. Varenfl. Java (1939) 26.—*C. javanica* var. *rigida* BL. En. Pl. Jav. (1828) 245, p.p.—(?) *C. polycarpa* JUNGH. Nat. Geneesk. Arch. N.I. 2 (1845) 40; Flora 30 (1847) 522.—*C. excelsa* [non SW.] KUNZE, Bot. Zeit. 6 (1848) 284.—*C. spinulosa* var. *muriculata* HASSK. in Hook. J. Bot. Kew Misc. 7 (1855) 322; v. A. v. R.

Handb. (1908) 25; Suppl. (1917) 36.—*C. leucophaea* HASSK. in Hook. J. Bot. Kew Misc. 7 (1855) 323; Obs. Fil. Jav. 1 (1856) 26; v. A. v. R. Handb. (1908) 24.—*C. zollingeriana* METT. Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 57 (not of v. A. v. R. Handb. (1908) 20, 785; Suppl. (1917) 26, Corr. 42, which is *C. oinops* HASSK.).—*C. oinops* (non HASSK.) RAC. Fl. Btzig 1 (1898) 63 ('*sinops*'); v. A. v. R. Handb. Suppl. (1917) Corr. 44.—*C. distans* ROSENST. Med. Rijksherb. 31 (1917) 2.—Fig. 9f, 11.

Stipe warty, not spiny; scales to 25 by 3 mm, dark with paler fragile edges; pneumathodes in double row; main rachis rather pale when dry, finely warty, glabrescent. Lower pinnae not greatly reduced, longest 60 cm long. Largest pinnules commonly 70–100 by 17–20 mm, in some cases 25–30 mm wide (*C. sinops*, *C. distans*), lobed almost to the costa, the wider ones with a few pairs of basal segments separately adnate to costa and joined by a narrow wing; costules 3½–5 mm apart; veins to 12 pairs, mostly forked, middle ones often 2-forked; lamina-segments firm, crenate, the basal ones where fertile often deeply lobed. Sori near costules; indusium at first complete, thin, translucent, mostly caducous after breaking, leaving an irregular disc with pale thin edges; receptacle swollen, paraphyses short. Scales and hairs: pinna-rachis rather pale (green when living), finely warty on lower surface, residual scales small, pale, with short fringe of hairs; similar scales abundant on costae, especially near base, sometimes with flat elongate brown scales with pale edges which may bear dark setae; on costules of sterile pinnules pale brown convex to bullate scales.

Type specimen: BLUME, Java (L; dupl. at K).

Distr. *Malaysia*: Java, Lesser Sunda Is (Flores).

Ecol. In forest, 1700–2700 m.

Notes. *C. trachypoda*, *C. macropoda* and *C. magnifolia* of Sumatra are closely allied, and clear distinctions need to be established; the warty, not spiny, stipe of *C. crenulata* seems to be distinctive. *C. sinops* and *C. distans* were described from specimens with unusually wide pinnules having several basal segments separately adnate to the costa. It may be that these should rank as a distinct species, as *C. incisoserrata* COPEL. is here ranked as distinct from *C. latebrosa*.

37. *Cyathea macropoda* DOMIN, Acta Bot. Bohem. 9 (1930) 133.—*C. longipes* v. A. v. R. Bull. Jard. Bot. Btzig III, 5 (1922) 189 (non COPEL. 1917).

Stipe nearly 100 cm, dark at base and armed with spines to 5 mm long, paler distally with very short spines, pneumathodes in a single row, well spaced; scales not seen; rachis pale, lower surface glabrescent and somewhat warty. Lower pinnae slightly reduced, longest 50 cm long. Pinnules to 70 by 17 mm, abruptly short-acuminate to caudate, 1–2 basal segments free, rest of pinnule lobed almost to costa; costules 3½–4 mm apart; veins 10 pairs; lamina-segments firm, very slightly crenate. Sori near costules; indusium at first complete, very thin over apex of sorus, breaking and falling, leaving an irregular disc. Scales and hairs: pinna-rachis beneath smooth, pale, gla-



Fig. 11. *Cyathea crenulata* BL., showing how old fronds persist and cover upper part of trunk. Kawah Baru, Papandajan, Java (VAN STEENIS).

brescent; scales on costae few, those near base narrow, dark with pale edges bearing long dark setae, grading to ovate flat pale scales bearing a few short marginal hairs distally and on costules; no bullate scales seen.

Type specimen: BÜNNEMEIJER 9642, Mt Kerintji, Sumatra (BO; dupl. at L, U, US, A).

Distr. *Malaysia*: Central Sumatra (3 collections).

Ecol. At 2000–2400 m.

38. *Cyathea saccata* CHRIST, Ann. Jard. Bot. Btzg 19 (1904) 42; v. A. v. R. Handb. (1908) 19.

Stipe 25 cm long, medium brown, bearing slender spines 3 mm long; scales not seen. *Pinnae* to at least 43 cm long. *Pinnules* to 80 by 17 mm, lowest on stalks 2½ mm long, basal segments not free, apex caudate-acuminate; costules 4–4½ mm apart; veins 8–9 pairs; lamina-segments rather thin, light green, conspicuously crenate. *Sori* near costules; indusium complete, thin, translucent, breaking and caducous except for a brown disc at the base. *Scales and hairs*: pinna-rachis light brown, shortly spiny near base, glabrescent; on lower surface of costae some very small pale scales with long crisped pale fringing hairs, also elongate flat pale scales grading to rather sparse pale bullate scales on distal part of costae and on costules.

Type specimen: P. & F. SARASIN 2045, Mt Topapu, Central Celebes (P; dupl. at BAS).

Distr. *Malaysia*: Celebes.

Ecol. At 1300–1700 m.

39. *Cyathea magnifolia* v. A. v. R. Bull. Jard. Bot. Btzg III, 2 (1920) 135.—*C. acanthopoda* v. A. v. R. *ibid.* III, 5 (1922) 190.

Stipe dark with spines to 5 mm long; scales not seen. Largest *pinnae* c. 100 cm long. Largest *pinnules* 150–175 by 30–40 mm, lobed almost to costa; costules 4–5½ mm apart; veins c. 12(–14) pairs; lamina-segments firm, crenate. *Sori* near costules, at first covered with a thin complete indusium which breaks at maturity and is in part caducous, leaving an irregular disc with pale thin edges. *Scales and hairs*: pinna-rachis smooth and glabrous beneath; costae bearing a few small pale fringed scales; on costules a few entire bullate or strongly convex scales.

Type specimen: BÜNNEMEIJER 4175, Mt Malintang, Sumatra (BO; dupl. at L).

Distr. *Malaysia*: Sumatra.

Ecol. At 1100–2000 m.

Note. This species is near *C. crenulata* BL., differing in large size, long spines on stipe and very slight scaliness.

40. *Cyathea acanthophora* HOLTUM, Kew Bull. 16 (1962) 51.

Stipe to 80 cm; base dark with rather slender spines 4–7 mm long; scales early caducous, those on a young frond to 20 by 1 mm, medium shining brown with narrow dull concolorous edges lacking setae; pneumathodes 14–17 mm long, in a single row, rather widely spaced. *Pinnae* to 65 cm long.

Pinnules more or less articulate to rachis, largest 85–100 by 15–18 mm, lowest segment contracted at base but not free, rest of pinnule lobed almost to the costa; costules 4–4½ mm apart; veins 9–10 pairs; lamina-segments rather thin, more or less crenate, separated by sinuses ½ width of segments. *Sori* near costules; indusium at first covering sorus, very thin and mostly caducous, leaving a thin basal disc which either has the receptacle at its centre or may be only on costular side of receptacle; paraphyses short. *Scales and hairs*: pinna-rachis smooth and glabrous, pale; lower surface of costae bearing some residual flat elongate entire brown scales, grading to small flat scales; pale bullate scales on costules.

Type specimen: CLEMENS 34012, Mt Kinabalu, N. Borneo (BO; dupl. at US).

Distr. *Malaysia*: N. Borneo.

Ecol. In forest, at 1250–2000 m.

41. *Cyathea rubiginosa* (BRAUSE) DOMIN, Acta Bot. Bohem. 9 (1930) 154; COPEL. Philip. J. Sc. 77 (1947) 109.—*Alsophila rubiginosa* BRAUSE, Bot. Jahrb. 56 (1920) 66.—*Alsophila hunsteiniana* BRAUSE, *ibid.* 65.—*C. albidula* DOMIN, Acta Bot. Bohem. 9 (1930) 88.

Stipe 60 cm, dark purplish with many small conical spines to 1 mm high; scales to 15 mm (5 cm?) by hardly 1 mm wide above the base, thick at the base, edges pale and thin, bearing many long flexuous setae, also apparently superficial setae, near base of scale; very small dull brown scales bearing short dark setae also present. Lowest *pinna* 25 cm long, longest 42 cm. *Pinnules* well-spaced, to 67 by 17 mm, lobed to c. 1 mm from costa, subsessile, acuminate; costules 4–4½ mm apart; veins to 8 pairs; lamina-segments rigid, edges crenate. *Sori* on distal veins near costule, on basal veins further from it; indusium very thin, at first covering sorus, breaking and mostly caducous, leaving an irregular disc round base of sorus. *Scales and hairs*: pinna-rachis smooth and more or less glabrescent, usually with scattered narrow dull copiously setiferous scales 3–6 mm long and very small irregular non-setiferous dull brown scales; basal scales on costae elongate, dull, with irregular long setae, grading to pale bullate scales distally and on costules, some bullate scales bearing setae.

Type specimen: LEDERMANN 12539, Sepik Region, NE. New Guinea (B).

Distr. *Malaysia*: New Guinea.

Ecol. In rocky open forest or mossy forest, at 1100–2840 m.

42. *Cyathea apiculata* (ROSENST.) DOMIN, Pterid. (1929) 262.—*Alsophila apiculata* ROSENST. in Fedde, Rep. 13 (1914) 213; v. A. v. R. Handb. Suppl. (1917) 73.—*Alsophila indrapurae* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 20 (1915) 2; Handb. Suppl. (1917) 63.—*C. crenulata* f. *subspinulosa* v. A. v. R. Handb. Suppl. (1917) 28.—*C. indrapurae* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 28 (1918) 13.—*C. paleata* COPEL. Un. Cal. Publ. Bot. 14 (1929) 372, t. 56.

Stipe more than 30 cm, dark at base, paler upwards, not spiny, scaly almost throughout; scales to 15 by 3 mm, dark with paler fragile edges. *Pinnae* to at least 40 cm long. *Pinnules* to 75 by 20 mm, almost sessile, caudate-acuminate, lobed almost to costa; costules 4-4½ mm apart; veins 10 pairs; lamina-segments slightly crenate, sinuses narrow. *Sori* near costules; indusium very thin and fragile, breaking and mostly caducous; receptacle globular; paraphyses short, slender. *Scales and hairs*: pinna-rachis smooth and glabrescent beneath, not hairy; costal scales few, those near base flat, ovate, bearing a few setae on pale edges; costular scales broad, thin, pale, not bullate.

Type specimen: J. WINKLER, Pea Radja, Batakland, Sumatra (ROSENST., Fil. Sumatr. Exsic. 197, S-PA; dupl. at BM, L, P, UC).

Distr. *Malaysia*: Sumatra.
Ecol. In forest, at 1800 m.

Note. Under the original description of *C. indrapuræ*, three separate collections, made by C. G. MATTHEW in different localities, were cited. In view of the name *indrapuræ*, the specimen n. 374, from Indrapoera (= Mt Kerintji) is selected as type, and appears to me to be not different from *C. apiculata*; n. 696, from Mt Merapi, is *C. hymenodes* METT.

43. *Cyathea bunnemeijerii* v. A. v. R. Bull. Jard. Bot. Btzg III, 5 (1922) 187.

Stipe dark, at least 30 cm, near base bearing many conical spines hardly 1 mm long; scales dark with paler fragile edges, mostly caducous. *Pinnae* to 40 cm or more long. *Pinnules* to 70 by 16 mm, lobed almost to costa, lowest segment almost free; costules 3½-4 mm apart; veins to 10 pairs; lamina-segments rather thin, drying very dark, edges crenate. *Sori* near costules; indusium thin, at first completely covering sorus, breaking and in part falling, the persistent part sometimes cup-shaped; paraphyses longer than sporangia, in some cases 2 cells wide at base. *Scales and hairs*: pinna-rachis purplish beneath, slightly warty, glabrescent; scales at base of costa brown, flat, elongate, entire, grading to paler ovate or bullate scales distally and on costules.

Type specimen: BÜNNEMEIJER 5839, Mt Ranai Bunguran, Natuna Is (BO; dupl. at L).

Distr. *Malaysia*: Natuna Islands (NW. of Sarawak).

Ecol. In open scrub on summits of two hills, at 600 m.

44. *Cyathea excavata* HOLTUM, Gard. Bull. S. S. 8 (1935) 306; Rev. Fl. Malaya 2 (1954) 121; MOLESWORTH ALLEN, Gard. Bull. Sing. 17 (1959) 255, photogr. facing p. 266.—Fig. 12.

Trunk to 2 m, sometimes with lateral buds forming small crowns of fronds; fronds to 2 m long. *Stipe* at least 40 cm, smooth and green (pale when dry); basal scales few, dull, thin, soon disappearing; pneumathodes 15-20 mm long, in a single almost continuous row, at base of stipe shorter and deeply excavated. *Pinnae* to 60 cm long, lowest somewhat reduced. Largest *pinnules* commonly 80-100 by



Fig. 12. *Cyathea excavata* HOLTUM. Trunk-apex, showing deeply excavated pneumathodes arranged as V below base of a stipe. Cameron Highlands, Malaya (R. E. HOLTUM).

18-22 mm, sometimes to 130 by 27 mm, sessile, rather shortly acuminate, lobed almost to costa, lowest segment not free; costules 4-5 mm apart; veins 10-12(-14) pairs, often twice forked, pinnately branched where segments are deeply lobed; lamina-segments thin, the larger ones usually lobed ½-½ towards costule. *Sori* near costules, usually only on 1-3 basal pairs of veins; indusium pale, thin, covering young sorus completely but soon breaking, leaving an irregular persistent disc as large as base of sorus; receptacle swollen, often split when dry; paraphyses short. *Hairs and*

scales: pinna-rachis smooth and glabrous; costal scales sparse, brown, thin, entire, broadly and irregularly ovate, sometimes with a few dark setae; thinner similar scales on costules, distal ones pale, entire, flat; on veins many conspicuous very small hairs (bases of former scales).

Type specimen: HOLTUM 23538, Cameron Highlands, Malaya (S; dupl. at BO, K).

Distr. *Malaysia*: Malay Peninsula.

Ecol. Only known on Main Range in Cameron Highlands district at c. 1500 m; originally found in primary forest, in recent years on stream-sides in clearings and on forest edges, also in open grassy places (MOLESWORTH ALLEN, *l.c.*). Old fronds persist, hanging down and covering the trunk, as in *C. orientalis* (also in *C. crenulata*).

45. *Cyathea christii* COPEL. Philip. J. Sc. 1, Suppl. II (1906) 144; *ibid.* 4 (1909) Bot. 49; v. A. v. R. Handb. (1908) 785; Suppl. (1917) 29; COPEL. Fern Fl. Philip. 2 (1960) 217.

Stipe to 15 cm. Lower *pinnae* gradually reduced (sometimes a gap between lowest and next?), lowest 5 cm or more long, longest 50 cm. *Pinnules* to 70 by 15 mm, lobed nearly to costa; costules 3–3½ mm apart; veins to 8 pairs; lamina-segments rather thin, more or less crenate. *Sori* near costules; indusium at first completely covering sorus, rather thin, breaking irregularly and sometimes in part caducous. *Scales and hairs*: pinna-rachis pale and glabrescent on lower surface, warty towards base, sometimes with residual narrow scales bearing a few setae; bullate scales present throughout lower surface of costae and on costules; sometimes narrow setiferous scales present also near base of costae.

Type specimen: COPELAND 1141, Mt Apo, Mindanao (MICH; dupl. at US).

Distr. *Malaysia*: Philippines (Mindanao).

Ecol. At 900–1800 m.

46. *Cyathea geluensis* ROSENST. in Fedde, Rep. 5 (1908) 371; *ibid.* 12 (1913) 525, *incl. var. tomentosa* ROSENST.; v. A. v. R. Handb. Suppl. (1917) 30; COPEL. Philip. J. Sc. 77 (1947) 102.—*C. novoguineensis* BRAUSE, Bot. Jahrb. 49 (1912) 12, fig. 1B; v. A. v. R. Handb. Suppl. (1917) 35.—*C. sepikensis* BRAUSE, Bot. Jahrb. 56 (1920) 54; COPEL. Philip. J. Sc. 77 (1947) 103.—*C. subspatulata* BRAUSE, Bot. Jahrb. 56 (1920) 53.

Trunk slender; fronds to c. 10, 100–230 cm long. Stipe variable in length, warty or shortly spiny, scaly near base; scales pale, or partly or wholly dark, with dull fragile edges, commonly to 15 by 2 mm, in some specimens to 20 by 5 mm; stipe also covered with a more or less continuous layer of pale flexuous hairs or very small scales bearing such hairs. Lower *pinnae* reduced, sometimes continuously to a small size (5–8 cm long), sometimes a single small pair near base and then a gap; longest *pinnae* 25–45 cm long. Largest *pinnules* commonly 40–60 by 12–15 mm, on some plants to 80 by 20 mm, almost sessile, acuminate, lobed almost to costa, lowest segment sometimes almost free; costules 3½–4 mm apart; veins 7–9 pairs;

lamina-segments rather thin, crenate to subentire. *Sori* near costules; indusium pale and thin but firm, at first covering sorus, breaking irregularly and persistent; paraphyses slender, as long as sporangia. *Scales and hairs*: lower surface of main rachis and pinna-rachis closely covered with entangled flexuous pale hairs, with more or less abundant pale scales mostly bullate at base; costae rather closely covered with pale bullate scales, sometimes near base also flexuous hairs and elongate pale flat scales; pale bullate scales on costules.

Type specimen: WERNER 80, Mt Gelu, NE. New Guinea (S–PA; dupl. at B).

Distr. *Malaysia*: Central and Eastern New Guinea, Louisiade Archipelago.

Ecol. In forest at 1000–2000 m on mainland; at 700–900 m on the islands, mostly in mossy forest.

Note. Possibly more than one species should be recognized; specimens examined seem to show various combinations of characters, especially as regards length of stipe and degree of reduction of lower *pinnae*.

47. *Cyathea macgregorii* F. v. M. Trans. R. Soc. Victoria 1 (1889) 40; BAK. J. Bot. 28 (1890) 104; v. A. v. R. Handb. (1908) 17; RIDL. Trans. Linn. Soc. II, Bot. 9 (1916) 251; C. CHR. Brittonia 2 (1937) 280.—*C. keysseri* ROSENST. in Fedde, Rep. 12 (1913) 164; v. A. v. R. Handb. Suppl. (1917) 23.—*C. cheilanthoides* COPEL. Un. Cal. Publ. Bot. 18 (1942) 219; Philip. J. Sc. 77 (1947) 121, pl. 14.—Fig. 10e, f, g, 13.

Trunk to 3 m, to 24 cm ø, bearing up to 60 fronds 70–100 cm long. Stipe 5–15 cm, its base covered with shining brown dull-edged scales to 50 by 2–3 mm, warty and glaucous beneath after fall of scales; main rachis more or less persistently covered with small pale long-fringed scales, also narrow elongate thin pale scales, sometimes quite glabrescent. Lower *pinnae* gradually reduced, sometimes irregularly spaced, with a rather long gap between lowest *pinnae* (sometimes hidden by basal scales) and the next; lowest pinna 5–7 cm long; longest pinna 11–18 cm long. Largest *pinnules* 20–35 by 7–8 mm, bearing free but almost sessile very rigid tertiary leaflets, their bases 2–2½ mm apart. Largest tertiary leaflets commonly 3 by 2½ mm, ovate to deltoid, edges strongly reflexed and inrolled, more or less lobed near base; veins to 4 pairs, basal ones forked, strongly raised on lower surface but not on upper. *Sori* 4–6 on largest tertiary leaflets, fewer on smaller ones; indusium firm, brown, at first covering sorus, breaking irregularly and persistent; receptacle swollen, no persistent paraphyses. *Scales and hairs*: pinna-rachis and costae more or less persistently scaly on lower surface as main rachis, at length glabrescent and finely warty; costules bearing small long-fringed pale or brown scales between the sori.

Type specimen: W. MCGREGOR 63, Mt Knutsford, E. New Guinea (MEL; dupl. at K, P).

Distr. *Malaysia*: New Guinea.

Ecol. In open peaty grassland or on edge of forest, sometimes gregarious, 3000–3700 m.

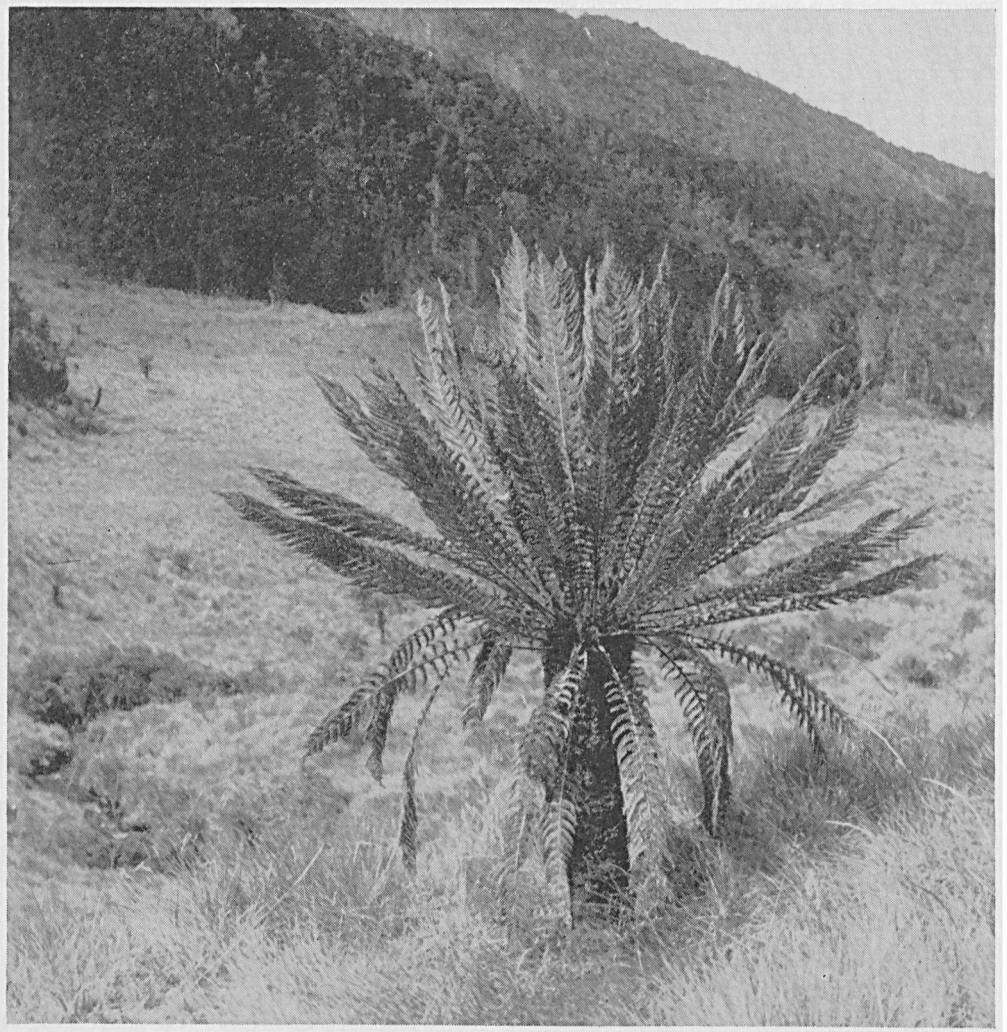


Fig. 13. *Cyathea macgregorii* F. v. M., Mt Wilhelm, Eastern Highlands, Territory of New Guinea, 3450 m (R. D. HOOGLAND).

48. *Cyathea gleichenioides* C. CHR. Brittonia 2 (1937) 281; COPEL. Philip. J. Sc. 77 (1947) 123.—Fig. 1-2, 14.

Differs from *C. macgregorii* as follows: pinnae to 10½ cm long; pinnules mostly 13-15 mm long, basal acroscopic pinnule to 17 mm; tertiary leaflets almost circular, c. 1 mm long and wide, bearing 1 or 2 sori.

Type specimen: BRASS 4595, Murray Pass, Wharton Range (BM; dupl. at A, BO, BRI).

Distr. *Malaysia*: Eastern New Guinea.

Ecol. 'A conspicuous feature of the open grasslands' at 2840-3680 m (BRASS).

Note. CHRISTENSEN stated that another distinctive character of this species in the occurrence of short pinnae close to the base of the stipe, with

a gap of 15 cm to the next pair; but such a condition has also been seen in fronds which have leaflets like typical *C. macgregorii*. It seems that there is a good deal of variation in the disposition of the lower pinnae in the latter species. It seems to me also possible that the distinction of size of tertiary leaflets is not a constant one, in which case *C. gleichenioides* should be united with *C. macgregorii*.

49. *Cyathea havilandii* BAK. Trans. Linn. Soc. II, Bot. 4 (1894) 249; v. A. v. R. Handb. (1908) 22; C. CHR. Gard. Bull. S. S. 7 (1934) 221.—*C. paleacea* COPEL. Philip. J. Sc. 12 (1917) Bot. 53.—*C. rigida* COPEL. l.c.

Trunk very short; fronds almost erect, to c. 100

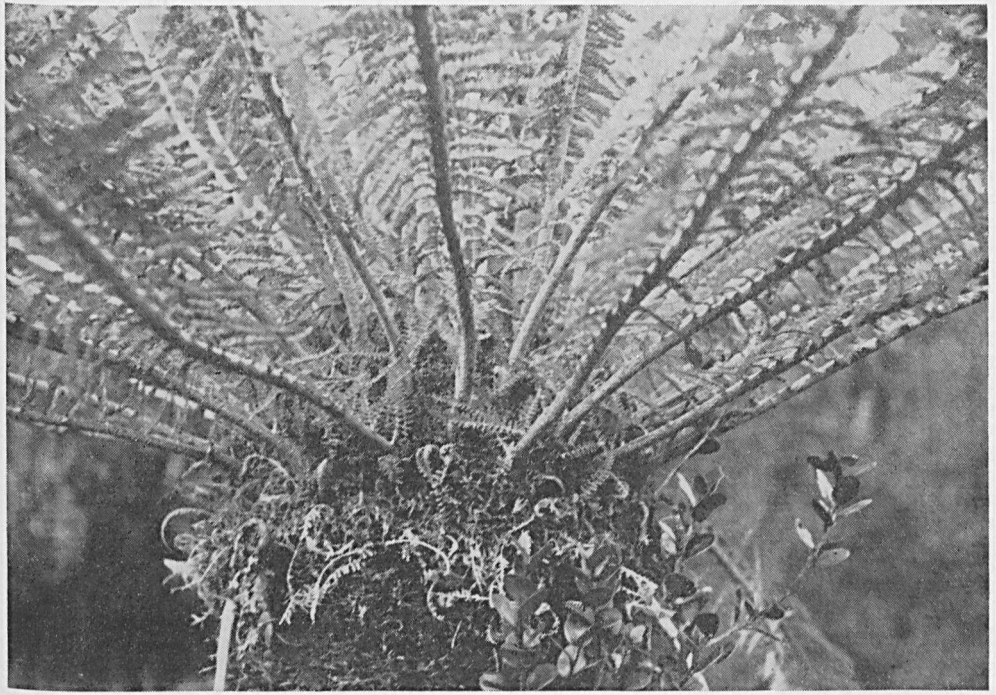


Fig. 14. *Cyathea gleichenioides* C. CHR. (BRASS 4265), top of trunk and bases of fronds, showing lowest pinnae partly covered by mass of scales. Mt Albert Edward, Papua, 3680 m (L. J. BRASS).

cm long. *Stipe* 30–40 cm, dark and warty where scales are removed, densely scaly throughout; scales near base to 15 by 1–2 mm, shining medium brown with very narrow concolorous fragile edges, size decreasing gradually upwards; upper part of stipe on abaxial surface densely covered also with much smaller scales of same colour, each ending in a long flexuous brown seta. Lower *pinnae* not much reduced; longest pinna 10–16 cm long. *Pinnules* to 25 by 7 mm, only a few near the base of larger *pinnae* free, rest separately adnate to pinna-rachis or connected by a narrow wing; largest *pinnules*, where fertile, lobed about halfway to costa, smaller and sterile ones slightly lobed; costules 2 mm apart; veins 2–3 pairs, strongly raised on lower surface; lamina very rigid, drying dark. *Sori* in a single row on each side of costa of pinnule, 1 or 2 to each vein-group; indusium very firm and dark, covering sorus to maturity, then gaping a little at the apex and breaking irregularly; paraphyses slender, short. *Scales and hairs*: main rachis densely and persistently scaly beneath throughout as upper part of stipe, some scales on distal part having bullate bases; pinna-rachis and costae of pinnules similarly scaly, scales smaller, costal ones mostly quite bullate, all ending in a long flexuous shining brown hair (hair-tip of costal scales often more than 1 mm long); upper surface of main rachis and pinna-rachis densely hairy, hairs long, darker than scales, antrorse; upper surface of costae glabrescent.

Type specimen: HAVILAND 1485, Mt Kinabalu, N. Borneo (K).

Distr. *Malaysia*: North Borneo.

Ecol. Abundant in the low open *Leptospermum-Dacrydium* forest of the ridges on Mt Kinabalu, 2400–3000 m.

50. *Cyathea imbricata* v. A. v. R. Nova Guinea 14 (1924) 11; C. CHR. *Brittonia* 2 (1937) 282; COPEL. *Philip. J. Sc.* 77 (1947) 123.

Trunk to 2 m; fronds 60–70 cm long. *Stipe* 7½–10 cm, dark, bearing spines 1 mm long, scaly when young; largest scales 12–15 by 2–4 mm, castaneous with paler fragile edges; small scales forming a woolly covering also present. Lower *pinnae* gradually reduced, lowest less than 5 cm long; middle *pinnae* close and imbricate, to 8½ cm. *Pinnules* to 18 by 8 mm, deeply lobed except towards apex, lobes close, 2–3 by 2 mm, thick and rigid but edges not reflexed; veins 4–5 pairs, simple or forked. *Sori* 1–4 to each lobe of lamina; indusium firm, at first quite covering sorus, breaking irregularly and persistent. *Scales and hairs*: pinna-rachis glabrescent beneath, residual scales firm, brown, with thin paler edges bearing a few short hairs and a hair-point; scales on costae similar but smaller, with long caudate tips, mostly caducous.

Type specimen: LAM 1625, foot of Doorman summit, W. New Guinea (BO; dupl. at S, US, L, U, UC).

Distr. *Malaysia*: Western New Guinea.
Ecol. In open forest at 3240 m.

51. *Cyathea longipes* COPEL. Philip. J. Sc. 12 (1917) Bot. 54; C. CHR. Gard. Bull. S. S. 7 (1934) 222.

Stipe slender, to 200 cm, dark and copiously spiny near base; spines to 5 mm long; basal scales mostly caducous, rather broad; no persistent small scales. *Pinnae* to at least 70 cm long. *Pinnules* all stalked except distal ones, stalks of lowest on lower pinnae to 10 mm, on smaller pinnae 3–6 mm; largest pinnules 100–130 by 20–32 mm, acuminate, 1–3 pairs of basal segments free or separately adnate and connected by a costal wing, rest of pinnule lobed almost to costa; costules 4½–6 mm apart; veins 10 pairs; lamina-segments crenate or the lowest ones more deeply lobed. *Sori* near costules; indusium rather thin, at first completely covering sorus, breaking irregularly and mostly persistent; receptacle swollen; paraphyses slender, about as long as sporangia. *Scales and hairs*: main rachis and pinna-rachis quite glabrescent, rather pale, sparsely short-spiny; scales on lower surface of costae ovate-acuminate, thin, entire, brown, shorter and more or less bullate distally; bullate-acuminate scales on costules.

Type specimen: CLEMENS 10915, Mt Kinabalu, North Borneo (MICH; dupl. at K, BO, UC, A).

Distr. *Malaysia*: North Borneo.

Ecol. In ridge forest at 1250–1500 m, only on Marai-Parai spur of Mt Kinabalu, locally abundant.

52. *Cyathea acuminata* COPEL. Philip. J. Sc. 81 (1952) 15; Fern Fl. Philip. 2 (1960) 213.

Stipe not known. *Pinnae* to 70 cm long. Largest *pinnules* 100–120 by 22 mm, long-acuminate, lower ones on stalks to 4 mm long; all segments separated by rather wide sinuses, several lower pairs separately adnate to costa; costules 4½–6 mm apart; veins to 12 pairs; lamina-segments rather thin, strongly crenate-serrate. *Sori* near costules; indusium at first quite covering sorus, rather firm, breaking irregularly and persisting; receptacle much swollen, bearing some small scales at its apex; paraphyses slender. *Scales and hairs*: pinna-rachis glabrescent beneath, bearing scattered small spines near base; scales near base of costae elongate, flat, dull brown, entire, grading to bullate ones distally and on costules.

Type specimen: RAMOS & EDANO, BS 30900, Jamindan, Capiz Prov., Panay (UC; dupl. at S, US, K, P, BM).

Distr. *Malaysia*: Philippines (Panay, Samar).

Note. The type of this species and other specimens were distributed from Manila as *C. spinulosa*.

53. *Cyathea insulana* HOLTUM, Kew Bull. 16 (1962) 56.

Trunk 8–10 m, 14 cm ø; fronds spreading, 3 m long including stipe. *Stipe* 100 cm, covered with many thick conical spines 2 mm long and throughout with a thin felt of very small pale-brown short-fringed or setiferous scales; large scales abundant along edges of grooves of adaxial surface of basal

25 cm of stipe, these scales 35–45 mm long, shining castaneous, rigid, much twisted, with pale fragile edges, largest scales 1½–3 mm wide at base; pneumathodes in a single row on each side of stipe, 7–11 mm long, those near base deeply excavated. *Pinnae* to at least 50 cm long. Largest *pinnules* 120–130 mm long, caudate-acuminate, lobed nearly to costa with basal 1–2 segments separately adnate; sterile pinnules 30 mm wide, fertile 20 mm, lowest ones with stalks 2 mm long; costules to 5 mm apart; veins 12–14 pairs; lamina-segments strongly crenate or lowest ones more deeply lobed. *Sori* near costules; indusium at first completely covering sorus, thin and pale, breaking irregularly. *Scales and hairs*: scales on pinna-rachis abundant, very small, light brown, mostly setiferous; on costae similar scales and sometimes also narrow setiferous ones; on costules similar very small setiferous scales, also a few larger thin ovate flat or convex scales bearing a few slender setae; on veins many very small light brown almost circular somewhat bullate scales, not setiferous.

Type specimen: BRASS 24725, Goodenough I., Milne Bay District, Papua (A; dupl. at L).

Distr. *Malaysia*: d'Entrecasteaux Is. (Goodenough I., Normanby I., Fergusson I.).

Ecol. In mossy forest or in ravines near rain-forest-mossy forest transition, 750–1600 m.

Note. The specimens here included from Normanby and Fergusson Is are smaller than the type and from lower elevations; they have stipes less spiny, pinnules to 82 by 20 mm. They also show elongate narrow setiferous scales on costae; possibly these were caducous on the type specimen.

54. *Cyathea pseudomuelleri* HOLTUM, Kew Bull. 16 (1962) 61.—Fig. 15.

Trunk 4 m, bearing many fronds; stipe-bases persistent. *Stipe* 10 cm, above base dull, rather pale, finely warty; scales near base many, to 40 by hardly 1 mm, rigidly erect, twisted, dark with very narrow paler edges. Lower *pinnae* gradually reduced, lowest 12 cm long, longest 24 cm. Largest *pinnules* 45 by 10 mm, very rigid, shape and texture about as in *C. muelleri*, differing in having veins prominent on both surfaces. *Sori* at first completely covered by firm indusia which break irregularly and persist. *Scales and hairs*: most scales on pinna-rachis and costae soon caducous, remaining larger ones light brown, flat, elongate, setiferous, also pale sub-bullate scales ½ mm long and wide; costules usually bare; veins bearing minute hairs on lower surface.

Type specimen: BRASS 9430, Mt Wilhelmina, W. New Guinea (A; dupl. at L, BO, MICH, UC).

Distr. *Malaysia*: W. New Guinea (one collection).

Ecol. At 3200 m.

55. *Cyathea archboldii* C. CHR. Brittonia 2 (1937) 278; COPEL. Philip. J. Sc. 77 (1947) 105.—*C. bidentata* COPEL. Un. Cal. Publ. Bot. 18 (1942) 218; Philip. J. Sc. 77 (1947) 105, pl. 3.

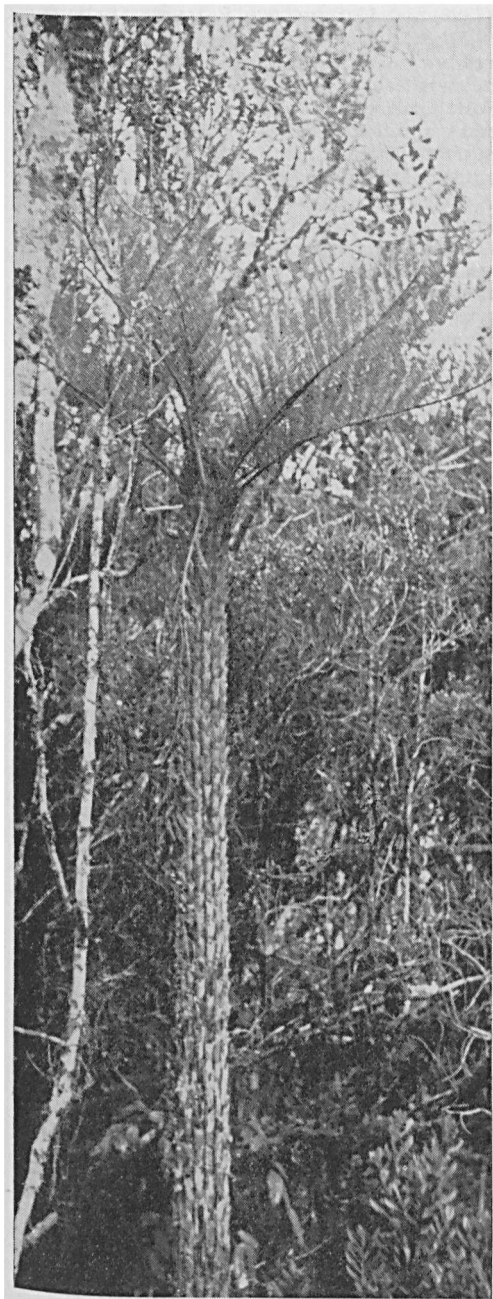


Fig. 15. *Cyathea pseudomuelleri* HOLTUM (BRASS 9430), showing habit and persistent stipe-bases throughout trunk. Mt. Wilhelm, W. New Guinea, 3200 m (L. J. BRASS).

Fronds 200–300 cm long, about 10. Stipe c. 50 cm, base bearing short spines and covered with scales; largest scales 30–40 by $1\frac{1}{2}$ –2 mm, very pale to

pale brownish with fragile edges which may be darker than the rest; also present a rather close thin layer of rusty brown scurf consisting of very small irregular scales mostly bearing 1 or more dark flexuous setae; rachis similarly covered with small scales, sometimes also with narrow scales to 10 mm long. Largest pinna 45 cm long. Largest pinnules 60–90(–120) by 13–20(–25) mm, sessile, several basal pairs of segments separately adnate to costa; costules 3–5 mm apart; veins to 9 pairs; lamina-segments rather thick and rigid, crenate-serrate, basal ones lobed up to $\frac{1}{2}$ way to costule, lobes retuse or bidentate. Sori near costules; indusium at first covering sorus, sometimes opening by a small apical circle, soon breaking irregularly, persistent. Scales and hairs: pinna-rachis, costa and costules covered with scales like the small ones on the stipe, those on costules with many long flexuous shining marginal setae, none bullate; small dark setiferous scales also present on lower surface of veins; narrow elongate scales sometimes also present on pinna-rachis and costae.

Type specimen: BRASS 4551, Murray Pass, Wharton Range, Papua (BM; dupl. at A, BO, BRI, MICH).

Distr. Solomon Is (Bougainville), in Malaysia: New Guinea.

Ecol. At 1950–2840 m, in forest, in New Guinea; at 1000 m on Bougainville I. The Bougainville specimen is less rigid and small scales generally are pale-fringed, not setiferous. A Papuan specimen from 3000 m, in alpine shrubbery (SCHODDE 1890) is smaller and much more densely scaly throughout than other specimens.

var. horrida HOLTUM, *var. nov.*

A *typo speciei differt: paleis stipitis atrocaneis, spinis ad $2\frac{1}{2}$ mm longis, paleis venarum paucioribus, non vel raro setiferis.*

Type specimen: HOOGLAND & PULLEN 5506, NE. New Guinea, at 2400 m, in mountain forest (K).

56. *Cyathea foersteri* ROSENST. in Fedde, Rep. 10 (1912) 321; v. A. v. R. Handb. Suppl. (1917) 28; C. CHR. Brittonia 2 (1937) 279; COPEL. Philip. J. Sc. 77 (1947) 104.

Trunk to 10 m, bearing 9 fronds 225 cm long (BRASS). Stipe 5–15 cm, closely covered throughout with pale scales to 15 by little over 1 mm. Lower pinnae gradually reduced, lowest 8 cm long; longest 35 cm. Largest pinnules to 90 by 15 mm (on a small frond to 55 by 16 mm), lowest segments (sometimes several pairs) free or distinctly separate and joined by a narrow wing; costules $2\frac{1}{2}$ – $3\frac{1}{2}$ mm apart; veins 7–10 pairs, dark and raised on lower surface; lamina-segments rather thin, finely crenate-serrate, free basal ones sometimes deeply lobed, lobes bidentate. Sori near costules; indusium thin and firm, covering sorus to maturity, breaking and persisting; receptacle swollen; apparently no paraphyses. Scales and hairs: pinna-rachis more or less persistently covered with small pale scales which are usually setiferous, also sometimes scattered narrow scales 5 mm or

more long, often with long dark marginal setae; costal scales ovate to elongate, often closely overlapping, edges usually setiferous but the smaller sometimes with a short pale fringe; costular scales as costal but smaller, in some cases smallest ones setiferous, in other cases fringed with short hairs; similar scales more or less abundant on lower surface of veins.

Type specimen: KEYSER 16, Sattelberg, NE. New Guinea (S-PA; dupl. at B).

Distr. *Malaysia*: Eastern New Guinea.

Ecol. In scrub on forest edge and in mossy forest, at 1600-2800 m.

Note. This species is very near *C. archboldii*, but appears to be distinct in its short stipe with reduced lower pinnae, and shorter narrower stipe-scales; also possibly in thinner pinnule-segments. There is a good deal of variation in the abundance of dark setae on the scales of pinna-rachis, costae and costules.

57. *Cyathea nigrolineata* HOLTUM, Kew Bull. 16 (1962) 58.

Fronde 210 cm or more long, in 1 or 2 whorls of 5-8 each. *Stipe* to 12 cm, not spiny, densely covered throughout with scales to 25 by less than 1 mm, shining and almost white or more usually with a narrow median black line, all ending in a dark seta, fragile edges dull; also a thin under-cover of small dull brown scales, some setiferous. Lower *pinnae* gradually reduced, lowest 5 cm long, longest 35-45 cm (rarely to 60 cm). Largest *pinnules* of type 47 by 12 mm, of another collection 90 by 20 mm, sessile, apex abruptly pointed, several lower pairs of segments partly free (constricted on acroscopic side at base), 1-2 pairs sometimes quite free; costules 2½-3 mm apart; veins 8-10 pairs, concolorous and not raised on lower surface; lamina-segments very firm, edges entire or undulate, not crenate, or those on larger pinnules sometimes lobed where fertile, lobes sometimes bidentate. *Sori* near costules; indusium firm, brown, at first complete, breaking and persistent. *Scales and hairs*: pinna-rachis bearing copious very small brown scales with setiferous apex, also scattered scales 2-3 by ½ mm, with dark shining mid-band and paler edges, and somewhat smaller, narrower scales bearing marginal setae; scales on costae many, small, dark, shining, with many curved dark setae; on costules and veins smaller, those on veins scattered but abundant.

Type specimen: HOOGLAND & PULLEN 5495, Eastern Highlands, NE. New Guinea (K; dupl. at BO, US, SYD, BRI, L).

Distr. *Malaysia*: Eastern New Guinea (4 collections).

Ecol. At 2300-2400 m in forest or secondary growth (specimen from secondary growth is largest). This species should perhaps be united with *C. foersteri* ROSENST. Type material of the latter does not show stipe nor larger scales of pinna-rachis.

58. *Cyathea inquinans* CHRIST, Verh. Nat. Ges. Basel 11 (1896) 422; Ann. Jard. Bot. Btzig 15

(1898) 83, t. 13, f. 5; v. A. v. R. Handb. (1908) 23.

Stipe 15 cm, densely scaly; larger scales bright red-brown, rather thin, to 30 by 2 mm, long-acuminate, apex a dark red seta, fragile edges narrow; small scales very abundant, often with dark red setiform apex. *Rachis* similarly scaly on lower surface, larger scales to 10 by 1 mm, bearing rather many dark red setae more than ½ mm long. *Pinnules* to 60 by 15 mm, short-acuminate, lobed nearly to costa, close and more or less imbricate; costules 3 mm apart; veins 9 pairs; lamina-segments where fertile rather deeply lobed. *Sori* near costules; indusium thin, brown, at first complete, breaking and persistent. *Scales and hairs*: pinna-rachis scaly as main rachis, small scales very abundant and mostly setiferous; costal scales light brown, all setiferous, grading from elongate acuminate to very small; costular scales as smaller ones on costae; no hairs on lower surface of pinnules.

Type specimen: P. & F. SARASIN 1328, Mt Lompobattang (= Bonthain), SW. Celebes (BAS).

Distr. *Malaysia*: SW. Celebes (2 collections), Moluccas: Ceram (?).

Ecol. At 2000-2800 m.

Note. A sterile specimen collected by EYMA in Ceram (*n.* 2371) agrees with *C. inquinans* in scabiness, but is larger, apparently with a longer stipe; it has pinnae to 60 cm long, pinnules to 100 by 20 mm, costules 4 mm apart, veins 15 pairs. If not *C. inquinans*, it probably represents a new species. The altitude given for this specimen is 40 m, but EYMA had just descended from the mountains and it seems possible that the specimen was collected there.

59. *Cyathea ferruginea* CHRIST, Philip. J. Sc. 2 (1907) Bot. 181; v. A. v. R. Handb. (1908) 784; COPEL. Fern Fl. Philip. 2 (1960) 215.—*C. ferrugineoides* COPEL. Philip. J. Sc. 81 (1952) 15; Fern Fl. Philip. 2 (1960) 215.

Stipe 12 cm, bearing many spines 1 mm long; scales rather sparse, to 15 by 1 mm, dark with narrow pale fragile edges bearing setae. Lowest *pinnae* 5-6 cm long, possibly a gap between these and next pinnae; longest pinna 35 cm or more. *Pinnules* to 80 by 15-20 mm, lower ones on stalks 2-4 mm long, acuminate, lobed nearly to costa; costules 3½-4½ mm apart; veins to 9 pairs; lamina-segments thin to firm, slightly crenate; fertile pinnules narrower than sterile, with closer costules. *Sori* near costules; indusium at first complete, thin, pale, breaking irregularly and persistent; paraphyses many, as long as or longer than sporangia, not widened at base. *Scales and hairs*: pinna-rachis glabrescent on lower surface, residual scales mostly very narrow, on distal part some scales as costae and also slender crisped hairs; scales near base of costae narrow, flat, entire, grading to paler acuminate bullate scales; bullate scales on costules.

Type specimen: FOXWORTHY BS 560, Palawan (P; dupl. at BO, K, US, MICH, A).

Distr. *Malaysia*: Philippines (Palawan, Balabac, Negros).

Ecol. In forest, to 1150 m, the type from mossy forest, near summit of Mt Pulgar, other specimens apparently from lower altitudes.

60. *Cyathea oosora* HOLTUM, Kew Bull. 16 (1962) 59.—*C. assimilis* [non HOOK.] CHRIST, Ann. Jard. Bot. Btzg 15 (1898) 82.

Stipe 50 cm or more, warty near base; pneumathodes 14–20 mm long, in an almost continuous row; scales not seen. Longest *pinnae* 60 cm long. Largest *pinnules* 90 by 20 mm, sessile or nearly so, acuminate, lobed almost to costa, lowest segment not free; costules 3½–4 mm apart; veins 9–10 pairs; lamina-segments rigid, edges crenate. *Sori* near costules; indusium firm, shining brown when old, at first ovoid with a small apical aperture, breaking irregularly and persistent; paraphyses short, slender. *Scales and hairs*: pinna-rachis glabrescent on lower surface, residual scales 3–4 mm long, narrow, brown, crisped, not setiferous; costae densely scaly, scales uniformly brown, lower ones elongate-acuminate with slightly bullate base, grading to hair-pointed bullate scales distally and on costules; some of the larger costal and costular scales have marginal concolorous hairs, not dark setae.

Type specimen: CLEMENS 51188, Mt Kinabalu, N. Borneo (K; dupl. at A, L, MICH, UC).

Distr. *Malaysia*: N. Borneo, N. Celebes.

Ecol. At 2200–3000 m in ridge-forest, on Mt Kinabalu; at 1500–2000 m in Celebes.

Note. The Celebes specimens differ from those on Mt Kinabalu in having paler scales, and one of them (SARASIN 933) has very few scales on the pinnules.

61. *Cyathea halconensis* CHRIST, Philip. J. Sc. 3 (1908) Bot. 270; COPEL. Philip. J. Sc. 4 (1909) Bot. 51; v. A. v. R. Handb. Suppl. (1917) 24; COPEL. Fern Fl. Philip. 2 (1960) 216.—*C. mearnsii* COPEL. Philip. J. Sc. 3 (1909) Bot. 356; *ibid.* 4 (1909) Bot. 57; v. A. v. R., Handb. Suppl. (1917) 24; COPEL. Fern Fl. Philip. 2 (1960) 214.—*C. melanophlebia* COPEL. Philip. J. Sc. 38 (1929) 131; Fern Fl. Philip. 2 (1960) 220.

Stipe commonly 5 cm, spines copious, conical, to 1 mm long; scales to 30 by 2 mm, dark brown, hardly shining, with distinct concolorous fragile edges bearing a few dark setae. Lower *pinnae* gradually reduced, lowest 7–12 cm long, sometimes bipinnate; longest *pinna* 50 cm. Largest *pinnules* commonly 70–100 by 20 mm wide at base, sessile, caudate-acuminate (cauda to 15 mm), lowest 1–3 pairs of segments free or nearly so, rest of pinnule lobed almost to costa; costules 3½–4½ mm apart; veins to 12 pairs; lamina-segments thin but firm, crenate. *Sori* near costules, quite covered when young by rather thin pale indusia which break and persist; receptacle swollen; paraphyses short, some apical ones with a broad base. *Scales and hairs*: pinna-rachis rather pale, glabrescent, sparsely warty, residual scales narrow, bearing a few setae; scales on costae and costules few, thin, brown, ovate or narrower, entire, flat; minute hairs on veins abundant and often conspicuous.

Type specimen: MERRILL 6055, Mt Halcon, Mindoro, Philippines (P; dupl. at US, MICH, A).

Distr. *Malaysia*: Philippines (Mindoro, Luzon).

Ecol. Probably in forest, at 1200–1700 m.

Note. The wide pinnules are a character of this species; on the type collection are pinnules only 65 by 20 mm. COPELAND reported pinnules 29 mm wide on the type of *C. mearnsii*, but I found none larger than 110 by 23 mm.

62. *Cyathea ascendens* DOMIN, Acta Bot. Bohem. 9 (1930) 94.—*Alsophila rosenstockii* BRAUSE, Bot. Jahrb. 56 (1920) 63; COPEL. Philip. J. Sc. 77 (1947) 116.

Trunk slender; fronds to 100 cm long, well spaced, with long-decurrent bases. *Stipe* 8–12 cm; scales on stipe and lower part of rachis to 8 by 1 mm, dark and shining with fragile pale edges bearing long flexuous dark setae. *Pinnae* 35–40 pairs, lower ones gradually reduced, longest 8½ by 1¾ cm, almost sessile, pinnatifid nearly to costa; costules of pinna-segments 4½ mm apart (fertile) to 5½ mm (sterile); veins to 10 pairs, simple or forked. *Sori* median; no indusia. *Scales and hairs*: main rachis beneath covered with copious crisped dark hairs, with a few scales attached to wart-like bases, scales very narrow, to 3–4 mm long, brown with irregular long flexuous marginal setae; costae of pinnae similarly hairy and scaly beneath; costules of pinna-segments bearing paler and sparser hairs on lower surface and a few small scales; no bullate scales seen.

Type specimen: LEDERMANN 9963, Sepik Region, NE. New Guinea (B).

Distr. *Malaysia*: NE. New Guinea (2 collections).

Ecol. In forest, at 800–1000 m.

Notes. The collector wrote of the trunk '1–2 m lang, krumm'. The herbarium specimen shows the apex of the trunk, 14 cm long, straight, lacking roots. There is no evidence of climbing habit; it seems more likely that the slender trunk had fallen, or partly fallen, and that the apical part grew erect after the fall, the whole being thus crooked. This species seems nearest to *C. gregaria*, but, apart from the simply pinnate condition, the rachises are far more hairy on the lower surfaces.

63. *Cyathea recurvata* (BRAUSE) DOMIN, Acta Bot. Bohem. 9 (1930) 153.—*Alsophila recurvata* BRAUSE, Bot. Jahrb. 56 (1920) 61.

Trunk to 5 m; fronds of type not over 150 cm long (*sec. coll.* 200 cm). *Stipe* 10 cm; scales medium brown, to 12 by 1½, their fragile edges bearing dark setae; pneumathodes 4 mm long, well-spaced. Lower *pinnae* gradually reduced, lowest 4 cm long, longest 20 cm. *Pinnules* to 28 by 8 mm wide at base, rather suddenly contracted to 5–6 mm wide, lobed to about half-way to costa; costules 2½ mm apart; veins to 5 pairs in basal segments, in others 3 pairs, simple except in basal segments. *Sori* near costules; no indusium; receptacle rather elongate; paraphyses short. *Scales and hairs*: lower surface of pinna-rachis bearing narrow setiferous scales to 2 mm long and crisped

dark hairs; costae similar; no scales seen on costules (all pinnules of type are fully fertile).

Type specimen: LEDERMANN 9264, Sepik Region, NE. New Guinea (B).

Distr. *Malaysia*: NE. New Guinea (one collection).

Ecol. At 850 m.

64. *Cyathea eriophora* HOLTUM, Kew Bull. 16 (1962) 55.

Trunk to 3 m; fronds few, to 225 cm long.

Stipe 15 cm, dark, with spines to 1 mm long, covered throughout with a close felt of very small pale scales, the larger with dark setiform apex; large scales abundant on stipe and base of rachis, to 20 by 2 mm, narrowed to twisted tip, shining dark brown with narrow fragile edges bearing many long dark setae. Lower surface of *main rachis* smooth, medium brown, with dense felt of pale crisped hairs and scattered long narrow dark setiferous scales. Lower *pinnae* gradually reduced, lowest 5–8 cm long, longest 30–42 cm. *Pinnules* to 75 by 18 mm, sessile, short-acuminate, lowest segment almost free, rest of pinnule lobed nearly to costa; costules 3–3½ mm apart; veins 8–9 pairs; lamina-segments rather thin, almost entire or lowest ones on lower pinnules deeply crenately lobed. *Sori* near costules, without indusia; receptacle swollen; paraphyses short. *Scales and hairs*: lower surface of pinna-rachis densely covered with long tangled pale crisped hairs, also many narrow dark scales with pale edges bearing long setae; costae similar; costules bearing pale bullate scales, usually hair-pointed; upper surface of pinna-rachis and costae covered with dark hairs, also on pinna-rachis some scales as on lower surface.

Type specimen: CARR 14439, Boridi, Papua (K; dupl. at BM, L).

Distr. *Malaysia*: Eastern New Guinea (3 collections).

Ecol. In wet ravine in forest, locally common, at 1400–1950 m.

65. *Cyathea gregaria* (BRAUSE) DOMIN, Acta Bot. Bohem. 9 (1930) 120.—*Alsophila gregaria* BRAUSE, Bot. Jahrb. 56 (1920) 68.

Trunk 4–5 m, 'arm-thick'. *Stipe* 40 cm; spines to 1 mm long; scales few, to 15 by 1 mm, medium brown with pale edges bearing long flexuous setae. Lowest *pinna* 17 cm long, longest 32 cm. *Pinnules* to 60 by 15 mm, lobed almost to costa; costules 3½ mm apart; veins to 9 pairs; lamina-segments crenate, sinuses rather wide. *Sori* near costules, without indusia; receptacle rather high. *Scales and hairs*: lower surface of pinna-rachis bearing rather sparse dark crisped hairs; on lower surface of costae dark crisped hairs and some dark narrow scales with scattered marginal setae; on costules similar hairs and a few scales.

Type specimen: LEDERMANN 8596, Sepik Region, NE. New Guinea (B).

Distr. *Malaysia*: Eastern New Guinea (one collection).

Ecol. In forest, growing in groups, 100 m.

66. *Cyathea modesta* (BAK.) COPEL. Philip. J. Sc. 4 (1909) Bot. 48.—*Alsophila modesta* BAK. J. Bot. 18 (1880) 210; v. A. v. R. Handb. (1908) 37.—*Hemitelia singalanensis* v. A. v. R. Bull. Jard. Bot. Btzig II, n. 16 (1914) 15; Handb. Suppl. (1917) 43.—*Hemitelia confluens* v. A. v. R. Bull. Jard. Bot. Btzig II, n. 16 (1914) 14; Handb. Suppl. (1917) 49.—*Hemitelia subconfluens* v. A. v. R. Bull. Jard. Bot. Btzig II, n. 28 (1918) 25.—*C. singalanensis* DOMIN, Pterid. (1929) 264.—*C. confluens* DOMIN, l.c. 263.—*C. subconfluens* DOMIN, Acta Bot. Bohem. 9 (1930) 162.

Stipe 35–50 cm or more; spines bluntly conical, hardly 1 mm high; scales abundant throughout, to 30 by 1½ mm, medium brown with narrow concolorous fragile edges; also more or less abundant hairs at rachis. Main *rachis* covered with a close felt of crisped pale hairs, also with more or less caducous very narrow entire crisped brown scales 5–10 mm long. *Pinnae* to 40 cm or more long. *Pinnules* to 60 by 14 mm, sessile, abruptly pointed, one to several basal segments almost free; costules 3–4 mm apart; veins 7–10 pairs; lamina-segments firm, crenate, or the basal ones more deeply lobed, sinuses (apart from basal ones) narrow. *Sori* near costules; indusium hemiteloid, firm, brown, sometimes semicircular, or smaller and a little bilobed, hidden or almost hidden by ripe sorus; paraphyses as long as sporangia, sometimes widened at base. *Scales and hairs*: pinna-rachis densely covered throughout with crisped hairs, very narrow crisped entire brown scales at first abundant, also distally smaller scales bullate at base; at base of costae narrow acuminate entire scales, flat or bullate at base, grading to bullate-acuminate scales, some of which occur throughout costa; scales on costules bullate, often hair-pointed.

Type specimen: BECCARI 434, G. Singgalang, Sumatra (K; dupl. at FI).

Distr. *Malaysia*: Sumatra.

Ecol. In forest at 1800–2400 m.

Note. The type of *Alsophila modesta* was an unusually small specimen, with pinnules to 40 by 11 mm.

67. *Cyathea doctersii* v. A. v. R. Bull. Jard. Bot. Btzig III, 2 (1920) 136.

Stipe-base not seen. Main *rachis* and pinna-rachis glabrous on the median raised part of the upper surface (some hairs present in the small groove on each side of this), hairy throughout on lower surface. *Pinnae* to 45 cm long. *Pinnules* to 75 by 17 mm, lobed almost to the costa, almost sessile, shortly pointed; costules 3½–4 mm apart; veins to 8 pairs; lamina-segments almost entire. *Sori* near costules; indusium a thin brown scale of varied shape and size on costular side, often 2-lobed, sometimes encircling the base of the receptacle. *Scales and hairs*: scales near base of costae elongate, entire, flat, grading to similar scales bullate at the base and to bullate-acuminate; hairs also present on lower surface of costae, not on upper surface.

Type specimen: DOCTERS VAN LEEUWEN 3265, Deli, Sumatra (BO; dupl. at L).

Distr. *Malaysia*: Sumatra (one collection).

Ecol. Probably in forest, at 150 m.

Note. This is near *C. javanica* in character and distribution of hairs and scales, but almost all indusia are hemitelioid; it is possibly a hybrid between *C. javanica* and one of the species of the *C. latebrosa* alliance.

68. *Cyathea cucullifera* HOLTUM, Kew Bull. 16 (1962) 54.

Fronds 150–175 cm long, in 2 whorls of 4–6 each. *Stipe* 15 cm, warty, densely scaly throughout; larger scales all round base of *stipe*, along sides above base, to 20 by ½ mm, dark, shining, with narrow pale edge bearing scattered long flexuous dark setae; small scales forming a dense felt over whole abaxial surface of *stipe*, dark brown, larger ones setiferous; *rachis* pale brown, finely warty, with sparse covering of very small pale brown scales. Lower *pinnae* gradually reduced, lowest less than 5 cm long, largest 30 cm. *Pinnules* to 40 mm long and 10 mm wide (sterile), 6–8 mm wide (fertile), sessile, short-acuminate, lobed nearly to costa, lowest segment not quite free; costules 3 mm apart (sterile), 2–2½ mm (fertile); veins 8–9 pairs (sterile), 6 pairs (fertile); lamina-segments firm, close, nearly entire. *Sori* close to costule; indusium a pale brown scale backing the costule, concave towards sorus, when flattened usually more than a semicircle (rarely spreading round base of receptacle); paraphyses slender, short. *Scales and hairs*: lower surface of pinna-rachis covered with interlacing crisped hairs and very small scales with a crisped hair-tip, also scattered elongate flat scales bearing a few long marginal setae; at base of costae some (usually deciduous) narrow setiferous scales, also very small pale scales, some with long flexuous hair-tips, grading to crisped hairs and to very small scales, distally to small pale bullate scales; on costules very small pale hair-tipped scales and pale bullate scales; on veins abundant very short appressed hairs (bases of scales?).

Type specimen: HOOGLAND & PULLEN 5497, Eastern Highlands, NE. New Guinea (K; dupl. at L, BO, US, SYD, BRI).

Distr. *Malaysia*: E. New Guinea (4 collections).

Ecol. Common in mountain forest, at c. 2400 m.

69. *Cyathea setulosa* COPEL. Philip. J. Sc. 81 (1952) 14; Fern Fl. Philip. 2 (1960) 212.

Stipe not known. *Pinnae* 45 cm long. Largest *pinnules* 90 by 17 mm, sessile, shortly caudate, basal 1–2 segments free, then 1–2 pairs separately adnate to costa, rest of pinnule lobed nearly to costa; costules 3½ mm apart; veins 9–11 pairs; lamina-segments almost entire except the lower fertile ones which are sometimes deeply crenate near base. *Sori* near costules; indusium dark brown hemitelioid, more than half covering mature sorus, at length reflexed and backing the costule; paraphyses short. *Scales and hairs*: lower surface of pinna-rachis densely covered with dark shining crisped hairs, with a few dark very narrow entire scales; costae hairy beneath as pinna-rachis except near apex, scales few, small, not setiferous;

no bullate scales seen on costae and costules.

Type specimen: ALCASID & EDANO, PNH 5068, Mt Camatis, Quezon Province, Luzon (UC).

Distr. *Malaysia*: Philippines (Luzon).

70. *Cyathea muelleri* BAK. J. Bot. 28 (1890) 104; v. A. v. R. Handb. (1908) 25; COPEL. Philip. J. Sc. 77 (1947) 105.—*C. longipaleata* ALSTON, J. Bot. 78 (1940) 226; Nova Guinea n.s. 4 (1940) 110, t. 4, f. 2, t. 5, f. 3.—Fig. 16.

Trunk to 10 m, 15–20 cm ø, bearing fronds in whorls of 10–12, usually 2 whorls present; fronds c. 100 cm long, apices upcurved. *Stipe* 10–12 cm; spines to 1 mm long; scales rigid, ± twisted, 50 by 1½ mm, shining brown, fragile edges very narrow. Lower *pinnae* gradually reduced, lowest 4–5 cm long; longest pinna 20 cm. Largest *pinnules* 40–50 by 10–16 mm, sessile, shortly pointed, lowest 1–2 segments free, then c. 3 pairs constricted at base on acroscopic side and decurrent on basicopic side; costules 3–3½ mm apart; veins 7 pairs, flat or slightly grooved on both surfaces; lamina-segments very rigid, edges slightly reflexed and minutely crenate, or lower ones distinctly lobed if fertile. *Sori* usually to 6 pairs on a segment; indusium very firm, brown, almost covering sorus to maturity but open on side remote from costule; receptacle swollen, sporangia very numerous; paraphyses short, slender. *Scales and hairs*: pinna-rachis glabrescent and finely warty; scales on costae and costules early caducous, some residual scales on costae broad and flat, some very narrow and setiferous; costules of sterile pinnules sometimes bearing dark brown entire ovate convex to almost bullate scales.

Type specimen: W. MCGREGOR 62, Mt Knutsford, Papua (K; dupl. at BM, MEL).

Distr. *Malaysia*: New Guinea.

Ecol. At 3500–3600 m, 'common in marginal scrub of subalpine forest and drier more sheltered grass slopes; one or several stems from a common base' (BRASS).

71. *Cyathea oinops* HASSK. in Hook. J. Bot. Kew Misc. 7 (1855) 322; Obs. Fil. Jav. 1 (1856) 23; v. A. v. R. Handb. (1908) 25; Suppl. (1917) Corr. 43; BACKER & POSTH. Varenfl. Java (1939) 25, p.p.—*C. oligocarpia* JUNGH. Nat. Geneesk. Arch. N.I. 2 (1845) 39 (non KUNZE, 1834).—*C. zollingeriana* (non METT.) v. A. v. R. Handb. (1908) 20, 785; Suppl. (1917) 26, Corr. 42.—*C. crenulata f. squamulosa* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 20 (1915) 10; Handb. Suppl. (1917) 27, Corr. 63.—*C. crenulata f. latissima* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 28 (1918) 11; Handb. Suppl. (1917) Corr. 64.—*C. faberiana* DOMIN, Acta Bot. Bohem. 9 (1930) 114.—Fig. 8a, 9d.

Stipe c. 35–60 cm, sometimes with a pair of small *pinnae* near base, dark, warty, base covered with firm pale scales to 35 by 3 mm, rest with ± abundant very small scurfy scales or glabrescent. Lower *pinnae* more or less reduced, longest 40–55 cm long. Largest *pinnules* 70–100 by 15–20 mm wide just above base, sessile, shortly acuminate, basal segments largest, 2–3 pairs often

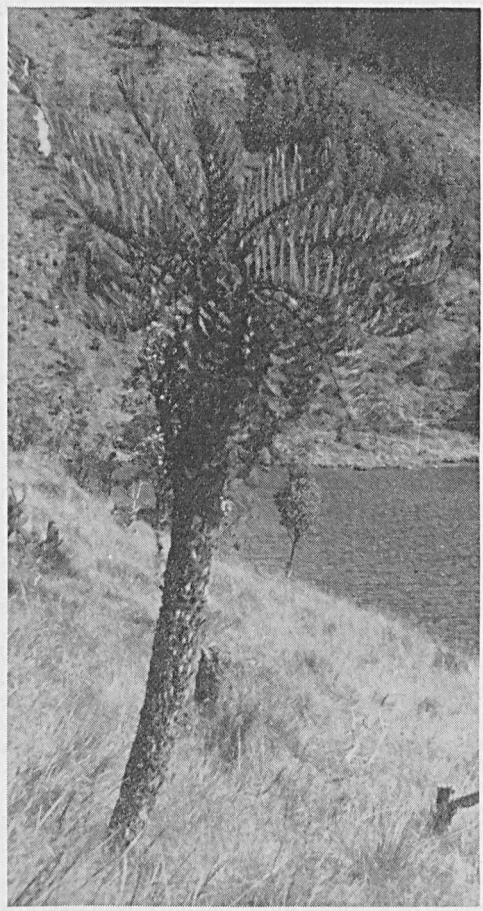


Fig. 16. *Cyathea muelleri* BAK. (HOOGLAND 5707). Mt Wilhelm, Eastern Highlands, E. New Guinea, 3200 m (R. D. HOOGLAND).

separately adnate to costa; costules 3–4 mm apart; veins 10–12 pairs; lamina-segments firm, where sterile finely crenate-serrate, where fertile lobed $\frac{1}{3}$ or more towards costule, lobes bidentate. *Sori* near costules; indusium firm, brown, covering the sorus almost to maturity but open on side remote from costule; paraphyses slender, shorter than sporangia. *Scales and hairs*: pinna-rachis more or less glabrescent, finely warty, often with a persistent covering of very small, dull, pale brown irregularly short-fringed scales, with some scattered larger elongate scales; costal scales abundant, often closely overlapping, elongate, brown with pale thinner edges bearing scattered dark setae especially near apices, also smaller thin pale fringed scales; on costules thin brown short-fringed scales, ovate to narrower and acuminate, almost flat to convex, sometimes with a few setae.

Type specimen: HASSKARL, Mt Gedeh, W. Java (BO; dupl. at L).

Distr. *Malaysia*: Sumatra, Java, Lesser Sunda Is (Lombok), SW. Celebes.

Ecol. At 2000–2500 m, in forest (specimen from Lombok in *Casuarina* forest).

Note. In Fl. Btzig 1 (1898) 36, RACIBORSKI described a species under the name *Cyathea sinops* HASSK., which appears to have been a misprint for *oinops*. RACIBORSKI's specimen was, however, from an unusually large frond of *C. crenulata* BL., which see for further references.

72. *Cyathea loheri* CHRIST, Bull. Herb. Boiss. II, 6 (1906) 1007; v. A. v. R. Handb. (1908) 787; TAGAWA, Act. Phytotax. Geobot. 14 (1951) 94; COPEL. Fern Fl. Philip. 2 (1960) 211.—*C. fructuosa* COPEL. in Elmer, Leaf. Philip. Bot. 2 (1908) 419; v. A. v. R. Handb. Suppl. (1917) 37; COPEL. Fern Fl. Philip. 2 (1960) 207.—*C. mitrata* COPEL. Philip. J. Sc. 3 (1909) Bot. 354; *ibid.* 4 (1909) Bot. 42; v. A. v. R. Handb. Suppl. (1917) 37; COPEL. Fern Fl. Philip. 2 (1960) 211.—*C. campbellii* COPEL. Philip. J. Sc. 38 (1929) 132; Fern Fl. Philip. 2 (1960) 210.—*C. korthalsii* (non METT.) C. CHR. Gard. Bull. S. S. 7 (1934) 222.—*C. indusiosa* COPEL. Philip. J. Sc. 81 (1952) 14; Fern Fl. Philip. 2 (1960) 211.

Trunk to 10 m. *Stipe* short; scales to 25 by $1\frac{1}{2}$ –3 mm, pale, firm, their fragile edges bearing scattered long dark setae; pneumathodes to 11 mm long, in one row. Lower *pinnae* gradually reduced, lowest c. 7 cm long; longest *pinnae* to 40 cm or more. Largest *pinnales* 75–95 by 15–19 mm, sessile, short-acuminate, lowest 1–4 segments more or less contracted at base, rest of *pinnule* lobed nearly to costa; costules $3\frac{1}{2}$ –4 mm apart; veins 10–12 pairs; lamina-segments firm, crenate or the larger ones more deeply lobed where fertile. *Sori* near costules; indusium firm, shining brown to purplish, almost covering sorus to maturity but open on side remote from costule, more or less breaking when old. *Scales and hairs*: pinna-rachis finely warty, at first densely scaly, many scales usually persistent; small ones rusty, dull, short-fringed, larger ones pale with some dark setae; on costae many scales, lower ones rather pale brown, acuminate with setae or hairs on edges, grading to numerous bullate scales; bullate scales, sometimes with dark setae, present on costules.

Type specimen: LOHER *s.n.*, 7 Jan. 1906, Mt Banajao, Luzon (not found at P; dupl. at S-PA).

Distr. Formosa, in *Malaysia*: Philippines (Luzon, Negros, Mindanao), N. Borneo.

Ecol. In forests, 600–2500 m.

Notes. This species is closely allied to *C. oinops*, but differs in bullate scales and apparently in the lower *pinnae* always gradually reduced. Young plants (as seen by me on Mt Kinabalu) have long-stalked fronds. Possibly *C. oinops* and *C. loheri* should be united; *C. oinops* is the older name.

73. *Cyathea cinerea* COPEL. in Elmer, Leaf. Philip. Bot. 5 (1913) 1681; v. A. v. R. Handb. Suppl. (1917) 36; COPEL. Fern Fl. Philip. 2 (1960) 215.

Trunk 5 m, 12 cm ϕ . *Stipe* bearing spines 8 mm

long (*vide* COPEL., not seen); length of stipe not recorded. Main *rachis* spiny near base, spines to 3 mm long. *Pinnae* to 55 cm long. Largest sterile *pinnules* 90 by 18 mm, fertile 13 mm wide, sessile, acuminate, lobed almost to costa, basal segment not free; costules 3–3½ mm apart; veins 12 pairs; lamina-segments firm, crenate-serrate, sterile ones close, fertile narrower and separated by sinuses 1 mm wide. *Sori* near costules; indusium almost covering sorus to maturity but open on side remote from costule; paraphyses short, slender. *Scales and hairs*: pinna-rachis pale, with a few slender spines ½ mm long, persistently but sparsely covered with irregular pale scales less than 1 mm long and a few narrow entire brown scales to 3 mm long; scales on costae dull brown, flat, elongate, rarely with a few long dark setae, also very small scales as on pinna-rachis; on costules (of sterile *pinnules*) pale entire bullate-acuminate scales.

Type specimen: ELMER 13860, Mt Urdaneta, Agusan Province, Mindanao (US; dupl. at MICH, K, BO, P, A, UC, L, U, BM).

Distr. *Malaysia*: Philippines (Mindanao, one collection).

Ecol. At 1050 m.

74. *Cyathea pachyrrhachis* COPEL. Un. Cal. Publ. Bot. 18 (1942) 218; Philip. J. Sc. 77 (1947) 107, pl. 5.

Trunk to 7 m, 7½ cm ø, stipe-bases not persistent, scars in alternate whorls of 5; fronds 10 (or 5), 150–300 cm long. *Stipe* cm, copiously warty; scales pale or partly dark, to 20 by 1 mm, with narrow fragile edges, not setiferous, also very small dull pale irregular scales. Lowest *pinnae* 20–25 cm long, longest 40–60 cm. Largest *pinnules* 60–100 by 15–20 mm, sessile, acuminate, 1–2 pairs basal segments free, rest of *pinnule* lobed nearly to costa; costules 3–4 mm apart; veins to 12 pairs (sterile), 9 pairs (fertile); lamina-segments very firm, sterile ones crenate, fertile rather deeply lobed, lobes bifid; sterile segments contiguous, fertile separated by sinuses. *Sori* near costules; indusium firm, covering sorus to maturity but open on side remote from costule, breaking somewhat when old. *Scales and hairs*: pinna-rachis more or less glabrescent, residual scales setiferous, very small with a few elongate narrow dark ones; costae rather densely scaly near base, some scales to 3 mm long, narrow, very dark, shining, with thin pale edges bearing a few setae near apices, grading to entirely pale setiferous scales, smaller ones all flat, ovate to nearly circular; similar scales on costules and rarely also on veins.

Type specimen: BRASS 12118, Idenburg River, W. New Guinea (MICH; dupl. at BO, BM, UC, L, A).

Distr. *Malaysia*: New Guinea (several collections), d'Entrecasteaux Is (Goodenough I.).

Ecol. In forest, 1000–2850 m. A specimen from secondary *Nothofagus* forest at 2060 m (BRASS 29674) has small fronds (*pinnules* 60 mm long), the smaller scales all strongly dark-setiferous, including those on veins, the latter being abundant, another (30316) from mossy forest at 2770 m, had

fronds of similar size, scales on veins rarely setiferous; BRASS 30668, from 2850 m, has the broadest *pinnules*, with several pairs of basal segments almost free.

75. *Cyathea latipinnula* COPEL. in Elmer, Leaf. Philip. Bot. 4 (1911) 1149; Fern Fl. Philip. 2 (1960) 226.—*Hemitelia latipinnula* v. A. v. R. Handb. Suppl. (1917) 52.

Trunk 120 cm, 10 cm ø; fronds 180 cm long. *Stipe* 60 cm long (*vide* COPEL.), scales not seen; main *rachis* glabrescent, bearing numerous spines less than 1 mm long. *Pinnae* to 40 cm long. *Pinnules* to 120 by 40 mm, caudate-acuminate, lower ones somewhat shorter and on stalks to 7 mm long, lowest 1–2 segments of larger *pinnules* quite free, next 1–2 pairs constricted at base; costules 5–6 mm apart; veins to 12 or more pairs, basal basicopic vein of each group attached at very base of costule; lamina-segments very firm, tapering and crenate towards apices, free basal ones sometimes deeply lobed. *Sori* near costules; indusium hemitelioid, small, dark, outer edge uneven, not reaching costule and hidden by mature sorus; receptacle swollen; paraphyses as long as sporangia, some several cells wide at base. *Scales and hairs*: pinna-rachis minutely spiny, also bearing short crisped hairs and a few residual narrow brown scales which may be setiferous; a few narrow scales at base of costae, most being ovate-acute, grading to bullate; entire bullate scales on costules.

Type specimen: ELMER 12512, Sibuyan Island (MICH; dupl. at US, K, FI, P, A, SYD, BO, BM).

Distr. *Malaysia*: Philippines (Sibuyan Island, one collection).

Ecol. On windy ridge at 1400 m.

76. *Cyathea masapilidensis* COPEL. Philip. J. Sc. 81 (1952) 17; Fern Fl. Philip. 2 (1960) 227.

Stipe rather slender, bearing close sharp slender spines to 5 mm long; scales not seen. Lower *pinnae* unknown; middle *pinnae* 50 cm long. Largest *pinnules* 65–80 by 16–18 mm, acuminate, on stalks to 6 mm long, lobed almost to costa, lowest segment sometimes free; costules 3½ mm apart; veins 10 pairs; lamina-segments very firm, nearly entire. *Sori* near costules; indusium thin, dull brown, covering about half of sorus at maturity, hemitelioid. *Scales and hairs*: pinna-rachis glabrescent, residual scales very narrow, dark, with long marginal setae; scales on costae sparse, flat, brown with pale margins bearing some setae, grading to very small flat scales; no costular scales seen, and none bullate.

Type specimen: RAMOS & EDANO, BS 37858, Mt Masapilid, Bontoc Subprov., Luzon (MICH; dupl. at US, BO).

Distr. *Malaysia*: Philippines (Luzon, 2 collections).

77. *Cyathea loerzingii* HOLTUM, Kew Bull. 16 (1962) 58.

Stipe at least 40 cm, rather sparsely warty near base; persistent scales few, to 20 by 2½ mm, shining dark brown with rather broad paler fragile

edges; pneumathodes 10–15 mm long, in an irregular double row. *Pinnae* probably to 50 cm long (only upper ones seen). *Pinnules* to 100 by 18 mm, lowest on stalks to 7 mm long, apex acuminate, lowest 1–2 segments not free but on larger pinnules separated by a narrow wing from the rest; costules 4 mm apart; veins 10–11 pairs; lamina-segments firm, drying very dark on upper surface, edges finely crenate, lowest ones not deeply lobed. *Sori* near costules; indusium at maturity firm, brown, semicircular, reflexed against costule, c. 1 mm wide; receptacle swollen, bearing at its apex a small group of scales 4–5 cells wide (bases of paraphyses?), other paraphyses short, slender. *Scales and hairs*: lower surface of pinna-rachis smooth, glabrescent; scales near bases of costae elongate, shining brown with a few hairs or dark setae on margins, grading to acuminate bullate-based scales distally; on costules brown bullate scales, often acuminate.

Type specimen: LÖRZING 14904, Mt Sibajak, Sumatra (L; dupl. at BO).

Distr. *Malaysia*: Sumatra (one collection).

Ecol. In forest at 1300–1400 m.

78. *Cyathea rufopannosa* CHRIST, Philip. J. Sc. 2 (1907) Bot. 180; v. A. v. R., Handb. (1908) 784; COPEL. Fern Fl. Philip. 2 (1960) 212.

Trunk (dry) 4 cm ø. *Stipe* 40–50 cm, sometimes with a pair of small pinnae near base; base warty; scales 15 by 2 mm, castaneous or paler, fragile edges narrow. Largest *pinnae* 37 cm long. *Pinnules* to 65 by 13–15 mm, sessile, short-acuminate, several pairs of lower segments contracted at base, lowest 1–3 quite free; costules 2½–3 mm apart; veins 8 pairs; lamina-segments firm, crenate. *Sori* near costules; indusium hemitelioid, more than a semicircle, covering costular side of sorus at maturity; receptacle rather slender; paraphyses long, often broad at the base. *Scales and hairs*: pinna-rachis densely and persistently scaly beneath; scales of all sizes, largest 6 by 1 mm, flat, entire, light brown, smaller ones bullate at base; at bases of costae many elongate flat light brown entire scales, grading to bullate (some bullate to base of costa); bullate scales on costules.

Type specimen: COPELAND 1730, San Ramon, Mindanao (P; dupl. at MICH); also from same locality COPELAND 1735 (P, US, SYD, S-PA).

Distr. *Malaysia*: Philippines (Mindanao).

Ecol. Probably in forest, 1200 m.

79. *Cyathea callosa* CHRIST, Bull. Herb. Boiss. II, 6 (1906) 1008; v. A. v. R. Handb. (1908) 787; COPEL. Fern Fl. Philip. 2 (1960) 222, *excl. syn. Hemitelia caudiculata* ROSENST.—*C. foxworthyi* COPEL. Philip. J. Sc. 3 (1909) Bot. 355; v. A. v. R. Handb. Suppl. (1917) 35; COPEL. Fern Fl. Philip. 2 (1960) 220.—*C. camaguinensis* COPEL. Philip. J. Sc. 81 (1952) 16; Fern Fl. Philip. 2 (1960) 223.

Stipe to c. 15 cm, copiously short-spiny (spines c. 2 mm); scales 15–20 by 1 mm, dark with pale fragile edges. Lower *pinnae* gradually reduced, lowest commonly less than 10 cm long; largest pinna 40 cm long or more. *Pinnules* to 100 by 24 mm, sessile, acuminate, lowest segment more or

less free, rest of pinnule lobed nearly to costa; costules 4–4½ mm apart; veins to 12 pairs; lamina-segments firm, crenate, lowest ones sometimes deeply so. *Sori* near costules; indusium thin and pale except near receptacle, almost covering sorus to maturity but not closed on side remote from costule, at maturity breaking and the thinner parts sometimes caducous, remnant then reflexed against costule; paraphyses not longer than sporangia. *Scales and hairs*: pinna-rachis glabrescent, rather pale, bearing scattered small slender spines or warts (lower pinnae most spiny); costal scales sparse, dull brown, rather broad, sometimes with a dark seta near apex; costular scales few, ovate, flat, pale, not bullate but sometimes convex; on lower surface of veins many very short appressed but conspicuous hairs.

Type specimen: LOHER, Mt Maquiling, Luzon, April 1906 (not seen at P; dupl. at M).

Distr. *Malaysia*: Philippines (Luzon).

Ecol. In mid-mountain forest; few records of altitude in Luzon.

Note. This species is very near *C. spinulosa* WALL. which is widely distributed from the NE. Himalayas to S. China and Formosa (syn. *C. austrosinica* CHRIST and *C. taiwaniana* NAKAI), but appears to differ in short less spiny stipe and in gradually reduced lower pinnae.

80. *Cyathea dicksonioides* HOLTUM, Blumea 11 (1962) 529.—Fig. 10c, d, 17.

Trunk to 3 m, 20 cm ø, bearing fronds in 2 whorls of 10–12 each; fronds to 90 cm long, those of outer whorl almost straight, those of inner whorl bent downwards near the base. *Stipe* to 10 cm, not spiny, covered with scales; scales 45 mm by 2 mm wide at base, shining, castaneous with narrow paler fragile edges, straight, the finely acuminate apical part much twisted; sparse small scales beneath the larger ones. Lowest *pinnae* rather abruptly reduced, 8–10 cm long, longest *pinnae* 17–20 cm. *Pinnules* close, largest 35 mm long, sessile, 5 mm wide above the widened base, pinnate almost throughout; midribs of tertiary leaflets 2 mm apart. *Tertiary leaflets* contiguous, almost triangular with rounded tip, edges strongly reflexed, basal leaflets to almost 4 mm long and distinctly lobed; veins to 4 pairs, lower 1–2 pairs forked, not raised on upper surface, pale and strongly raised on lower surface. *Sori* 2–4 on each leaflet; indusium pale, firm, attached on costular side and forming a hood which partly covers the mature sorus, in shape very much like the inner indusium of *Dicksonia*; receptacle swollen; sporangia many; no paraphyses seen. *Scales and hairs*: all rachises and costae minutely warty and glabrescent on lower surface, antrorse hairs on upper surface pale; residual scales on rachises long, pale brown, very narrow, entire; on lower surface of midribs of tertiary leaflets a few spreading light-brown hair-tipped scales.

Type specimen: HOOGLAND & SCHODDE 7171, Western Highlands, NE. New Guinea (L).

Distr. *Malaysia*: NE. New Guinea (2 collections).

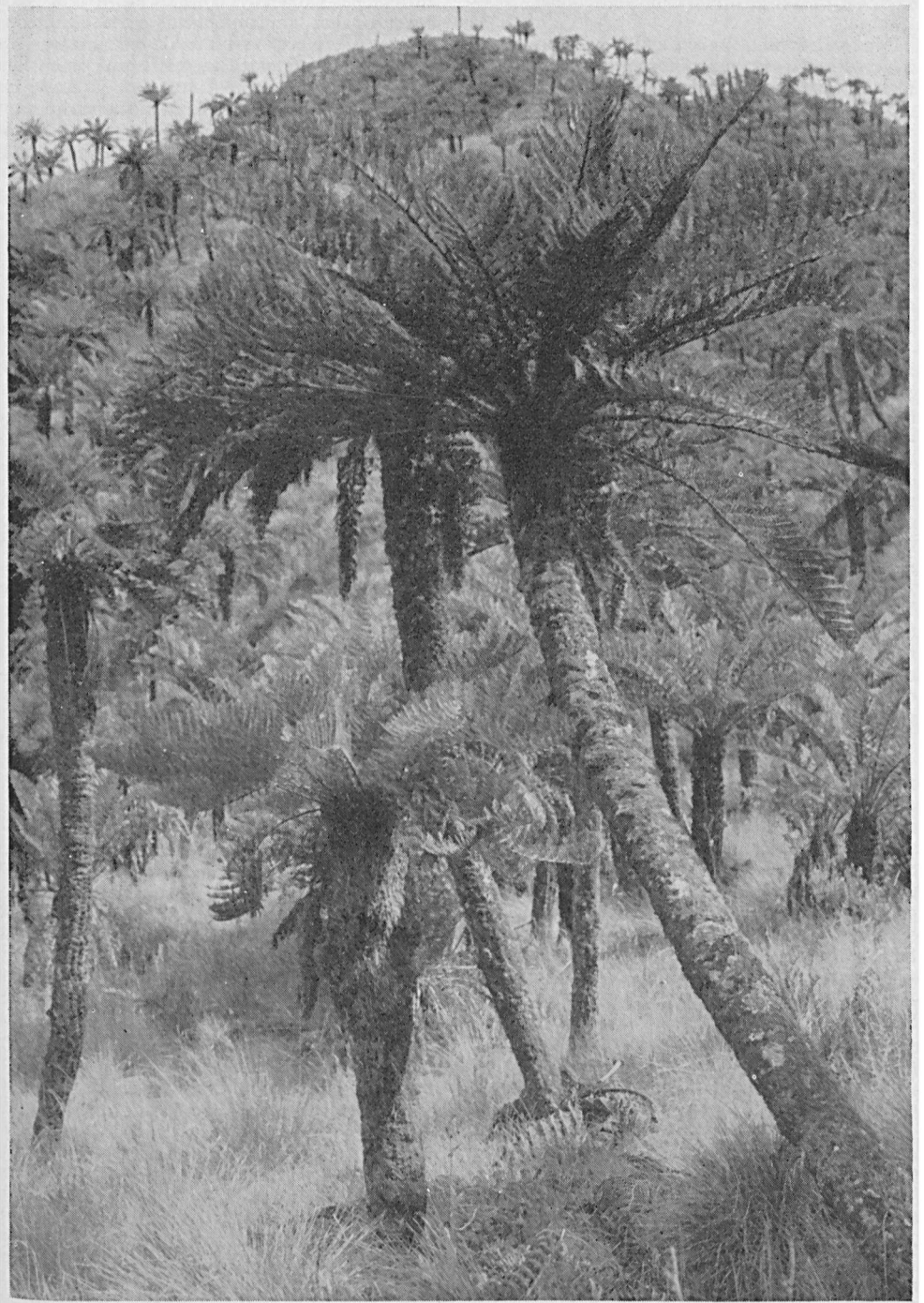


Fig. 17. *Cyathea dicksonioides* HOLTUM (small plant in centre) with taller *C. atrox* C. CHR., in tree-fern grassland, N. slopes of Sugarloaf complex, Western Highlands, Territory of New Guinea, 2880 m (R. D. HOOGLAND).

Ecol. In tree-fern grassland, infrequent, 2600–2900 m.

Note. In form of leaflets and in basal scales this is very like *C. macgregorii*, but it is quite different in indusium and costular scales, and in habit of growth, the fronds being in two whorls, those of the inner whorl bent downwards at the base.

81. *Cyathea heterochlamydea* COPEL. in Elmer, Leaflet. Philip. Bot. 2 (1908) 418; Fern Fl. Philip. 2 (1960) 218.—*Hemitelia heterochlamydea* v. A. v. R. Handb. Suppl. (1917) 53.—*Hemitelia caudiculata* ROSENST., Med. Rijksherb. 31 (1917) 2.—*C. caudiculata* DOMIN, Acta Bot. Bohem. 9 (1930) 104.—*C. merrillii* COPEL. Philip. J. Sc. 46 (1931) 212; Fern Fl. Philip. 2 (1960) 231.—Fig. 9c.

Stipe short, warty or short-spiny; pneumathodes in 2–3 irregular rows; scales dark, shining, with narrow (often abraded) paler fragile edges. Lower *pinnae* gradually reduced; longest to 60 cm long. *Pinnules* commonly to 100 by 18 mm, exceptionally to 120 by 23 mm, sessile, strongly acuminate, lowest segment often free, on largest pinnules 2–3 pairs segments constricted on acroscopic base, decurrent basicopically, most pinnules lobed almost to costa throughout with narrow sinuses between segments; costules 3½–4 mm apart; veins commonly 10–11 pairs, on largest pinnules to 14 pairs; lamina-segments firm, crenate, basal free ones sometimes deeply so. *Sori* near costules; indusium firm, brown, overarching costular side of sorus at maturity, its edge firm, open on side remote from costule; receptacle rather tall, slightly swollen; paraphyses short. *Scales and hairs*: lower surface of pinna-rachis finely warty, glabrescent or bearing very small irregular short-fringed pale brown scales and sometimes sparse crisped hairs; lower surface of costae usually with numerous very small irregular short-fringed scales and sometimes also short crisped hairs, larger scales usually all deciduous, residual ones flat, dull brown, with setiform apex and sometimes 1–2 other setae; costules of fertile segments usually without scales, on sterile ones a few ovate thin convex or just bullate scales.

Type specimen: ELMER 9742, Cuernos Mts, Negros (MICH; dupl. at US, FI, BO, K, P, A, SYD, U, L, BM).

Distr. *Malaysia*: Philippines (Luzon, Negros, Panay, Mindanao).

Ecol. Little information; apparently in mid-mountain forest.

Note. Apart from size of indusium and larger pinnules, there seems little distinction between this and *C. caudata* (J. SM.) COPEL.

82. *Cyathea edanoi* COPEL. Philip. J. Sc. 46 (1931) 211; Fern Fl. Philip. 2 (1960) 219.

Stipe c. 5 cm; scales dark, rather narrow with narrow fragile edges. Lower *pinnae* gradually reduced and close together, lowest 5 cm long; longest *pinnae* 40 cm. *Pinnules* to 60 by 14 mm, almost sessile, shortly caudate-acuminate, lowest 2 segments almost free, most of remaining segments constricted at base on acroscopic side, de-

current basicopically; costules 3–3½ mm apart; veins 8 pairs; lamina-segments rather thin, edges crenate. *Sori* near costules; indusium large, hemitelioid, covering at least half sorus on costular side at maturity, rather firm and dark. *Scales and hairs*: lower surface of pinna-rachis glabrescent; lower surface of costae bearing few flat light-brown scales, sometimes with a long seta; on costule no scales seen (all fertile).

Type specimen: EDAÑO BS 78709, summit of Mt Cagua, Luzon (MICH; dupl. at BO).

Distr. *Malaysia*: Philippines (Luzon, 3 collections).

Ecol. At 1300 m.

Note. This is very closely related to *C. heterochlamydea*, having similar sori and scales, and may perhaps be a small form of that species due to habitat conditions at or near a mountain-summit.

83. *Cyathea fuliginosa* (CHRIST) COPEL. Philip. J. Sc. 4 (1909) Bot. 43; Fern Fl. Philip. 2 (1960) 224.—*Alsophila fuliginosa* CHRIST, Bull. Herb. Boiss. 6 (1898) 138; v. A. v. R. Handb. (1908) 39.—*Alsophila mindanensis* CHRIST in Warb. Monsunia (1900) 90, p.p. (fertile specimen; sterile is *Dicksonia*); v. A. v. R. Handb. (1908) 44.—*C. loheri* var. *tonglonensis* CHRIST, Philip. J. Sc. 2 (1907) Bot. 180; v. A. v. R. Handb. (1908) 787.—*C. lanaensis* CHRIST, Philip. J. Sc. 3 (1908) Bot. 271; v. A. v. R. Handb. Suppl. (1917) 23; COPEL. Fern Fl. Philip. 2 (1960) 219.—*C. mindanensis* COPEL. Philip. J. Sc. 4 (1909) Bot. 34; Fern Fl. Philip. 2 (1960) 223.—*C. bicolor* COPEL. in Elmer, Leaflet. Philip. Bot. 3 (1910) 804; Fern Fl. Philip. 2 (1960) 225.—*Hemitelia tonglonensis* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 7 (1912) 14; Handb. Suppl. (1917) 42.—*C. warihon* COPEL. in Elmer, Leaflet. Philip. Bot. 5 (1913) 1680; Fern Fl. Philip. 2 (1960) 226.—*Alsophila warihon* C. CHR. Ind. Fil. Suppl. 2 (1917) 4.—*Hemitelia bicolor* v. A. v. R. Handb. Suppl. (1917) 44.—*Hemitelia warihon* v. A. v. R. l.c. 43.—*C. tonglonensis* DOMIN, Pterid. (1930) 264.—*C. squamicosta* COPEL. Philip. J. Sc. 46 (1931) 212; Fern Fl. Philip. 2 (1960) 209.—*C. dura* COPEL. Philip. J. Sc. 81 (1952) 13; Fern Fl. Philip. 2 (1960) 206.—*C. lepidigera* COPEL. Philip. J. Sc. 81 (1952) 16; Fern Fl. Philip. 2 (1960) 224.—*C. sulitii* COPEL. Philip. J. Sc. 81 (1952) 18; Fern Fl. Philip. 2 (1960) 225.—*C. biliranensis* COPEL. Philip. J. Sc. 84 (1955) 162.

Trunk to at least 5 m. *Stipe* c. 7 cm, closely warty or with conical spines under 1 mm long; scales to 15 by 1½ mm, dark, shining, with fragile concolorous edges. Lower *pinnae* gradually reduced, lowest c. 7 cm long; longest *pinna* 40–50 cm. Largest *pinnules* commonly 60–75 by 13–18 mm (exceptionally to 90 by 21 mm), sessile, short-acuminate, basal basicopic segment longest, basal 1–2 segments free, rest of pinnule lobed nearly to costa; costules 3–4 mm apart; veins 8–9 pairs; lamina-segments very firm, crenate, fertile ones more deeply so than sterile, on largest pinnules the basal segments sometimes deeply lobed, several pairs being separately adnate to costa. *Sori* near costules; indusium hemitelioid,

firm, dark, with thinner uneven edge at maturity, on type specimen about a quadrant of a circle, on some others more nearly a semicircle; paraphyses not longer than sporangia, some near apex of receptacle flat at base. *Scales and hairs*: upper surface of main rachis and pinna-rachis bearing spreading very narrow crisped scales to 7 mm long in addition to usual antrorse hairs; lower surface of main rachis closely warty, glabrescent; lower surface of pinna-rachis closely warty, pale, bearing more or less deciduous pale bullate-based scales, these more abundant distally; costae at first copiously scaly, scales near base acuminate, slightly bullate at base, grading to small bullate scales distally, all scales light brown and entire; old costae conspicuously warty beneath; costules glabrescent or bearing bullate scales.

Type specimen: LOHER 893, March 1897, Baguio, Luzon (P; dupl. at K, US).

Distr. *Malaysia*: Philippines (Luzon, Mindanao, Biliran).

Ecol. In forest at 640–2400 m.

Notes. LOHER's *n.* 893 was not cited with the original description by CHRIST, but appears on the original label of the specimens at Paris, Kew and Washington. The degree of scaliness of lower surfaces of pinna-rachis and costae varies considerably, and also the abundance of warts; warts and scales are more abundant on the lower pinnae, and possibly also on plants in more exposed conditions of habitat.

84. *Cyathea semiamplectens* HOLTUM, Kew Bull. 16 (1962) 62.

Trunk 150–200 cm tall, stout, bearing numerous fronds to 175 cm long. *Stipe* 5–15 cm, not spiny, covered with scales; scales 20–30 by 1–3 mm, narrower ones often with dark median band, wider ones mostly entirely pale except the apex, setae on the fragile edges rare. Lower *pinnae* gradually reduced, lowest 4–12 cm long, longest 40 cm. Largest *pinnules* 50–75 by 15–20 mm, sessile, hardly acuminate, with 6–10 pairs of separately adnate segments; costules 3–4½ mm apart; veins to 7 pairs, not prominent on either surface; lamina-segments firm, sterile ones crenate, larger fertile ones lobed ½–¾ to costule. *Sori* near costules; indusium hemitelioid, nearly 1 mm wide, covering costular side of ripe sorus; no paraphyses seen. *Scales and hairs*: pinna-rachis rather persistently covered beneath with very small light brown bullate scales, sometimes with setiform apex, and very narrow entire scales; scales on costae small, pale brown, bullate, entire, with some broader flat elongate ones; costular scales mostly deciduous.

Type specimen: WOMERSLEY 11500, Eastern Highlands, NE. New Guinea (BRI; dupl. at L).

Distr. *Malaysia*: E. New Guinea (two collections).

Ecol. At 3300–3560 m, 'in broken subalpine shrubbery' (WOMERSLEY), exposed to sun; and 'in subalpine forest' (BRASS). The latter collection has larger fronds, with *pinnules* more dissected.

85. *Cyathea alleniae* HOLTUM, Kew Bull. 16 (1962) 52.

Trunk to 4 m, 15 cm ø; several smaller crowns of fronds sometimes produced by branches from the trunk. *Stipe* at least 30 cm, near base with many thick conical spines to 2 mm long; scales dark, shining, to 20 by 1½ mm, fragile edges mostly abraded; pneumathodes to 25 mm long, in a single row. *Pinnae* to 70 cm long. *Pinnules* sessile, rather easily detached when dry, short-acuminate, largest 140–150 by 30 mm, more than half the segments separated by wide sinuses and constricted at base, connected by a narrow costal wing, only the lowest segments sometimes quite free; costules 5–6 mm apart; veins to 12 pairs; lamina-segments deeply crenate, the larger ones lobed halfway to costule, veins in such lobes pinnate. *Sori* near costules; indusium a firm brown scale of rather irregular shape on costular side, often nearly circular, sometimes unevenly lobed, rarely extending round base of receptacle on side remote from costule; paraphyses shorter than sporangia, some near apex of receptacle broad and scale-like at base. *Scales and hairs*: pinna-rachis near base glabrescent and warty, distal half at least bearing crisped hairs on lower surface; costae bearing some hairs as pinna-rachis on lower surface, also firm brown elongate scales, the larger ones with a dark setiform apex and sometimes dark marginal setae; scales on costules bullate, brown. *Fronds of branch-crowns*: pinnae to 18 cm long, *pinnules* to 65 by 13 mm, lowest 1–2 pairs of segments deeply lobed, lowest 4–6 pairs of segments constricted at base on acroscopic side; veins to 9 pairs; sori and scales as fronds of main crown.

Type specimen: B. E. G. MOLESWORTH-ALLEN 4127, Kuala Terla, Pahang (K; dupl. at US).

Distr. *Malaysia*: Malay Peninsula.

Ecol. On forest edge, steep ground, at 1200 m.

86. *Cyathea costulifera* DOMIN, Acta Bot. Bohem. 9 (1930) 108.—*Hemitelia montana* v. A. v. R. Bull. Jard. Bot. Btzg III, 2 (1920) 153, non *C. montana* SM. 1793.

Stipe 70 cm, warty almost throughout; many persistent scales to 20 by 1½ mm, on lower 30 cm; main rachis glabrescent, pale, smooth or moderately warty. *Pinnae* to 50 cm long. *Pinnules* to 60 by 16 mm, sessile, abruptly pointed, lobed almost to costa, no free segments; costules 3 mm apart; veins 7–8 pairs; lamina-segments thin, subentire, sinuses ½ mm wide. *Sori* near costules; indusium firm, brown, large, backing the costule, more than a semicircle; receptacle swollen; paraphyses not evident on old sori. *Scales and hairs*: lower surface of pinna-rachis distally bearing a thin covering of pale crisped hairs and some very small scales; scales near base of costae narrow, flat, dark, with some dark setae near apices, also very small scales; many small pale bullate scales on costules.

Type specimen: BÜNNEMEIJER 4606, Mt Merapi, Sumatra (BO; dupl. at L).

Distr. *Malaysia*: Sumatra (one collection).

87. *Cyathea caudata* (J. SM.) COPEL. Philip. J. Sc. 1, Suppl. II (1906) 144; Fern Fl. Philip. 2 (1960) 222.—*Alsophila caudata* J. SM. ex HOOK. [J. Bot. 3 (1841) 419, nomen] Sp. Fil. 1 (1844) 52, t. 20B; Syn. Fil. (1866) 42; v. A. v. R. Handb. (1908) 37, 785.—*Hemitelia manilensis* PR. Abh. K. Böhm. Ges. Wiss. V, 5 (1848) 351; v. A. v. R. Handb. Supplement (1917) 53.—*Amphicosmia manilensis* MOORE, Ind. Fil. (1857) 61.—*Hemitelia caudata* METT. Fil. Lechl. 2 (1859) 30; v. A. v. R. Handb. Suppl. (1917) 52.—*C. manilensis* DOMIN, Pterid. (1929) 264.—*C. dupaxensis* COPEL. Philip. J. Sc. 46 (1931) 211; Fern Fl. Philip. 2 (1960) 217.—*C. brevipes* COPEL. Philip. J. Sc. 81 (1952) 18; Fern Fl. Philip. 2 (1960) 232.—*C. arborescens* COPEL. Philip. J. Sc. 84 (1955) 162.

Stipe short, copiously warty; scales narrow, dark, shining, to 15 mm long. Lower pinnae gradually reduced, lowest 5–8 cm long; longest pinnae 40–50 cm. Pinnules commonly to 85 by 16–18 mm, almost sessile, more or less caudate-acuminate (cauda on type 25 mm); costules 3–3½ mm apart; veins to 10 pairs; lamina-segments firm, rather strongly crenate-serrate. *Sori* near costules; indusium hemitelioid, in shape a quadrant of a circle to a semicircle, firm, reflexed against costule; receptacle swollen; paraphyses short, some apical ones broad at base. Scales and hairs: lower surface of pinna-rachis glabrescent, sometimes bearing crisped hairs towards apex; lower surface of costae bearing sparse flat brown thin-edged scales, some with a few marginal setae, also very small scales and sometimes a few crisped hairs; scales on costules flat or somewhat convex, not bullate.

Type specimen: CUMING 267, Luzon (K; dupl. at P, L, A).

Distr. *Malaysia*: Philippines (Luzon, Mindoro).

Ecol. In mid-mountain forest; few records of altitude.

Note. Apart from size of indusium and of pinnules, there seems no clear distinction between this species and *C. heterochlamydea* COPEL.

88. *Cyathea borneensis* COPEL. Philip. J. Sc. 6 (1911) Bot. 135; v. A. v. R. Handb. Suppl. (1917) 33.—*Alsophila latebrosa* var. *denudata* BEDD. J. Bot. 31 (1893) 225; RIDL. J. Mal. Br. R. As. Soc. 4 (1926) 9.—*C. hemichlamydea* COPEL. Philip. J. Sc. 6 (1911) Bot. 361.—*Hemitelia hemichlamydea* v. A. v. R. Handb. Suppl. (1917) 47, 488.—*C. obtusata* ROSENST. Med. Rijksherb. n. 31 (1917) 1; HOLTUM, Gard. Bull. S. S. 8 (1935) 306, pl. 30; Rev. Fl. Mal. 2 (1954) 121.

Trunk to 2 m or more. Stipe 5–25 cm, short-spiny or warty; scales to 15 by 1 mm, dark, shining, fragile edges narrow and often abraded; pneumathodes 12–18 mm long, in a single row, with gaps between them. Lower pinnae rather irregularly reduced and variable in size, lowest 4–10 cm long, longest where stipe is longest; longest pinnae 60 cm. Largest pinnules 80–100 by 17–22 mm, almost sessile, acuminate, lobed almost to costa, basal segment not free; costules 3½–5 mm apart; veins to 10 pairs; lamina-segments thin but firm, almost entire, ends rounded, sinuses narrow. *Sori*

near costules; indusium rather thin, on costular side, variable in shape and size, reaching the costule and usually visible at maturity of sorus; receptacle swollen; paraphyses short. Scales and hairs: pinna-rachis pale to purplish, bearing some crisped hairs distally and sometimes throughout, also some residual very narrow dark spreading flexuous entire scales; scales on costae dark, entire, acuminate, flat or bullate-based, grading to bullate scales distally; rather dark bullate scales on costules.

Type specimen: C. J. BROOKS 58, Mt Penrissen, Sarawak (MICH; dupl. at BM).

Distr. S. Siam northwards to Mergui, in *Malaysia*: Malay Peninsula, Borneo.

Ecol. In forest, from lowland to 1100 m.

Notes. Bornean specimens seem on the whole larger than those from Malaya, and are also more often suffused with purple on the rachis which in Malayan specimens is usually green (pale when dry). ROSENSTOCK wrongly cited the number of the type collection of his *C. obtusata* as 1148; it should be 7148 (*leg.* KING'S Coll., Perak).

89. *Cyathea fenicis* COPEL. Philip. J. Sc. 3 (1909) Bot. 354; *ibid.* 4 (1909) 61; Fern Fl. Philip. 2 (1960) 232.—*Alsophila fenicis* C. CHR. Ind. Fil. Suppl. (1913) 5; v. A. v. R. Handb. Suppl. (1917) 66.—*Alsophila fujiana* NAKAI, Bot. Mag. Tokyo 41 (1927) 72.

Stipe 60 cm; spines 1 mm long; scales 15 mm long, narrow, dark; one pair of pinnae 6 cm long near base of stipe (*vide* COPELAND). Largest pinnae 40 cm long. Largest pinnules 80–100 by 13–21 mm, sessile, acuminate, lowest 1–2 pairs of segments constricted at base and nearly free, rest of pinnule lobed nearly to costa; costules 3½–4½ mm apart; veins 10–11 pairs; lamina-segments firm, crenate. *Sori* near costules; indusium small, brown, on costular side. Scales and hairs: pinna-rachis beneath glabrescent; costal scales few, flat, rather broad, entire, paler distally; on costules pale entire scales, ovate, grading to bullate.

Type specimen: FENIX BS 3797, Batan Islands (US; dupl. at P).

Distr. Taito I. (near Formosa), in *Malaysia*: Philippines (N. Luzon: Batan Is., several collections).

Notes. The type was presumably in the Manila herbarium, destroyed during the war. Specimens of the same collection at US and P do not show the stipe; all other details given above are taken from them. COPELAND wrongly reported this species as *exindusiata*.

90. *Cyathea junghuhniana* (KUNZE) COPEL. Philip. J. Sc. 4 (1909) Bot. 58.—*Alsophila extensa* [non (FORST.) SPR.] BL. En. Pl. Jav. (1828) 246 (*p.p.*?).—*Alsophila lunulata* [non (FORST.) R. BR.] BL. *l.c.* (*p.p.*?).—*Alsophila junghuhniana* KUNZE, Bot. Zeit. 6 (1848) 284.—*Hemitelia javanica* PRESL, Epim. Bot. (1851) 34.—*Alsophila robusta* DE VRIESE in Jungh. Java 1 (1852) 310, 476.—*Alsophila debilis* DE VRIESE, *l.c.*—*Alsophila melanopus* HASSK. in Hook. J. Bot. Kew Misc. 7 (1855) 325;

Obs. Bot. Fil. 1 (1856) 42; v. A. v. R. Handb. (1908) 40; Suppl. (1917) 65(?).—*Amphicosmia javanica* MOORE, Ind. Fil. (1857) 60.—*Hemitelia junghuhniana* METT. Fil. Lechl. 2 (1859) 31; Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 55; RACIB. Fl. Btzg 1 (1898) 38, p.p., excl. var. *dissoluta*; v. A. v. R. Handb. (1908) 28; Suppl. (1917) 45, Corr. 44; BACKER & POSTH. Varenfl. Java (1939) 28.—*Hemitelia latebrosa* (WALL.) METT. Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 54, p.p. (*pl. jav. tantum*); RACIB. Fl. Btzg 1 (1898) 39; v. A. v. R. Handb. (1908) 38, p.p.; BACKER & POSTH. Varenfl. Java (1939) 27.—*C. melanophylla* COPEL. Philip J. Sc. 4 (1909) Bot. 48.—*Hemitelia glaucophylla* v. A. v. R. Bull. Jard. Bot. Btzg II n. 7 (1912) 16; Handb. Suppl. (1917) 50.—*Hemitelia alsophiliformis* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 16 (1914) 15; Handb. Suppl. (1917) 46.—*Hemitelia merapiensis* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 16 (1914) 16; Handb. Suppl. (1917) 45.—*Hemitelia fallax* v. A. v. R. Bull. Jard. Bot. Btzg III, 2 (1920) 153, incl. var. *major*.—*C. glaucophylla* DOMIN, Pterid. (1929) 264.—*C. alsophiliformis* DOMIN, l.c. 263.—*C. merapiensis* DOMIN, l.c. 264.—*C. fallax* DOMIN, Acta Bot. Bohem. 9 (1930) 115.

Trunk to 2 m or more; leaf-bases persistent. *Stipe* 30–50 cm or more, base bearing spines $1\frac{1}{2}$ – $2\frac{1}{2}$ mm long; scales to 30 by 2 mm, dark, shining; pneumathodes 5–14 mm long, in a close double or triple row. Lower *pinnae* somewhat reduced; longest *pinnae* 55–70 cm long. Largest *pinnules* 80–115 by 14–21 mm, sessile, acuminate, lobed almost to costa, lowest segment not free; costules $3\frac{1}{2}$ – $4\frac{1}{2}$ mm apart; veins 10–12 pairs; lamina-segments firm, subentire to distinctly crenate (the latter usually when fertile). *Sori* near costules; indusium hemitelioid, variable in size and shape, rather thin, when largest semicircular in shape and distinctly visible on costular side of mature sorus; receptacle swollen; paraphyses short, slender. *Scales and hairs*: pinna-rachis smooth, glabrescent, sometimes with minute fringed scales; scales on costae elongate, flat, entire, of varying size; on costules bullate, or acuminate with bullate base.

Type specimen: JUNGHUHN, Java (Herb. SCHLECHTENDAL, not seen; dupl. at L, K).

Distr. *Malaysia*: South and Central Sumatra, Java.

Ecol. In forest at 1000–2000 m, very abundant above Tjibodas on Mt Gedeh in West Java.

Note. All authors from METTENIUS to BACKER & POSTHUMUS tried to distinguish both *C. latebrosa* (WALL.) COPEL. and *C. junghuhniana* in West Java, but the former does not occur there. For confusion of *C. junghuhniana* with *C. raciborskii*, see note under latter species.

91. *Cyathea raciborskii* COPEL. Philip. J. Sc. 4 (1909) Bot. 45.—*Hemitelia capensis* [non (L. f.) R. BR.] HOOK. Sp. Fil. 1 (1844) 36, p.p.; Syn. Fil. (1865) 29, p.p.—*Hemitelia crenulata* METT. Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 55; RACIB. Fl. Btzg 1 (1898) 38; v. A. v. R. Handb. (1908) 27; Suppl. (1917) 42; BACKER & POSTH. Varenfl. Java (1939) 27, non *C. crenulata* BL. 1828.—*Alsophila*

crenulata HOOK. Syn. Fil. (1866) 44.—*Hemitelia junghuhniana* var. *dissoluta* RACIB. Fl. Btzg (1898) 38.—*Alsophila brevifoliolata* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 20 (1915) 3; Handb. Suppl. (1917) 64.—*C. brevifoliolata* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 28 (1918) 13.

Trunk rarely to 2 m. *Stipe* 30–50 cm, warty near base; scales little over 10 mm by 1 mm, dark, shining; pneumathodes in a single row (in two rows on largest fronds), 2–5 mm long. Lowest *pinnae* varying in size, smallest seen 22 cm long; largest *pinnae* 40–50 cm. Largest *pinnules* 65 by 14(–20) mm, sessile, abruptly narrowed at apex or short-acuminate, lobed almost to costa, lowest segment not free; costules $3\frac{1}{2}$ mm (rarely to $4\frac{1}{2}$ mm) apart; veins to 8 pairs; lamina-segments rather thin, usually almost entire, lobed in very wide *pinnules*. *Sori* near costules, usually only on lowest 2–3 pairs of veins; indusium on costular side of sorus, of variable size (in Sumatran specimens sometimes encircling base of receptacle); paraphyses not longer than sporangia, some several cells wide at base. *Scales and hairs*: lower surface of pinna-rachis bearing many persistent very small fringed scales and sometimes sparse crisped hairs on distal part; on costae and costules many small pale bullate scales throughout, with some darker elongate scales near base of costae.

Type specimen: BLUME, Mt Boerangrang, W. Java (L; dupl. at BO).

Distr. *Malaysia*: S. Sumatra, W. Java.

Ecol. In forest at 1200–1600 m, abundant above Tjibodas on Mt Gedeh.

Note. This species was confused with *C. junghuhniana* by v. A. v. R. and others, as indicated by their determination of specimens in herbaria. The two species grow side by side in the forest above Tjibodas, and in my experience are quite distinct in size, shape of *pinnules*, scales on costae, and in pneumathodes of *stipe*.

92. *Cyathea glaberrima* HOLTUM, Kew Bull. 16 (1962) 55.

Trunk slender, to 2 m, bearing many fronds to 190 cm long. *Stipe* c. 8 cm, finely warty; scales many, light castaneous; shining, to 15 by $1\frac{1}{2}$ mm, fragile edges narrow, not setiferous. Lower *pinnae* gradually reduced, lowest 3–4 cm long; longest *pinna* 50 cm. *Pinnules* distinctly dimorphous; sterile *pinnules* to 150 by 25 mm, lowest on stalks to 8 mm long, apex long-acuminate, lobed to 3–4 mm from costa, costules 6– $6\frac{1}{2}$ mm apart, veins 9 pairs, lowest from costa; fertile *pinnules* to 120 by 18 mm, on stalks to 6 mm long, lobed as sterile, costules 5– $5\frac{1}{2}$ mm apart. Lower *sori* medial, distal ones nearer to costule; indusium a small dark brown scale on costular side; receptacle large; paraphyses shorter than sporangia. *Scales and hairs*: pinna-rachis smooth, pale, glabrous except at bases of costae; at bases of costae on lower surface and adjacent parts of rachis a few rather thick crisped hairs and bullate scales; on costules very few bullate scales.

Type specimen: BRASS 27092, Fergusson I. (K; dupl. at US).

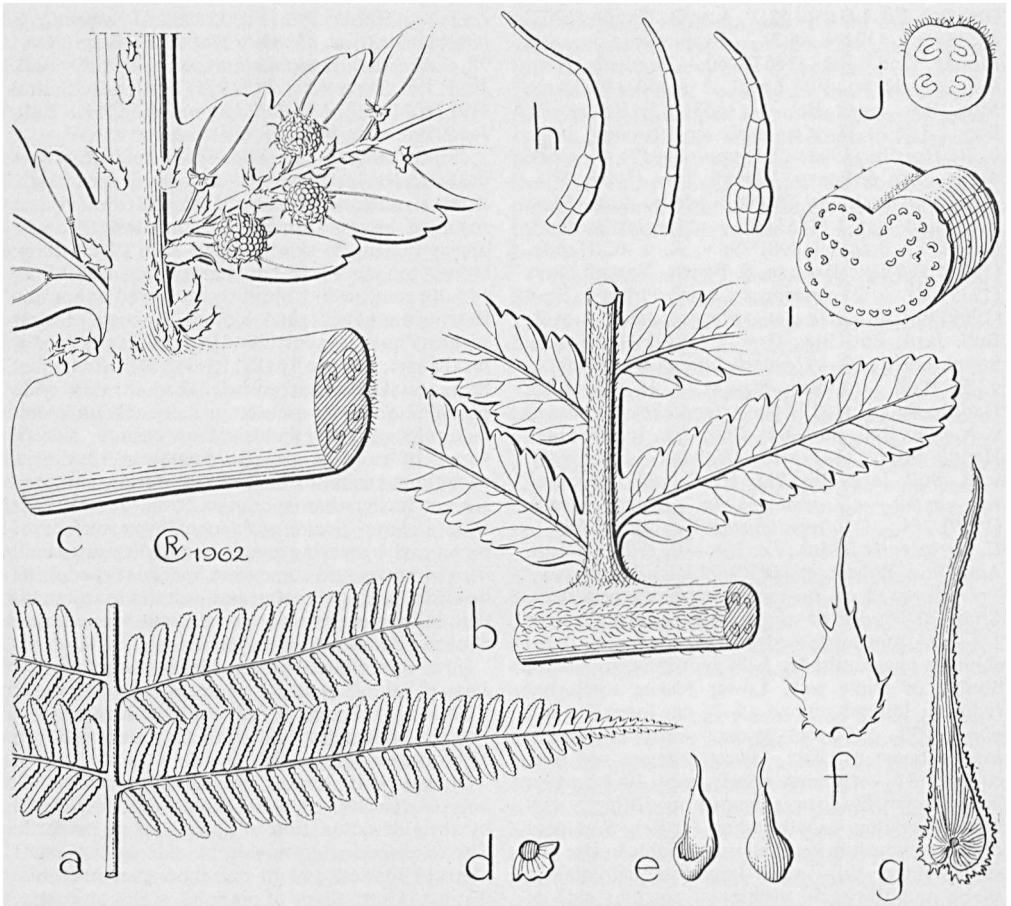


Fig. 18. *Cyathea incisoserrata* COPEL. a. Pinnules attached to pinna-rachis, upper surface, $\times \frac{2}{3}$, b. pinna-rachis and base of pinnule, upper surface, $\times 4$, c. as b, lower surface, showing sori and scales, $\times 10$, d. indusium and base of receptacle, $\times 20$, e. scales from costule, $\times 20$, f. scale from pinna-rachis, $\times 20$, g. scale from stipe, $\times 6$, h. paraphyses, $\times 50$, i. section of stipe, $\times \frac{1}{3}$, j. section of pinna-rachis, $\times 6$, (cult. R. B. G. Kew, origin Malay Peninsula).

Distr. *Malaysia*: D'Entrecasteaux Islands: Fergusson and Goodenough Is.

Ecol. In mossy oak forest, at 900–1400 m.

Note. The shallowly lobed pinnules are unusual in this group of species; the position of the basicopic vein, springing from the costa, is associated with this condition, as in *sect. Schizocaena*.

93. *Cyathea punctulata* v. A. v. R. Bull. Jard. Bot. Btzig II, n. 28 (1918) 13.—*Alsophila punctulata* v. A. v. R. Bull. Jard. Bot. Btzig II, n. 20 (1915) 5; Handb. Suppl. (1917) 64.

Stipe dark, warty, 40 cm or more, near base persistently scaly; scales to 40 by 2–3 mm, castaneous, shining, with narrow fragile edges. Pinnae to 70 cm long. Largest pinnules 125 by 22 mm, caudate-acuminate, lowest 6 pairs on larger pinnae distinctly stalked (stalk of lowest 3–5 mm), rest sessile, lobed nearly to costa; costules $4\frac{1}{2}$ mm

apart; veins to 12 pairs; lamina-segments very firm, rather strongly crenate-serrate, lowest one on larger pinnules reduced and almost free, sinuses narrow. Sori at $\frac{1}{3}$ distance from costule to edge; indusium very small, usually entirely on costular side, dark near its attachment to base of receptacle, outer edge pale, uneven; receptacle tall, sporangia very numerous; paraphyses short, slender. Scales and hairs: pinna-rachis closely and finely warty on lower surface, rather pale, glabrescent, residual scales small, pale, short-fringed; scales near base of costae broad, thin, ovate-acute, flat, entire or with short pale hairs, grading distally to bullate scales, very small irregular short-fringed scales also abundant; most scales on costules bullate, pale brown.

Type specimen: MATTHEW 679, Mt Korinchi, Sumatra (BO; dupl. at K).

Distr. *Malaysia*: Sumatra (one collection).

Ecol. In forest, at 2400 m.

94. *Cyathea incisoserrata* COPEL. Philip. J. Sc. 6 (1911) Bot. 361; HOLTUM, Gard. Bull. S. S. 8 (1935) 305.—*Alsophila ornata* var. *sikkimensis* (non CL. & BAK.) BEDD. J. Bot. 31 (1893) 225.—*Alsophila ornata* (non SCOTT) BEDD. Kew Bull. (1909) 423.—*Alsophila incisoserrata* C. CHR. Ind. Fil. Suppl. (1913) 5; v. A. v. R. Handb. Suppl. (1917) 72.—*Alsophila latebrosa* var. *ornata* RIDL. J. Mal. Br. R. As. Soc. 4 (1926) 8.—Fig. 7, 8b, 18.

Trunk to 4 m, 12 cm ϕ including leaf-bases. Stipe to 85 cm, warty or with conical spines to 1½ mm long on abaxial surface, rather persistently but sparsely scaly almost throughout, scales hardly more than 10 by 1 mm; pneumathodes in a continuous double row, almost coalescent. Lower pinnae slightly reduced, longest 70 cm. Pinnules commonly to 100 by 25 mm, largest sometimes 120 by 35 mm, sessile, acuminate, several pairs of segments near base distinctly separate, connected by a narrow costal wing; costules 4½–5½ mm apart; veins commonly 12 pairs, 14–15 pairs in largest segments, middle ones in largest segments pinnately branched; lamina-segments rather thin, strongly crenate, lower ones of largest pinnules often deeply lobed, almost all separated by wide sinuses except on smaller pinnae. Sori near costules; indusium hemitelioid, very small, often bilobed, hidden by sporangia; receptacle not swollen; paraphyses longer than sporangia, some of them 2–3 cells wide at base. Scales and hairs: lower surface of pinna-rachis almost smooth, rather pale (green when living), glabrescent or with some very small fringed scales; scales near base of costae elongate, flat, entire, or with short marginal hairs, brown, grading to bullate scales; bullate scales abundant on costules.

Type specimen: C. J. BROOKS 105, Mt Singie, Sarawak (MICH; dupl. at BM).

Distr. *Malaysia*: Sarawak, Malay Peninsula. Ecol. In forest or on edge of forest, from the lowland to 1250 m.

Note. This is very near *C. latebrosa*, agreeing in sori and scales on pinnules, but the size and shape of pinnules is characteristic. Young plants grown from spores at Kew agree exactly with the parent plant in these characters. The scales persistent throughout the stipe also show a difference from those of *C. latebrosa*.

95. *Cyathea physolepidota* ALSTON, Nova Guinea n.s. 7 (1956) 1.

Stipe 25 cm, strongly spiny, spines 3–5 mm long; scales sparse, to 10 by 1¼ mm, brown with pale fragile edges which have many slender hairs irregularly directed (not all deflexed as originally described). Main rachis smooth and rather pale, glabrescent. Lower pinnae reduced (lowest not seen); longest pinna 22 cm long. Largest pinnules 32 by 9 mm, sessile, short-acuminate, lobed to within 1 mm of costa, lowest segment not free; costules 2½ mm apart; veins 6 pairs, usually simple; lamina-segments firm, edges slightly sinuous or crenulate. Sori near costules; indusium very small, hemitelioid, usually bilobed; receptacle slender, rather tall; paraphyses short. Scales and hairs:

lower surface of pinna-rachis and costae bearing more or less abundant pale brown bullate scales, on bases of costae also sometimes flat scales with setiform apex.

Type specimen: CARR 13871, above the Gap, Papua (BM; dupl. at L, SING).

Distr. *Malaysia*: E. New Guinea (2 collections). Ecol. In forest, 2200–2500 m.

96. *Cyathea kanehirae* HOLTUM, *nom. nov.*—*Alsophila arfakensis* GEPP in Gibbs, Arfak (1917) 70 (non *C. arfakensis* GEPP, l.c.).

Stipe not known; rachis smooth and glabrescent on lower surface. Pinnae to 50 cm long; pinnules widely spaced and jointed to rachis. Pinnules to 80 by 20 mm, lower ones on stalks 6–7 mm long; basal 1–2 pairs of segments quite free and articulate to costa, next 2–3 pairs constricted at base, rest of pinnule lobed nearly to costa; costules 6 mm apart; veins 7–8 pairs, mostly forked, lowest often with each branch again forked, not prominent on either surface; lamina-segments thick and rigid, edges slightly crenate, apices rounded. Sori near costules (except lowest); indusium very small, hemitelioid, sometimes bilobed. Scales and hairs: scales on costae and costules few, flat, entire.

Type specimen: L. S. GIBBS 5990, Arfak Mts, W. New Guinea (BM; dupl. at K, P).

Distr. *Malaysia*: W. New Guinea. Ecol. In mossy forest, 1600–2700 m.

Note. The original specimens are fragmentary. The above description is drawn mainly from much better ones collected near the original locality by KANEHIRA & HATUSIMA (n. 13499, at BO, A).

97. *Cyathea nigropaleata* HOLTUM, Kew Bull. 16 (1962) 59.

Trunk of type 1.2 m, bearing 12 mature fronds and 8 young ones; fronds 200 cm long. Stipe warty, very dark at base, paler upwards; scales near base 20 by 2 mm, nearly black, shining, with narrow dull brown edges bearing scattered long dark setae. One pair of pinnae 6 cm long 20 cm from base of stipe, next pair much larger and higher; longest pinna 45 cm long (collector). Largest pinnules 55–80 by 12–17 mm, lowest with stalks 2–4 mm long, lowest 2 or more segments constricted at base and separated by a costal wing from the rest, rest of pinnule lobed to within 1 mm of costa; costules 3–4½ mm apart; veins 6–8 pairs; lamina-segments firm, rather pale, strongly crenate where fertile. Sori near costules; indusium a small lobed dark scale on costular side, hidden by sporangia; paraphyses a little longer than sporangia, some 2 cells wide at base. Scales and hairs: pinna-rachis pale, minutely warty and glabrescent on lower surface, dark-hairy above; costal scales rather sparse, flat, ovate to elongate, the larger with dark centre and pale edges sometimes with 1 or 2 setae; costular scales thin, light brown, flat, not fringed, setae rare.

Type specimen: PULLEN 666, Eastern Highlands, NE. New Guinea, (L).

Distr. *Malaysia*: Eastern New Guinea (2 collections).

Ecol. In *Nothofagus* forest, 2000 m.

98. *Cyathea microchlamys* HOLTUM, Kew Bull. 16 (1962) 58.

Stipe 45 cm, base dark, paler upwards, finely warty; scales near base to 15 by 1 mm, dark, shining, with pale edges bearing dark setae. Lowest pinna 24 cm long, longest 27 cm. Largest pinnules 65 by 13–15 mm, sessile, short-acuminate, lobed almost to costa, lowest segment not free; costules 4 mm apart; veins to 9 pairs; lamina-segments thin, minutely crenate, apices obtuse, sinuses narrow. *Sori* near costules; indusium a scale ½ mm wide on costular side of receptacle; paraphyses as long as sporangia. *Scales and hairs*: lower surface of pinna-rachis bearing scattered crisped hairs, also scattered flat narrow entire brown scales; costal scales sparse, flat, brown, entire; some scattered pale crisped hairs also on costae beneath; no costular scales seen (specimen is entirely fertile).

Type specimen: RAMOS BS 30475, Catanduanes, Luzon (US; dupl. at P).

Distr. *Malaysia*: Philippines (Luzon, one collection).

Note. This appears to be very near *C. caudata*, but has a long stipe and small indusia.

99. *Cyathea perpunctulata* (v. A. v. R.) DOMIN, Acta Bot. Bohem. 9 (1930) 146.—*Hemitelia perpunctulata* v. A. v. R. Bull. Jard. Bot. Btzig II, n. 28 (1918) 25.

Stipe unknown. *Rachis* near base copiously finely warty on lower surface, smooth and glabrescent distally. *Pinnae* articulate to rachis and rather easily detached on drying, longest 47 cm long. *Pinnules* articulate to pinna-rachis, largest 90 by 17 mm, sessile, acuminate, lobed nearly to costa, basal segment not free; costules 3½ mm apart; veins 10 pairs; lamina-segments rather thin, crenate, apices rounded, sinuses narrow. *Sori* near costules; indusium a small brown scale on costular side of receptacle, covered by sporangia; paraphyses not seen, certainly no long ones present. *Scales and hairs*: lower surface of pinna-rachis glabrescent, residual scales few, very narrow, dark, entire; scales on lower surface of costae near base numerous, elongate, firm, brown with pale edge, entire, grading to similar scales bullate at base and distally to many pale bullate acuminate entire scales; scales on costules bullate.

Type specimen: BÜNNEMEIJER 1219, Bt Kabung, Lubu Sikaping, Sumatra (BO; dupl. at L).

Distr. *Malaysia*: Sumatra (2 collections).

Ecol. In forest, 650 m.

100. *Cyathea alderwereltii* COPEL. Philip. J. Sc. 4 (1909) Bot. 50.—*Hemitelia sumatrana* v. A. v. R. Bull. Dép. Agr. Ind. Néerl. n. 18 (1908) 2; Handb. (1908) 28; Suppl. (1917) 48.—*Hemitelia horridipes* v. A. v. R. Bull. Jard. Bot. Btzig II, n. 16 (1914) 16; Handb. Suppl. (1917) 47.—*Hemitelia salticola* v. A. v. R. Bull. Jard. Bot. Btzig II, n. 20 (1915) 18; Handb. Suppl. (1917) 50.—*Hemitelia paraphysophora* v. A. v. R. Bull. Jard. Bot. Btzig III, 2 (1920) 154.—*Alsophila spinifera* v. A. v. R. *ibid.*

III, 5 (1922) 182.—*C. horridipes* DOMIN, Pterid. (1929) 264.—*C. salticola* DOMIN, l.c.—*C. paraphysophora* DOMIN, Acta Bot. Bohem. 9 (1930) 145.—*C. spinifera* DOMIN, l.c. 160.

Stipe 60 cm or more, copiously spiny at base, spines 3–4 mm long; scales to 18 by 2 mm, dark, shining, with narrow fragile edges; pneumathodes in a close double row. Lower pinnae somewhat reduced, longest 60 cm or more long. *Pinnules* to 90 by 18 mm, sessile, rather strongly acuminate, lobed almost to costa, basal 1–2 segments, rarely to 6 pairs, constricted at base; costules 3½ mm apart; veins 10–12 pairs; lamina-segments firm, rather strongly crenate, sinuses narrow. *Sori* near costules; indusium a small brown scale on costular side of receptacle, hidden by sporangia; paraphyses many, longer than sporangia, some of them 2–3 cells wide at base. *Scales and hairs*: lower surface of pinna-rachis sparsely warty, almost glabrescent, at length bearing scattered very small fringed scales and a few narrow dark ones, towards apex also some pale crisped hairs; lower surface of costae densely scaly towards base, basal scales 2 mm long, narrow, acuminate, firm, brown, entire, grading to thinner shorter ovate scales and to pale bullate scales distally; pale bullate scales abundant on costules.

Type specimen: TEYSMANN 2436, Talang Solok, Sumatra (BO; dupl. at L, K, US, U).

Distr. *Malaysia*: Central Sumatra.

Ecol. In forest at 1000–1500 m, very abundant on Mt Sago (Mt Malintang) where were collected the types of *Hemitelia horridipes* and *H. paraphysophora*. The type of *H. salticola* only differs from the others in having several basal pairs of segments on each pinnule constricted at the base, the pinnules to 22 mm wide.

101. *Cyathea amboinensis* (v. A. v. R.) MERR. Interpr. Rumph. Herb. Amb. (1917) 63.—*Alsophila latebrosa* var. *batjanensis* CHRIST in Warb. Monsunia (1900) 89.—*Alsophila amboinensis* v. A. v. R. Philip. J. Sc. 11 (1916) Bot. 103; Handb. Suppl. (1917) 492.

Stipe more than 50 cm, warty near base. Lower pinnae not greatly reduced, longest 50 cm long. Largest pinnules to 85 by 16–18 mm, sessile, acuminate, lobed nearly to costa, lowest segment not free; costules 3½–4 mm apart; veins 10 pairs; lamina-segments firm, rather strongly crenate. *Sori* near costules; indusium a very small dark scale on costular side of receptacle; paraphyses abundant, longer than sporangia, some of them 2 cells or more wide at base. *Scales and hairs*: pinna-rachis smooth and glabrescent beneath; costae bearing many pale bullate scales almost to base, at base some flat ovate-acuminate scales; many pale bullate scales on costules.

Type specimen: C. B. ROBINSON 464, Ambon (BO; dupl. at K, A, L, BM).

Distr. *Malaysia*: Moluccas (Ambon, Ceram, Batjan), Central and North Celebes (?).

Ecol. In forest at low elevations. KJELLBERG 2088, from Malili, Central Celebes, was collected in swamp-forest at sea-level; this and a specimen

from Menado collected by POSTHUMUS are referred with some doubt to this species.

102. *Cyathea media* WAGN. & GRETH. Un. Cal. Publ. Bot. 23 (1948) 44, pl. 15.

Stipe 20–25 cm, dark, warty; scales to 20 by 1½ mm, dark to medium brown, fragile edges narrow and usually eroded. Lower *pinnae* reduced, lowest 8–12 cm long; longest *pinnae* 48 cm long. *Pinnules* to 85 by 15 mm, almost sessile, lobed almost to costa, 1–2 basal segments constricted at base and almost or quite free; costules 3½ mm apart; veins 8–10 pairs; lamina-segments distinctly oblique, edges crenate, apices acute or rounded. *Sori* inframedial; indusium a minute scale on costular side of receptacle, hidden by sporangia; paraphyses long. *Scales and hairs*: near base of costae some elongate flat brown scales, bullate scales also throughout; bullate scales present on costules.

Type specimen: GREYER & WAGNER 4162, Manus I., Admiralty Is (UC; dupl. at MICH).

Distr. *Malaysia*: Islands to NE. of New Guinea. Ecol. In forest, to 1600 m.

Note. I have included here specimens collected by BRASS on Goodenough Island, in mossy oak forest at 1600 m, which are smaller than the type (*pinnules* to 50 by 11 mm) but agree in other respects.

103. *Cyathea latebrosa* (WALL. ex HOOK.) COPEL. Philip. J. Sc. 4 (1909) Bot. 52; C. CHR. Gard. Bull. S. S. 7 (1934) 222; HOLTUM, *ibid.* 8 (1935) 303, pl. 29, *p.p. max.*; Rev. Fl. Mal. 2 (1954) 120.—*Polypodium latebrosum* WALL. Cat. (1828) n. 318, *nomen*.—*Alsophila latebrosa* WALL. ex HOOK. Sp. Fil. 1 (1844) 37; Syn. Fil. (1866) 43, *p.p.*; BEDD. Handb. (1883) 11, *p.p.*; v. A. v. R. Handb. (1908) 38, 789, *p. p.*—*Dichorexia latebrosa* PRESL, Abh. K. Böhm. Ges. Wiss. V, 5 (1848) 344.—*Hemitelia latebrosa* METT. Fil. Hort. Lips. (1856) 111; Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 54, *p.p.*; v. A. v. R. Bull. Jard. Bot. Btzg II, n. 23 (1916) 13, *incl. var. paraphysata* v. A. v. R.; Handb. Suppl. (1917) 51, *p.p.*, 489.—*C. leucocarpa* COPEL. Philip.

J. Sc. 6 (1911) Bot. 362.—*C. longipinna* COPEL. l.c. 363.—*Alsophila leucocarpa* C. CHR. Ind. Fil. Suppl. (1913) 5; v. A. v. R. Handb. Suppl. (1917) 66.—*Alsophila longipinna* C. CHR. Ind. Fil. Suppl. (1913) 5; v. A. v. R. Handb. Suppl. (1917) 67.—*Alsophila lastreoides* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 23 (1916) 5; Handb. Suppl. (1917) 495.—*Hemitelia leptolepia* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 23 (1916) 12; Handb. Suppl. (1917) 488.—*Hemitelia rudimentaris* v. A. v. R. Bull. Jard. Bot. Btzg III, 5 (1922) 205.—*C. lastreoides* DOMIN, Acta Bot. Bohem. 9 (1930) 128.—*C. leptolepia* DOMIN, l.c. 130.—*C. rudimentaris* DOMIN, l.c. 154.

Trunk to c. 3 m, rather slender. *Stipe* 50 cm or more, closely short-spiny (spines 1–2½ mm long); few persistent scales, near base only, to 15 by little over 1 mm, dark, shining, fragile edges soon abraded; pneumathodes in an almost continuous row. Lower *pinnae* somewhat reduced; longest c. 60 cm long. Largest *pinnules* 80–100 by 12–18 (–20) mm, sessile, acuminate, lobed almost to costa, lowest segment sometimes almost free; costules 3–3½ mm (rarely 4 mm) apart; veins c. 10 pairs; lamina-segments rather thin, more or less crenate, almost touching or more often separated by distinct sinuses. *Sori* near costules; indusium a small often bilobed scale on costular side of receptacle, variable in size, hidden by mature sorus; paraphyses usually longer than sporangia, some of them 2–4 cells wide at base. *Scales and hairs*: pinna-rachis sparsely warty beneath, glabrescent; costae not densely scaly, scales near base elongate, flat, brown, entire, grading to bullate scales; bullate scales on costules (most abundant on sterile *pinnules*).

Type specimen: WALLICH 318, Penang (K; dupl. at L, US, A).

Distr. Hainan, Indo-China, and Thailand, southwards to *Malaysia*: Sumatra, Malay Peninsula, Borneo.

Ecol. In forest or on edge of forest from lowlands to 1500 m.

Note. The South Indian plants formerly included here have larger thinner indusia, and should rank as a separate species not yet described.

2. Section *Gymnosphaera*

(BL.) HOLTUM, *stat. nov.*—*Gymnosphaera* BL. En. Pl. Jav. (1828) 242; COPEL. Gen. Fil. (1947) 98, *p.p. (excl. sect. 3)*.—*Thysanobotrya* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 28 (1918) 66, t. 10.—*Alsophila sensu* C. CHR. Dansk Bot. Ark. 7 (1932) 37.—*Cyathea subg. Gymnosphaera* TINDALE, Contr. N. S. W. Nat. Herb. 2 (1956) 331.

Type species: *Cyathea glabra* (BL.) COPEL.—Fig. 19–21.

Distr. Madagascar; India and Ceylon, eastwards to southern China and Formosa; throughout *Malaysia*, eastwards to Fiji, and in NE. Australia. *Alsophila salvinii* HOOK. of Guatemala has dark axes, reduced fertile *pinnules* and no indusia, but it may not be closely related to *Malaysian* species.

Taxon. There is no doubt that *C. glabra* and its immediate allies are a natural group of species, but none of the characters by which they are separated from *sect. Cyathea* is sharply definable, and a few species (notably *C. macgillivrayi*) appear to be intermediate. To the distinguishing characters given by COPELAND, I have added hairiness of the lower surfaces of rachises; using this as a character which may occur in *sect. Cyathea*, almost all species which are exindusiate and have hairless lower surfaces belong to *Gymnosphaera*. I have included *C. macgillivrayi* in the keys to both sections.

Ecol. The species of this section appear all to be ferns of shady forest (some even of swamp forest), not of the open. Several, as here delimited, are rather widely distributed and also variable in the degree of division of pinnules, especially of fertile pinnules. Experimental cultivation might establish how much of this variation is due to edaphic and other environmental conditions, and how much is of genetic origin. *C. biformis* (ROSENST.) COPEL. is peculiar in the genus by its scandent habit.

KEY TO THE SPECIES

1. Reduced pinnae present at base of stipe, separated from normal pinnae.
 2. Sterile pinnules of normal pinnae c. 40 by 10 mm, fertile c. 30 by 8 mm; veins 4 pairs.
 104. *C. annae*
 2. Sterile pinnules of normal pinnae 60–100 by 15–20 mm, fertile 40–100 by 11–15 mm; veins 6–10 pairs.
 3. Segments of reduced basal pinnae all with very narrow lamina, forming a wing along each side of the veins.
 4. Lower sori medial on veins, distal ones close to costule. Paraphyses slender at base, widening to scale-like apex 105. *C. ramispina*
 4. All sori close to costules. Paraphyses thick and dark at base, tapering to apex.
 106. *C. atropurpurea*
 3. Segments of reduced basal pinnae all with broad lamina 107. *C. recommutata*
 1. Reduced pinnae, separate from the rest, lacking; lower pinnae in some cases reduced gradually almost to base of stipe, the lowest sometimes with narrow segments.
 5. Fronds simply pinnate with entire pinnae (sterile) or bipinnate with few pinnae and almost entire sterile pinnules; in either case the true frond-apex short and abortive, evident above attachment of uppermost pinna.
 6. Fertile pinnules lobed almost or quite to costa 108. *C. biformis*
 6. Fertile pinnules only slightly lobed 109. *C. scandens*
 5. Fronds with normal apex.
 7. Pinnules almost entire.
 8. Sterile pinnules to 50 by 10 mm, on stalks to 1 mm long; bullate scales present on costules.
 110. *C. rebecca*
 8. Sterile pinnules to 120 by 20 mm, on stalks to 4 mm long; no bullate scales on costules.
 111. *C. glabra*
 7. Pinnules distinctly lobed.
 9. Scales on lower surface of costules bullate.
 10. Bullate scales present on lower surface of veins of sterile pinnules.
 11. Pinnules to 100 mm long with several pairs of free segments at base 112. *C. hornei*
 11. Pinnules to 65 mm long without free basal segments 113. *C. dimorpha*
 10. Bullate scales lacking on veins.
 12. Axes very dark; scales on lower surface of costae bearing many setae 114. *C. lurida*
 12. Axes not very dark; scales on lower surface of costae sometimes with a few setae.
 13. Pinnules to 110 by 30 mm, cut to 2 mm from costae; costules of sterile pinnules to 6 mm apart.
 115. *C. rubella*
 13. Pinnules to 70 by 20 mm, cut to within 1 mm from costa; costules of sterile pinnules to 4½ mm apart 116. *C. macgillivrayi*
 9. Scales on lower surface of costules not bullate.
 14. Pinnules lobed almost to costa.
 15. Costal scales not setiferous 117. *C. acrostichoides*
 15. Costal scales bearing many setae 118. *C. schlechteri*
 14. Pinnules not lobed more than ⅓ towards costa.
 16. Scales on costae bearing lateral setae. Segments or lobes of pinnules rounded and subentire. Sori usually not converging towards apices of segments. Basal basicopic vein from costule.
 17. Stipe and basal part of rachis persistently scaly; largest pinnules with stalks at most 2 mm; veins to 6 pairs 119. *C. subdubia*
 17. Persistent large scales only at base of stipe; largest pinnules with stalks to 4 mm; veins 3–5 pairs
 111. *C. glabra*
 16. Scales on costae lacking lateral setae. Segments of lamina deltoid and distinctly toothed. Sori converging towards apices of segments. Basal basicopic vein often from costa.
 120. *C. gigantea*

104. *Cyathea annae* (v. A. v. R.) DOMIN, Acta Bot. Bohem. 9 (1930) 90.—*Alsophila annae* v. A. v. R. Bull. Jard. Bot. Btzig II, n. 23 (1916) 3; Handb. Suppl. (1917) 490.—Fig. 19c.

Stipe dark, slender; scales to 60 by 1 mm, dark and shining with dull paler edges. Basal pinnae about 4 on each side of the stipe, all within 11 cm

from the base, lowest with very narrow lamina on each side of veins and midribs of pinnules, upper ones with pinnules to 20 by 7 mm with crenate edges; largest pinnae 24 cm long, sterile and fertile pinnules dimorphous. Sterile pinnules to 43 by 10 mm, almost sessile, base broad, apex gradually narrowed, edges lobed to ⅓ towards



Fig. 19. *Cyathea recommutata* COPEL. a. Part of pinna showing transition from fertile to sterile pinnules, $\times \frac{2}{3}$, b. lower surface of fertile pinnule, $\times 4$.—*C. annae* (v. A. v. R.) DOMIN. c. Reduced pinnae at base of stipe, $\times \frac{2}{3}$ (a-b KUNSTLER 7130, c cult. Hort. Bog.).

costa; costules 3–3½ mm apart; veins 2–3 pairs, simple. Fertile pinnules to 30 by 8 mm, lobed $\frac{3}{4}$ towards costa, veins commonly 2 pairs, all sori-ferous; sori without indusia. Scales and hairs: scales on lower surface of costae near base narrow, dark with pale edges not setiferous, grading to pale narrow scales and to dull brown bullate scales distally and on costules.

Type specimen: Cult. Hort. Bog. II-K-XIII-10; origin Ambon, J. J. SMITH (BO; dupl. at L). Distr. Malaysia: Moluccas (Ambon, two collections).

Ecol. At 650 m.

Note. The original description contains no reference to the fact that the species was described from a cultivated plant, the citation being 'Amboina, J. J. Smith'; the type specimens in Herb. Bog. bear no reference to J. J. SMITH, but only the location of the plant in the garden. J. J. SMITH went to Ambon in 1900 (with BOERLAGE), and brought back many plants for cultivation at Bogor. The name *annae* commemorates Mrs SMITH.

105. *Cyathea ramispina* (HOOK.) COPEL. Philip. J. Sc. 4 (1909) Bot. 36; Sarawak Mus. J. 2 (1917) 346, 349; C. CHR. & HOLTUM, Gard. Bull. S.S.

7 (1934) 200, 220.—*Alsophila ramispina* HOOK. Syn. Fil. (1866) 42; v. A. v. R. Handb. (1908) 34; CHRIST, Ann. Jard. Bot. Btzg 20 (1906) 138.—*Alsophila burbidgei* (non BAK.) CHRIST, Ann. Jard. Bot. Btzg 20 (1906) 138, p.p.—*Alsophila hallieri* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 28 (1918) 2 (non ROSENST.).—*Alsophila amaiambitensis* v. A. v. R. l.c. 1.—*Alsophila kenepaiana* v. A. v. R. *ibid.* III, 2 (1920) 129.—*C. kenepaiana* DOMIN, Acta Bot. Bohem. 9 (1930) 127.—*C. amaiambitensis* DOMIN, l.c. 90.—*Gymnosphaera ramispina* COPEL. Gen. Fil. (1947) 98.

Trunk rather slender, persistently covered with the finely-divided basal pinnae attached to the persistent leaf-bases. Stipe dark, almost covered with small dull brown scales; larger scales very dark, shining, to 10 by 1½ mm, with narrow thin pale edges. Basal pinnae several pairs, all with lamina reduced to a narrow wing along veins and costae, to c. 6 by 4 cm, with c. 6 pairs of pinnules; segments of pinnules to 8 mm long; rest of stipe and rachis dark and shining, glabrescent on lower surface, pinna-rachises sometimes paler and distinctly reddish. Normal pinnae to 45 cm long. Pinnules slightly dimorphous (fertile smaller), lowest with stalks 2–3 mm long, largest 70–90 by

12–19 mm, lowest 1–2 pairs of segments sometimes almost or quite free, rest of pinnule lobed to about 2 mm from costa; costules 4–4½ mm apart; veins to 8 pairs, usually all simple; lamina firm, segments slightly crenate with rounded ends. *Sori* exindusiate, distal ones close to costule, basal ones more distant from it; paraphyses slender at base, widening abruptly to a small flat apex. *Scales and hairs*: scales on costae and costules narrow, dark, shining with pale edges which occasionally bear a dark seta, grading to pale bullate scales (sometimes with setiform apex).

Type specimen: LOBB, Sarawak (K).

Distr. *Malaysia*: Borneo.

Ecol. In rather exposed places on mountain ridges at 1800–2500 m; abundant on the main ridge of Mt Kinabalu. Also recorded at 100–170 m on sandstone hill-side in Tawau R. For. Res. Young plants do not bear the small pinnae at the bases of stipes.

Note. The type specimen of *Alsophila amaia-bitensis* v. A. v. R. has no stipe, and thus does not show the reduced basal pinnae, but agrees in other characters except that all scales seen on costules are narrow with dark setae, no bullate scales being present.

106. *Cyathea atropurpurea* COPEL. Philip. J. Sc. 3 (1909) Bot. 354; *ibid.* 4 (1909) Bot. 36, pl. 18.—*Alsophila atropurpurea* C. CHR. Ind. Fil. Suppl. (1913) 4.—*Gymnosphaera atropurpurea* COPEL. Gen. Fil. (1947) 98; Fern Fl. Philip. 2 (1960) 234.

Differs from *C. ramispina* in somewhat smaller size of pinnae (largest seen 30 cm long) and pinnules (to 80 by 17 mm), veins to 6 pairs, segments of lamina more strongly crenate, sori all close to the costa, paraphyses thick and dark at the base, tapering and paler distally.

Type specimen: MERRILL 6056, Mt Halcon, Mindoro (MICH; dupl. at A).

Distr. *Malaysia*: Philippines (Luzon, Mindoro, Leyte, Mindanao).

Ecol. At altitudes of 1000 m and over.

107. *Cyathea recommitata* COPEL. Philip. J. Sc. 4 (1909) Bot. 36; C. CHR. Gard. Bull. S.S. 7 (1934) 220; HOLTUM, Rev. Fl. Mal. 2 (1954) 125.—*Gymnosphaera squamulata* (non BL.) J. SM. ex HOOK. Gen. Fil. (1842) t. 100.—*Alsophila squamulata* HOOK. Sp. Fil. 1 (1844) 51, p.p.; BEDD. Ferns Br. Ind. (1867) t. 235.—*Alsophila commutata* METT. Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 53; BEDD. Handb. (1883) 14; v. A. v. R. Handb. (1908) 34 (non *C. commutata* SPR.).—*C. hewittii* COPEL. Philip. J. Sc. 6 (1911) Bot. 134, t. 14.—*Alsophila heteromorpha* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 16 (1914) 1; Handb. Suppl. (1917) 56; Bull. Jard. Bot. Btzg III, 2 (1920) 129, *incl. var. decomposita* v. A. v. R.—*Alsophila hewittii* v. A. v. R. Handb. Suppl. (1917) 55; C. CHR. Gard. Bull. S.S. 7 (1934) 221.—*C. toppingii* COPEL. Philip. J. Sc. 12 (1917) Bot. 51; C. CHR. Gard. Bull. S.S. 7 (1934) 220.—*Alsophila subulata* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 28 (1918) 1.—*C. heteromorpha* DOMIN, Pterid. (1929) 262.—

C. subulata DOMIN, Acta Bot. Bohem. 9 (1930) 164.—*Gymnosphaera recommitata* COPEL. Gen. Fil. (1947) 98.—*Gymnosphaera hewittii* COPEL. l.c.—Fig. 19a, b, 21d.

Trunk rather slender, commonly not over 3 m. *Stipes* very dark; basal scales dark, shining, with thin fragile margins, to c. 20 by 2 mm; small pale dull scales also abundant. *Reduced pinnae*, several (rarely to 9) pairs attached to lower part of stipe, largest to 10 cm long, on old fronds often reduced to their stout spine-like bases, their pinnules simple and entire or the largest slightly lobed; *largest pinnae* 40 cm. *Pinnules* dimorphous (sometimes with intermediate conditions); sterile *pinnules* commonly 60–70(–90) by 16 mm, lowest on stalks 2–3 mm long, one basal segment sometimes almost free, rest lobed about halfway to costa, apex acuminate; costules 4–4½ mm apart; veins to c. 7 pairs, simple; lamina-segments rigid, dark on upper surface, apices rounded and slightly crenate; *fertile pinnules* 6–12 mm wide, costules 3–4 mm apart, *sori* close to costules, no indusia; paraphyses dark, not longer than sporangia. *Scales and hairs*: pinna-rachis smooth and glabrescent on lower surface; scales near bases of costae narrow, dark and shining with pale edges, not setiferous, grading to brown bullate scales distally and on costules.

Type specimen: CUMING 396, Mt Ophir, Malay Peninsula (original lost; dupl. at K, BM, FI, GH).

Distr. *Malaysia*: Sumatra (central and south), Malay Peninsula, Borneo.

Ecol. Commonly at 600–1500 m, in acid peaty or sandy soil, in forest (not in exposed places); in Borneo also at 0–60 m, in swamp forest on sandy ground.

Note. The type collection of *C. hewittii* (BROOKS & HEWITT 21, Bongo Mt), both in Herb. Copel. (MICH) and at BM, is certainly referable to the present species, but another collection of BROOKS so named at Kew (*s.n.*, Jan. 1908) is a mixture of *C. recommitata* and *C. ramispina*.

108. *Cyathea bififormis* (ROSENST.) COPEL. Philip. J. Sc. 6 (1911) Bot. 364; *ibid.* 77 (1947) 117.—*Stenochlaena dubia* v. A. v. R. Bull. Dép. Agr. Ind. Néerl. n. 18 (1908) 26; Handb. (1908) 721; HOLTUM, Gard. Bull. S.S. 5 (1932) 250, non *C. dubia* (BEDD.) DOMIN, 1929.—*Alsophila bififormis* ROSENST. in Fedde, Rep. 9 (1911) 423; v. A. v. R. Handb. Suppl. (1917) 71; BRAUSE, Hedwigia 61 (1920) 401.—*Polybotrya arfakensis* GEFF in Gibbs, Arfak (1917) 71.—*Thysanobotrya arfakensis* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 28 (1918) 66, t. 10.—*C. gibbsiae* COPEL. Philip. J. Sc. 38 (1929) 129.—*Gymnosphaera bififormis* COPEL. Gen. Fil. (1947) 99.—Fig. 20.

Stem 1–1½ cm ø, climbing (clinging to supporting tree by its roots), apex and bases of stipes covered with shining very dark scales to 20 by less than 1 mm wide, long-acuminate, edges pale. *Stipe* nearly black, slightly rough and scaly near base only, rest smooth and shining. *Fronds* of two kinds, simply pinnate (always sterile) and bipinnate, the true frond-apex always short and abor-

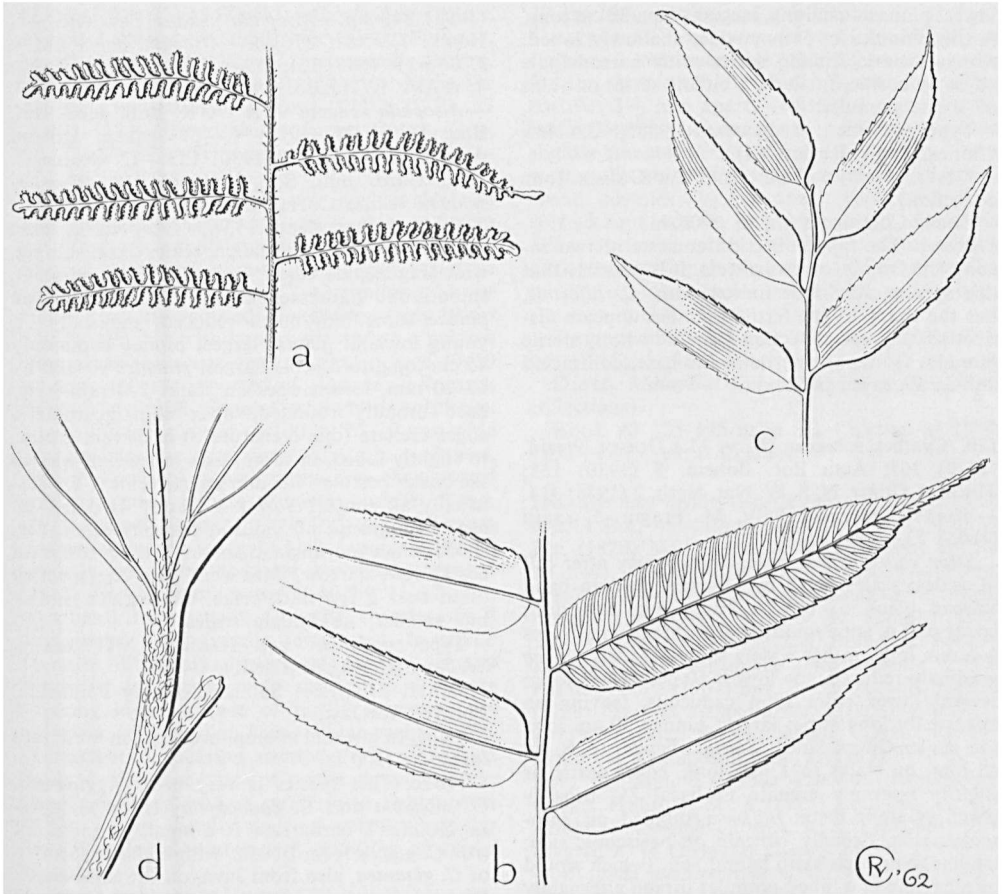


Fig. 20. *Cyathea biformis* (ROSENST.) COPEL. a. Fertile pinnules, $\times \frac{2}{3}$, b. sterile pinnules, $\times \frac{2}{3}$, c. apical part of frond, showing abortion of true apex, $\times \frac{2}{3}$, d. part of c, $\times 8$ (a-b BRASS 6806, c-d BRASS 8947).

itive, evident above the attachment of the uppermost pinna, the true pinna-apex of bipinnate fronds similarly abortive. *Simply pinnate fronds* to 45 cm long (excluding stipe) with up to 17 pairs of pinnae and a false apical one; pinnae to c. 60 by 18 mm, edges deeply crenate, apex shortly caudate-acuminate, bases slightly unequal, narrower and rounded acroscopically, broadly cuneate basiscopically, stalks 2 mm long, lamina firm, veins in pinnate groups, none separately from costa. *Bipinnate fronds*: stipe to 21 cm, sometimes bearing 1-2 small pinnae near the base, pneumathodes commonly 3-7 mm long, rather widely spaced; lamina to at least 100 cm long with pinnae 10-13 cm apart on each side of the rachis; pinnae to 28 cm long, lowest pinnules reduced, middle sterile pinnules stalked (2 mm), 60-90 by 15-18 mm, shaped as pinnae of simply pinnate fronds, occasionally (at high elevations) lobed $\frac{1}{4}$ - $\frac{1}{3}$ towards costa; *fertile pinnules* stalked (3-5 mm), c. 50 by 4-10 mm, lobed almost or quite to the costa, costules $3\frac{1}{2}$ mm apart, lobes $1\frac{1}{2}$ -2 mm wide, entire with rounded tips, basiscopic edge of

each lobe decurrent to join the lobe below it; *sori* to 4 pairs on each lobe, no indusia. *Scales on frond*: lower surfaces usually glabrous, in one case a few dark bullate scales seen on sterile leaflets.

Type specimen: COPLAND KING 57, Papua (S-PA; dupl. at MICH, BO).

Distr. *Malaysia*: Moluccas (Ambon), New Guinea.

Ecol. Climbing to 2-3 m or more, on trees in forest, at 300-2200 m, reported by BRASS to be common in mossy forest, rainforest and *Agathis* forest; PULLEN reported 'very common ground fern which often ascends trees to 8 feet', at 850 m, in *Nothofagus* forest.

Note. The only specimen with rather deeply lobed sterile pinnules is GIBBS 5984, from 2200 m (type of *Polybotrya arfakensis* GEPP).

109. *Cyathea scandens* (BRAUSE) DOMIN, Acta Bot. Bohem. 9 (1930) 156. — *Alsophila scandens* BRAUSE, Bot. Jahrb. 56 (1920) 77.

Habit of *C. biformis*, agreeing in abortive apices of frond and pinnae, differing: stipe 17 cm,

lowest pinnae 4 cm long, largest pinna 22 cm long, fertile pinnules c. 5 mm wide, shallowly lobed; elongate dark shining scales with narrow pale edges on costae, small dark bullate scales on veins of sterile pinnules.

Type specimen: LEDERMANN 9885, E. New Guinea, Sepik Region (B).

Distr. *Malaysia*: Eastern New Guinea (one collection).

Ecol. Climbing fern, at 1000 m.

Note. The type collection consists of two incomplete fronds, on two sheets. It is possible that this species should be united with *C. biformis*, but the shape of the fertile pinnules appears distinctive; the type collection bears no wholly sterile pinnules (some are sterile at the base, contracted and fertile towards apex).

110. *Cyathea rebecca* (F. v. M.) DOMIN, Pterid. (1929) 263; Acta Bot. Bohem. 9 (1930) 153; TINDALE, Contr. N. S. W. Nat. Herb. 2 (1956) 334. —*Alsophila rebecca* F. v. M. Fragm. 5, xxxiii (1865) 53, xxxvi (1886) 117.

Stipe very dark at base, finely warty after fall of scales; scales to 15 by 1½ mm, median band shining black to brown, edges thin and dull; upper part of *stipe* smooth purplish; pneumathodes 4–5 mm long, rather widely spaced. Lower *pinnae* gradually reduced, the lowest 10 cm or less long; several lower pairs soon caducous, leaving an apparently long *stipe*; largest *pinnae* 30 cm long (45 cm in Queensland). *Sterile pinnules* to 50 by 10 mm, on stalks to 1 mm long, edges entire or slightly unevenly crenate in basal ⅓, broadly blunt-serrate in distal ⅓; base rounded on acroscopic side, broadly cuneate on basisopic side; lamina firm; each main lateral vein (which would be a costule in a lobed pinnule) forked alternately 3 or 4 times, the first fork at or very close to the costa. *Fertile pinnules* slightly smaller than sterile; *sori* 2–4 to a vein-group; no indusia. *Scales and hairs*: near base of costae on lower surface dark flat elongate scales with pale edges; distally on costae and on veins of sterile pinnules a few small dark bullate scales; no hairs on upper surface of costae.

Type specimen: DALLACHY, Rockingham Bay, Queensland (MEL; dupl. at K).

Distr. NE. Queensland, in *Malaysia*: Lesser Sunda Is (Flores, 3 collections).

Ecol. In Flores found at 1300–1700 m in forest; a tree fern with short trunk. In Queensland reported from sea level to 1400 m, locally abundant, a small tree-fern with trunk up to c. 3 m high, fronds to 2½ m long.

111. *Cyathea glabra* (BL.) COPEL. Philip. J. Sc. 4 (1909) Bot. 35; HOLTUM, Gard. Bull. S.S. 8 (1935) 316; Rev. Fl. Mal. 2 (1954) 127. —*Gymnosphaera glabra* BL. En. Pl. Jav. (1828) 242; COPEL. Gen. Fil. (1947) 98. —*Alsophila glabra* HOOK. Sp. Fil. 1 (1844) 51; METT. Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 52, p.p. (?); BEDD. Handb. (1883) 14, p.p.; RACIBORSKI, Fl. Btzg 1

(1898) 34, p.p. —*Alsophila vexans* CES. Atti Ac. Napol. 7, n. 8 (1876) 4. —*Alsophila dubia* BEDD. J. Bot. 25 (1883) 1, t. 279a; Handb. Suppl. (1892) 4; v. A. v. R. Handb. (1908) 31; Suppl. (1917) 489. —*Alsophila reducta* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 28 (1918) 1. —*C. reducta* DOMIN, Acta Bot. Bohem. 9 (1930) 153. —*C. vexans* C. CHR. Gard. Bull. S.S. 7 (1934) 218. —*Gymnosphaera vexans* COPEL. Gen. Fil. (1947) 98.

Trunk rather slender. *Stipe* very dark, base rough after scales have fallen; scales dark, shining, with fragile pale edges; rachis dark to purplish, smooth and glabrescent on lower surface. Lowest *pinnae* sometimes much reduced, especially on young lowland plants; largest *pinnae* commonly 45 cm long, to 55 cm. Largest *pinnules* 90–120 by 15–20 mm, lowest ones on stalks 2–4 mm long, base broadly rounded, apex short-acuminate, edges crenate (one crenature to each vein-group) to slightly lobed, in some cases lobed half-way to the costa; costules 4–5 mm apart; veins 3–5 pairs, usually all simple. *Sori* 1–3 (rarely 4) pairs, on each vein-group; no indusia; paraphyses slender, shorter than sporangia. *Scales and hairs*: scales on costae few, narrow, dark with pale edges which often bear a few dark setae, on costules similar but smaller, no bullate scales.

Type specimen: VAN HASSELT, Mt Karang, W. Java (L; fragment at K).

Distr. *Malaysia*: Sumatra, Malay Peninsula, Borneo, W. Java.

Ecol. In lowland swamp forest and in mountain forest to 1500 m.

Note. This species is very near *C. gigantea*, *C. subdubia* and *C. podophylla* (HOOK.) COPEL. In HOOKER's herbarium is a small fragment of true *C. glabra* from BLUME, with a good specimen of *C. gigantea*, also from Java, on the same sheet. Probably because of this, BEDDOME and others gave the name *C. glabra* to ferns from India and Ceylon which are *C. gigantea*, and when BEDDOME received the true *C. glabra* from the Malay Peninsula he re-named it *C. dubia*. *C. podophylla*, from Indo-China and S. China, has pinnules always almost entire and almost sessile, the basal basisopic vein usually from the costa, veins of adjacent groups often slightly anastomosing, and in well-grown specimens several pairs of *sori* to each vein-group. HOOKER published an excellent figure of *C. podophylla* (2nd Cent. Ferns, t. 66, 1861).

112. *Cyathea hornei* (BAK.) COPEL. Bull. Bern. P. Bish. Mus. 59 (1929) 38; Philip. J. Sc. 77 (1947) 119. —*Alsophila hornei* BAK. J. Bot. 17 (1879) 293. —*Alsophila dissitifolia* BAK. *ibid.* 24 (1886) 182. —*Alsophila brunnea* BRAUSE, Bot. Jahrb. 56 (1920) 73. —*Alsophila ledermannii* BRAUSE, l.c. 76. —*Alsophila olivacea* BRAUSE, l.c. 74. —*Alsophila melanocaulos* v. A. v. R. Nova Guinea 14 (1924) 1. —*C. dissitifolia* DOMIN, Pterid. (1929) 262. —*C. brunnea* DOMIN, Acta Bot. Bohem. 9 (1930) 101; COPEL. Philip. J. Sc. 77 (1947) 117, 119. —*C. dimorphophylla* DOMIN, Acta Bot. Bohem. 9 (1930) 111 (new name for *Alsophila ledermannii*); COPEL.

Philip. J. Sc. 77 (1947) 117.—*C. olivacea* DOMIN, Acta Bot. Bohem. 9 (1930) 143; COPEL. Philip. J. Sc. 77 (1947) 118, 119.—*C. melanoclada* DOMIN, Acta Bot. Bohem. 9 (1930) 174 (new name for *Alsophila melanocaulos*); COPEL. Philip. J. Sc. 77 (1947) 118.—*Gymnosphaera hornei* COPEL. Gen. Fil. (1947) 99.—*Gymnosphaera melanoclada* COPEL. l.c.

Trunk rather slender (4 cm \varnothing when dry), to 3 or 4 m tall; leaf-scars to 2 cm \varnothing . *Stipe* to 25 cm but often much shorter, very dark, the basal part covered with dark shining pale-edged scales to 15 by 2 mm; pneumathodes 7–13 mm long. Lower *pinnae* gradually reduced, lowest commonly 10 cm long, sometimes with lamina reduced to a narrow wing along veins and costa; largest *pinnae* 40–50 cm long (60 cm reported of *Alsophila olivacea*), sterile and fertile pinnules strongly dimorphous. Largest *sterile pinnules* to 100 by 25–30 mm wide near the base, the lower ones with stalks to 3 mm, basal 2–4 pairs of segments quite free, then several pairs separately adnate to costa; costules 5 mm apart; veins to 10 pairs, mostly forked, middle ones in free segments twice forked; lamina-segments strongly crenate or the larger free ones somewhat lobed. *Fertile pinnules* to 50–60 by 11–17 mm, with basal free segments as sterile; costules 3½–4 mm apart; veins usually fewer than in sterile pinnules, often forked; segments crenate, usually separated by rather wide sinuses; *sori* almost covering lower surface of fertile segments, ex-indusiate. *Scales and hairs*: pinna-rachis dark, glabrescent or bearing narrow dark pale-edged scales; scales near bases of costae elongate, dark, shining with pale edges, grading to light brown bullate scales distally and on costules; similar bullate scales also abundant on veins of sterile pinnules.

Type specimen: J. HORNE 620, Fiji (K).

Distr. Fiji, Louisiade Arch., in *Malaysia*: Eastern New Guinea.

Ecol. On the mainland of New Guinea at 850–2000 m, in forest; on the Louisiade islands at c. 700 m in stunted or mossy forest of ridge-crests. Small plants have pinnules almost sessile, even on the largest pinnae.

Note. This species is here broadly interpreted, but I cannot see any clear differences in characters of the larger pinnae which would warrant its subdivision. There are differences in the small basal pinnae, which in some cases have very narrow ultimate divisions, in others broad divisions, comparable with the difference between *C. ramispina* and *C. recommutata* in Borneo. Many specimens however lack these basal pinnae, and it is at present impossible to estimate whether the differences in basal pinnae are in any way correlated with differences in the larger pinnae.

113. *Cyathea dimorpha* (CHRIST) COPEL. Philip. J. Sc. 4 (1909) Bot. 34.—*Alsophila dimorpha* CHRIST, Ann. Jard. Bot. Btzg 19 (1904) 41; v. A. v. R. Handb. (1908) 36.

Stipe short. Lower *pinnae* gradually reduced, lowest less than 9 cm long; largest pinnae seen

30 cm long; fertile and sterile pinnules strongly dimorphous. *Sterile pinnules* to 65 by 20 mm, on stalks to 3 mm, near base lobed ¾ towards costa, for the most part lobed only ⅓ towards costa; costules 3½ mm apart; veins to 6 pairs, simple; lamina-segments very firm, almost truncate, slightly crenate. *Fertile pinnules* to c. 35 by 7 mm, with stalks to 2 mm, lobed to within 1 mm of costa; costules 2½ mm apart; veins to 4 pairs; *sori* without indusia, paraphyses short. *Scales and hairs*: on lower surface of costae narrow shining dark scales with pale edges, not setiferous, grading to brown bullate scales on costules and veins of sterile pinnules.

Type specimen: SARASIN 2031, Bohaa Mts Celebes (BAS; dupl. at P).

Distr. *Malaysia*: Central and SE. Celebes (2 collections).

Ecol. At 125–645 m in SE. Celebes, at 1500–1700 m in Central Celebes.

114. *Cyathea lurida* (BL.) COPEL. Philip. J. Sc. 4 (1901) Bot. 45.—*Chnoophora lurida* BL. En. Pl. Jav. (1828) 244.—*Alsophila lurida* HOOK. Sp. Fil. 1 (1844) 55; v. A. v. R. Handb. (1908) 44; Suppl. (1917) 70.—*Alsophila kingii* CLARKE in Bedd. Handb. (1883) 475; v. A. v. R. Handb. (1908) 36.—*Alsophila bakeri* ZEILLER, Bull. Soc. Bot. Fr. 32 (1885) 72.—*Alsophila melanorachis* COPEL. Philip. J. Sc. 2 (1907) Bot. 146; v. A. v. R. Handb. (1908) 791.—*C. melanorachis* COPEL. Philip. J. Sc. 4 (1909) Bot. 38.—*C. kingii* COPEL. l.c. 56; HOLTUM, Gard. Bull. S.S. 8 (1935) 315, pl. 36; Rev. Fl. Mal. 2 (1954) 126.—*C. subdimorpha* COPEL. Philip. J. Sc. 8 (1913) Bot. 140, pl. 2.—*Alsophila heterophylla* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 16 (1914) 2; Handb. Suppl. (1917) 60.—*Alsophila subdimorpha* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 16 (1914) 2.—*C. heterophylla* DOMIN, Pterid. (1929) 262.—*Gymnosphaera melanorachis* COPEL. Gen. Fil. (1947) 98; Fern Fl. Philip. 2 (1960) 234.—*Gymnosphaera kingii* COPEL. Gen. Fil. (1947) 99.—Fig. 21a–c.

Trunk short. *Stipe* long (no reduced basal pinnae), very dark, rough near base after fall of scales; scales to 10 by 1½ mm, dark with pale edges; pneumathodes rather widely spaced, 6–9 mm long. *Pinnae* commonly to 50 cm long, rarely to 75 cm; pinnules strongly dimorphous, with occasional intermediate conditions. Largest *sterile pinnules* 75–110 by 16–25 mm, on largest fronds with several free basal segments, on all fronds lobed almost to the costa; stalks of lower pinnules 3–5 mm; costules 3½–4½ mm apart; veins to 10 pairs, mostly forked; lamina-segments firm, in the larger pinnules strongly crenate. *Fertile pinnules* 60–90 by 6–12(–17) mm wide, on stalks to 3 mm, the largest with free segments at base; costules commonly 3 mm apart, on largest fronds occasionally to 6 mm, in the latter case the segments separated by wide sinuses; *sori* ex-indusiate, almost covering lower surface of segments; receptacle much elongate; paraphyses shorter than sporangia. *Scales and hairs*: near bases of costae on lower surface narrow dark

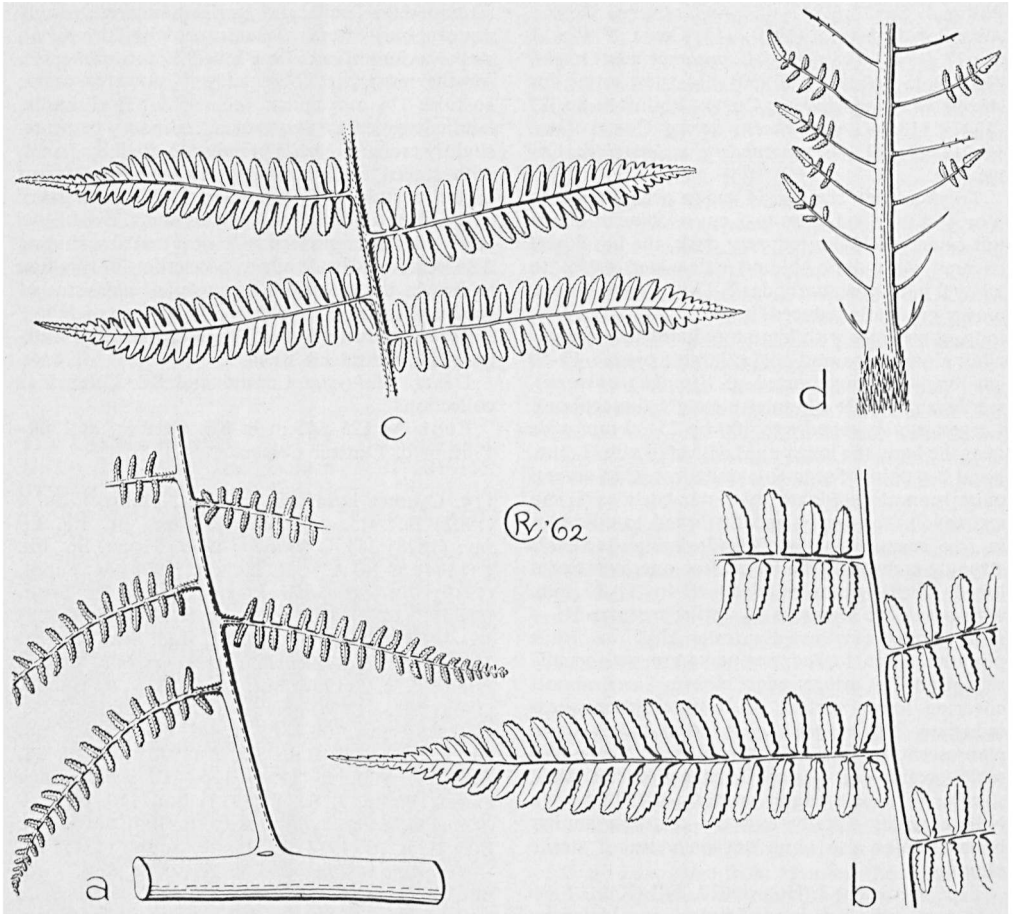


Fig. 21. *Cyathea lurida* (BL.) COPEL. *a.* Base of a fertile pinna, $\times \frac{2}{3}$, *b.* base of unusually large sterile pinna, $\times \frac{2}{3}$, *c.* normal form of sterile pinna, $\times \frac{2}{3}$.—*C. recommitata* COPEL. *d.* Base of frond, showing reduced pinnae, $\times \frac{1}{4}$ (*a-c* ERYL SMITH 833, *d* after HOLTUM, *Flora of Malaya* 2, fig. 50).

scales with pale edges sometimes bearing dark setae, grading to bullate scales on costules of sterile pinnules.

Type specimen: Java, herb. BLUME (L).

Distr. *Malaysia*: Sumatra, Malay Peninsula, W. Java, Philippines (Mindoro).

Ecol. In ridge forest (not in exposed places) at 1250–1800 m. In the Malay Peninsula especially abundant on a quartzite ridge at Fraser's Hill, but absent from forest on the neighbouring granite. On granite, it occurs only on the crests of steep ridges, often in moss-forest.

Note. The type of *Alsophila melanorachis* COPEL. from Mindoro agrees in all essential characters with *C. lurida* in Malaya. No specimens of *C. lurida* have been found in Borneo, so that there is a considerable gap in distribution.

115. *Cyathea rubella* HOLTUM, *Kew Bull.* 16 (1962) 61.

Trunk to 5 m; fronds many, to 200 cm long.

Stipe 12–20 cm, the base dark purple-brown when dry, paler upwards, throughout bearing scattered slender spines 2 mm long; scales abundant near base and throughout on each side of the band of hairs on upper surface, to 25 by hardly 2 mm, dark with narrow paler edges bearing many irregular setae; small irregular dull pale scales also scattered over surface of stipe. Lower pinnae gradually reduced, lowest 6–7 cm long; longest pinnae 45 cm long. Pinnules to 110 by 30 mm (more commonly narrower), the lowest stalked 2 mm, lobed throughout to 1–2 mm from costa (lowest 1–2 segments free only on largest pinnules), apex caudate-acuminate; costules $4\frac{1}{2}$ –6 mm apart (a little more widely spaced in sterile than in fertile pinnules); veins 8–10(–12) pairs, mostly forked, the basal basicopic vein attached well above base of costule; lamina-segments thin, somewhat tapering so that sinuses are triangular, edges crenate-serrate towards apex. Sori medial, at forks of veins or on one or both branches above the

fork in the case of basal veins; no indusia; paraphyses slender, shorter than sporangia. *Scales and hairs*: pinna-rachis reddish, paler distally, smooth apart from a few small spines, with scattered very small pale fringed scales; costae pale or somewhat suffused with red, sometimes with very small scales as pinna-rachis, larger scales sparse, flat, rather pale, apex setiform and sometimes one or more setae on the thin edges; costules bearing rather large pale bullate scales; no hairs on upper surface of costules.

Type specimen: HOOGLAND 4487, Papua, Northern District, Tufi Subdistrict (K; dupl. at BM, L, A).

Distr. *Malaysia*: East New Guinea and d'Entrecasteaux Is.

Ecol. At 650–900 m, 'common in fairly dense fairly low forest' (type); in rain-mossy forest transition in Normanby I. and in oak-rain forest transition in Goodenough I.

116. *Cyathea macgillivrayi* (BAK.) DOMIN, Pterid. (1929) 263; COPEL. Philip. J. Sc. 77 (1947) 109.—*Alsophila macgillivrayi* BAK. Syn. Fil. ed. 2 (1874) 458.—*C. gracillima* COPEL. Un. Cal. Publ. Bot. 18 (1942) 219; Philip. J. Sc. 77 (1947) 118, pl. 11.—*Gymnosphaera gracillima* COPEL. Gen. Fil. (1947) 99.

Trunk slender, to 4 m, often with bulbils growing from it or extra trunks at the base, bearing rather few fronds 100–150 cm long. *Stipe* usually 20–30 cm, in some cases only 10 cm, dark brown near base only, closely warty; scales to 15 by 1 mm, brown with narrow fragile edges. Lower *pinnae* gradually reduced, lowest 5 cm long when stipe is very short; longest *pinnae* to 40 cm. *Pinnules* commonly to 60 mm long, sometimes to 100 mm, fertile and sterile somewhat dimorphous (difference between them variable); *sterile pinnules* to 18 mm wide, costules 4–5 mm apart, veins 10 pairs, lamina-segments crenate with rounded apices, sinuses narrow; *fertile pinnules* 12–14 mm wide, costules about as in sterile pinnules but lamina-segments narrower so that sinuses are rather wide. *Sori* ± medial (at or sometimes above forks of veins, rarely on both branches of a vein), the distal ones sometimes nearer the costules; no indusium but sometimes 1 or 2 narrow scales on costular side at base of sorus; paraphyses about as long as sporangia. *Scales and hairs*: pinna-rachis pale, smooth, glabrescent, residual scales pale, largest with an occasional dark seta, smallest bearing long slender hairs, sometimes separate slender crisped hairs also present; on costae pale flat scales, elongate near base of costa, ovate and somewhat convex or bullate distally; on costules pale ovate convex or bullate.

Type specimen: MACGILLIVRAY, Louisiades (K).

Distr. *Malaysia*: New Guinea (except extreme west), Louisiade Archipelago.

Ecol. In forest, on the mainland on mountain ridges to 2000 m but apparently most abundant at lower elevations, on the islands mostly below 300 m, also on ridges, locally abundant.

Note. This species is on the border-line between

sect. Cyathea and *sect. Gymnosphaera*. It appears to be near *C. gregaria*, which differs in position of sori and in having dark crisped hairs and dark scales on costae.

117. *Cyathea acrostichoides* (v. A. v. R.) DOMIN, Acta Bot. Bohem. 9 (1930) 88.—*Alsophila acrostichoides* v. A. v. R. Bull. Jard. Bot. Btzig II, n. 28 (1918) 2.

Stipe slender, copiously spiny throughout, spines 1–2 mm; *rachis* similarly spiny near base, slightly rough near apex; no scales seen on stipe and rachis. *Frond* (excluding stipe) 90 cm long; lowest *pinnae* somewhat reduced and more widely spaced; longest *pinnae* 35 cm. *Pinnules* somewhat dimorphous; largest 50–75 mm long, sterile 14–18 mm wide, fertile 9–15 mm wide, almost sessile, lowest 1–2 segments free or nearly so (except on smaller fronds), rest lobed almost to costa, apex shortly acuminate; costules 3½–4½ mm apart; veins to 8 or 9 pairs, lower ones forked; lamina-segments crenate, or the lowest distinctly lobed, sterile separated by sinuses to 1 mm wide, fertile by sinuses to 2 mm wide (as wide as segments). *Sori* covering whole surface of segments of fertile pinnules; receptacle much raised and irregularly enlarged above the base; no indusium; paraphyses slender, shorter than sporangia. *Scales and hairs*: scales on costae flat, mostly ovate, medium brown, with some short marginal hairs; on costules smaller similar scales, more or less convex.

Type specimen: KORNASSI 541, Kaniki, Ceram (BO; dupl. at L).

Distr. *Malaysia*: Moluccas (Ceram), W. New Guinea (Japen I.).

Ecol. On Japen I. found at 650–1100 m, in forest, abundant, trunk 1–3 m tall; 'one community above a landslip which has opened the forest' (CHESMAN).

Note. Four collections from Japen Island agree well in size and all other characters with the type from Ceram. One of them includes a small frond, fully fertile, with largest pinna 12 cm and pinnules 22 mm long. Another collection (CHESMAN 1431, BM) consists of a much larger frond, with *pinnae* to 75 cm long, *pinnules* to 135 by 32 mm (all sterile), costules 5½ mm apart, veins to 14 pairs; it agrees with other specimens in shape of pinnules, in scales, and in spiny stipe.

118. *Cyathea schlechteri* (BRAUSE) DOMIN, Pterid. (1929) 263; COPEL. Philip. J. Sc. 77 (1947) 117, 119.—*Alsophila schlechteri* BRAUSE, Bot. Jahrb. 49 (1912) 15, f. 1D; v. A. v. R. Handb. Suppl. (1917) 61.—*Gymnosphaera schlechteri* COPEL. Gen. Fil. (1947) 99.

Stipe not known. *Pinnae* to 48 cm long. Sterile and fertile parts of *pinnules* strongly dimorphous (no completely sterile pinnules seen); largest pinnules 85 mm long (fertile in basal part, sterile distally), largest completely fertile pinnules 60 mm long; sterile part of pinnule 16 mm wide, lobed nearly to costa at the base, costules 4–4½ mm apart, veins 10 pairs, mostly forked; fertile part to 11 mm wide, fertile segments little over 2 mm

wide. *Sori* exindusiate, receptacle much raised. *Scales and hairs*: pinna-rachis smooth and glabrescent on lower surface, paler than main rachis; scales on costae sparse, the larger flat, ovate to elongate, pale with many long flexuous dark setae, also very small irregular pale scales; on costules setiferous scales as on costae but smaller, none bullate.

Type specimen: SCHLECHTER 17140, Kani Mts, E. New Guinea (B; dupl. at P, BM, UC).

Distr. *Malaysia*: East New Guinea (one collection).

Ecol. At 1000 m.

119. *Cyathea subdubia* (v. A. v. R.) DOMIN, Pterid. (1929) 263.—*Alsophila subdubia* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 20 (1915) 3; Handb. Suppl. (1917) 54.—*Alsophila persquamulata* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 28 (1918) 1.—*C. persquamulata* DOMIN, Acta Bot. Bohem. 9 (1930) 146.

Stipe dark, slightly warty near base after fall of scales; stipe and lower part of rachis persistently scaly on each side of the hairy median band of the upper surface; *scales* to 2 mm wide, median band dark and shining, edges pale, bearing irregular dark setae. *Pinnae* to 50 cm long, lower ones smaller. Largest *pinnules* 90–115 by 15–20 mm, almost sessile, lobed $\frac{1}{2}$ – $\frac{2}{3}$ towards costa, apex acuminate; costules 5–6 mm apart; veins 5–6 pairs, simple, lowest basicopic vein not from costa; lamina-segments rather thin, lobes broadly rounded and slightly crenate. *Sori* near costules, usually 3 pairs, exindusiate. *Scales and hairs*: on lower surfaces of pinna-rachis and costae smaller scales like those of main rachis (scales on costae 3 mm long); no scales seen on costules.

Type specimen: MATTHEW 672, Indrapura (G. Kerintji), Sumatra (BO; dupl. at K).

Distr. *Malaysia*: Central Sumatra, W. Java.

Ecol. At c. 1500 m.

120. *Cyathea gigantea* (WALL. ex HOOK.) HOLTUM, Gard. Bull. S. S. 8 (1935) 318; Rev. Fl. Mal. 2

(1954) 128.—*Alsophila gigantea* WALL. ex HOOK. Sp. Fil. 1 (1844) 53.—*Alsophila polycampa* KUNZE, Bot. Zeit. 4 (1846) 475.—*Alsophila helferiana* PRESL, Abh. K. Böhm. Ges. Wiss. V, 5 (1848) 341.—*Alsophila glabra* [non BL.] BEDD. Ferns S. India (1863) t. 60; Handb. (1883) 14; HOOK. & BAK. Syn. Fil. (1866) 43, p.p.; J. SCOTT, Trans. Linn. Soc. 30 (1874) 38; CLARKE, *ibid.* II, Bot. 1 (1880) 433; RACIBORSKI, Fl. Btzg 1 (1898) 34; v. A. v. R. Handb. (1908) 32.—*Alsophila umbrosa* WALL. ex RIDL. J. Mal. Br. R. As. Soc. 4 (1926) 6, p.p.

Stipe c. 50 cm, black or very dark, slightly rough after fall of scales; scales to 10 by $1\frac{1}{2}$ mm, dark brown, shining, with narrow pale fragile edges, not setiferous; very small dull brown scales also present; pneumathodes well-spaced, 7–15 mm long. *Pinnae* commonly to 45 cm long. Largest *pinnules* short-stalked, 80–110 by 15–20 mm, evenly narrowed to apex, edges lobed $\frac{1}{2}$ – $\frac{2}{3}$ towards costa; costules $4\frac{1}{2}$ –6 mm apart; veins 5 or 6 pairs, simple, basal basicopic vein of each group usually attached direct to costa; lamina-segments thin, tapering rather evenly from base so that sinuses are triangular, edges more or less strongly crenate. *Sori* exindusiate, those on basal veins widely separated from costule, on highest veins close to costule, so that each group forms an inverted V; paraphyses dark, attenuate from a thick base, shorter than sporangia. *Scales and hairs*: pinna-rachis dark purplish, smooth and glabrescent or with residual small scales like those on the stipe; scales near bases of costae firm, dark, elongate, brown with paler edges, apex setiform but no marginal setae; distally and on costules similar smaller and paler scales, none bullate.

Type specimen: WALLICH 321, Nepal, Sylhet (K).

Distr. Ceylon and S. India, NE. India southwards to Burma, Siam, Indochina; in *Malaysia*: Central Sumatra, N. part of Malay Peninsula, and W. Java.

Ecol. In rather open places from low elevation to c. 600 m.

Subgenus *Sphaeropteris*

(BERNH.) HOLTUM, *stat. nov.*—*Sphaeropteris* BERNH. in Schrader, J. Bot. 1800, ii (1801) 122.

Type species: *Cyathea medullaris* (FORST.) SW.

Distr. Throughout Asia, Malaysia, Australasia and Polynesia. A few tropical American species have similar scales and possibly should be included in the subgenus, e.g. *C. crassipes* SOD., *C. insignis* EATON, *C. princeps* (LINDEN) MEYER, and *C. brunei* CHRIST.

Taxon. The distinction between *sect. Sphaeropteris* and *sect. Schizocaena* is on the whole quite sharp, but there are small species of *sect. Schizocaena* in Borneo which have deeply divided pinnules which, if larger, would be very like *sect. Sphaeropteris*.

3. Section *Sphaeropteris*

Distr. Throughout the whole range of the subgenus.—Fig. 1, 3, 4, 6, 17, 22–27.

Taxon. The division into two subsections is quite sharp, *subsect. Fourniera* being distinct in having a combination of the following characters: sori lacking indusia but covered with scales like other scales on lower surface of pinnules, and fronds fully tripinnate. Several exindusiate species of *subsect. Sphaeropteris*, however, have narrow scales spreading round the base of the receptacle of a sorus, so that the distinction on this character alone is not absolute.

3a. Subsection *Sphaeropteris*

Distr. Throughout the range of the subgenus.—Fig. 1, 3, 4, 6, 17, 22–26.

Taxon. The species of this subsection in New Guinea are difficult to characterize clearly. Sterile pinnules show the characteristic scales better than fertile ones, and are not always present on herbarium specimens. The distribution of stout pale hairs on the lower surface of pinnules is usually a distinctive character. Most species are exindusiate.

Ecol. Mostly large tree-ferns which early become established in secondary growth and will tolerate full exposure of their fronds, notably *C. contaminans* (WALL.) COPEL. (fig. 22) which is the most widely distributed *Cyathea* in Malaysia.



Fig. 22. *Cyathea contaminans* (WALL.) COPEL. in secondary growth on abandoned tea plantations, Tjibodas, with trees of *Trema amboinensis* and undergrowth of *Eupatorium inulifolium* giving ground cover (W. M. DOCTERS VAN LEEUWEN).

KEY TO THE SPECIES

1. Indusium present.
 2. Stipe bearing many bristles 10–20 mm long, spreading at right angles, surface of bristles covered with dark setae.
 3. Slender hairs 1 mm long abundant on costae, costules and veins beneath **121. *C. pulcherrima***
 3. Such hairs lacking; at most much shorter hairs present towards apices of pinnules. **122. *C. procera***
 2. Stipe lacking such bristles.
 4. Largest pinnules 90–120 by 16–20 mm; costae not densely scaly; no bullate scales on costae and costules **123. *C. leucotricha***
 4. Largest pinnules 50 by 10 mm; costae densely scaly; bullate scales present on costules. **124. *C. strigosa***
1. Indusium lacking.
 5. Scales of stipe-base to 50 mm or more long, shining medium brown, rigid, edges bearing sparse rather long concolorous setae. Lamina very rigid, edges strongly reflexed and inrolled.

6. Pinnules to 30 mm long. Scales on stipe-base 2 mm wide; pinna-rachis rather persistently covered with a felt of small pale fringed scales; scales on costules bearing pale crisped marginal hairs. 125. *C. tomentosissima*
6. Pinnules 45–80 mm long. Scales on stipe-base 3–5 mm wide; pinna-rachis not persistently or densely so covered; scales on costules often bearing long dark setae.
7. Stipe bearing many dark shining spines 3–6 mm long. Pinnules to 80 mm long. 126. *C. atrox*
7. Stipe lacking spines. Pinnules commonly to 45 mm long 126. *C. atrox* var. *inermis*
5. Scales on stipe-base mostly shorter, often not rigid and pale, edges mostly bearing close dark setae. Edges of lamina rarely much reflexed and then not inrolled.
8. Upper part of stipe and all rachises finely and very closely warty; bullate scales always present on costules.
9. Long pale hairs normally lacking on lower surface of costae and costules, present on upper surface of costules; no setiferous scales on costae 127. *C. sangirensis*
9. Long pale hairs always rather abundant distally on lower surface of costae and costules, lacking or very few on upper surface of costules; setiferous scales present at least near base of costae.
10. Veins commonly 15 pairs; setiferous scales on costae of lower pinnules only. 128. *C. lunulata*
10. Veins 9–12 pairs; setiferous scales always abundant on costae 129. *C. elmeri*
8. Upper part of stipe and rachises thorny or conspicuously warty, warts not very fine and close; bullate scales present or not.
11. Scales on costules abundant, copiously fringed with long crisped hairs which become entangled and form a woolly covering.
12. Scales on costules not setiferous; lamina-segments much curved forwards when dry; hairs on upper surface of pinna-rachis pale 130. *C. tomentosa*
12. Scales at bases of costules bearing many long dark setae; lamina-segments spreading at right angles to costa; hairs on upper surface of pinna-rachis dark 131. *C. magna*
11. Scales on costules not thus fringed.
13. Bullate scales present on lower surface of costae and or costules.
14. Bullate scales present on lower surface of veins.
15. Copious long hairs also on lower surface of veins 132. *C. pilulifera*
15. Long hairs lacking on lower surface of veins, or only at vein-tips.
16. Pinna-rachis closely warty, warts dark; pinnules to 13 mm wide. Luzon. 133. *C. curranii*
16. Pinna-rachis sparsely thorny or warty; pinnules 15–25 mm wide. New Guinea. 134. *C. aeneifolia*
14. Bullate scales lacking on lower surface of veins.
17. Stipe conspicuously spiny; pale hairs on lower surface of costae few or lacking. 135. *C. tenggerensis*
17. Stipe warty; pale hairs abundant on lower surface of distal half of costae and on costules.
18. Costae copiously scaly throughout, with small pale-fringed scales as well as elongate setiferous ones; bullate scales not setiferous 136. *C. persquamulifera*
18. Costae rather sparsely scaly, small pale-fringed scales lacking; bullate scales on costules setiferous 137. *C. sarasinorum*
13. Bullate scales lacking on lower surface of costae and costules.
19. Pale erect hairs abundant on lower surface of veins.
20. Costae bearing many much-setiferous scales; pinnules to 20 mm wide.
21. Veins flat or impressed beneath; costular scales with long brown setae. 138. *C. angiensis*
21. Veins much raised beneath; costular scales with short dark setae . . . 139. *C. verrucosa*
20. Costae bearing very few scales; pinnules commonly 20–30 mm wide. 140. *C. contaminans*
19. Pale erect hairs absent or rare (near apices of segments) on lower surface of veins.
22. Stipe-scales pale, 40–50 mm long, 4–5 mm wide at base, distal half very narrow; costular scales broad, pale, flat, short-setiferous or short-fringed 141. *C. lepifera*
22. Stipe-scales otherwise; costular scales (if present) narrower, bearing long setae.
23. Setiferous scales abundant on costae; small scales present on lower surface of veins; no stout hairs on lower surface of costae.
24. Stipe-scales 5 mm wide. Pinnules to 25 mm wide. Veins 13–15 pairs. 142. *C. atrospinosa*
24. Stipe-scales 2 mm wide. Pinnules to 35 mm wide. Veins to 20 pairs. . . 143. *C. fugax*
23. Setiferous scales lacking or rare on lower surface of costae of mature fronds; no scales on lower surface of veins; stout pale hairs present near apices on lower surface of costae. 140. *C. contaminans*
121. *Cyathea pulcherrima* COPEL. Un. Cal. Publ. Bot. 18 (1942) 219; Philip. J. Sc. 77 (1947) 119, pl. 12.
- Trunk to 10 m, 3–5 cm \varnothing below completely caducous fronds; leaf-scars 1½ cm \varnothing . Stipe 60–100 cm, covered closely with rigid spreading dark brown bristles 2 cm long, their surfaces covered with short dark setae, some bristles flat at apex and bearing marginal setae; lower surface of rachis bearing similar shorter bristles mixed

with stout spreading reddish to pale hairs; similar hairs on lower surface of pinna-rachis. *Lamina* 100–190 cm long; longest pinnae 55–70 cm long. *Pinnules* to 100 by 20–24 mm, lobed to a narrow wing between the segments which are separated by wide sinuses; at least half the segments constricted on acroscopic side at base; costules 4–4½ mm apart; lamina thin, the fertile segments deeply crenate or more usually lobed ¾ towards the costule, each lobule with 2 or 3 teeth; veins to 8 pairs, forked once or twice. *Sori* one to each lobe, indusiate; indusium thin, translucent, covering the young sorus, breaking irregularly and persistent; paraphyses as long as sporangia. Pale slender spreading hairs 1 mm long abundant on both surfaces of costae, costules and veins; *scales* on lower surface of costae near base small, flat with copious dark marginal setae, most scales on costae pale and bullate at base, dark-setose towards apex (some setae are superficial), these grading to pale bullate hair-pointed scales distally and on costules.

Type specimen: BRASS 8940, east slopes of Cyclops Mts, 575 m, W. New Guinea (UC; dupl. at K, BM).

Distr. *Malaysia*: New Guinea, both west and east, and Admiralty Is.

Ecol. In forest, 100–1100 m.

122. *Cyathea procera* BRAUSE, Bot. Jahrb. 56 (1920) 50; COPEL. Philip. J. Sc. 77 (1947) 104.—Fig. 23.

Trunk up to 20 m (PULLE), bearing fronds in whorls of 6; fronds 250–350 cm long. *Stipe* densely covered with spreading bristles as in *C. pulcherrima* but these sometimes pale above the base; bristles in the adaxial groove at base of stipe flattened from near the base to form flat dark scales ½ mm wide with setiferous margins; very small strongly setiferous scales also on surface of stipe between bristles; upper part of stipe pale, copiously warty from bases of abraded bristles. *Rachis* finely warty on lower surface, glabrescent except for some very small scales. *Pinnae* to 65 cm long. Largest *pinnules* 85–120 by 18–23 mm wide, shape and sori as in *C. pulcherrima*. *Pinna-rachis* beneath as main rachis, upper surface bearing narrow pale dark-setiferous scales to 5 mm long with the usual antrorse hairs; *costae* beneath copiously scaly, scales small, basal ones entirely dark and shining with setae on edges, grading to distal ones and those on costules which are pale and bullate at base, apex with dark setae, or the smallest (these sometimes also on veins) with a pale fringe of fine hairs; in some cases thick pale hairs distally on lower surface of costae and costules.

Type specimen: LEDERMANN 11856, Sepik Region, 2070 m, NE. New Guinea (B).

Distr. *Malaysia*: New Guinea.

Ecol. In forest, at 1800–2400 m. PULLE noted on Mt Hellwig that this was the largest tree-fern he had seen. *C. procera* is the high-mountain counterpart of *C. pulcherrima*.

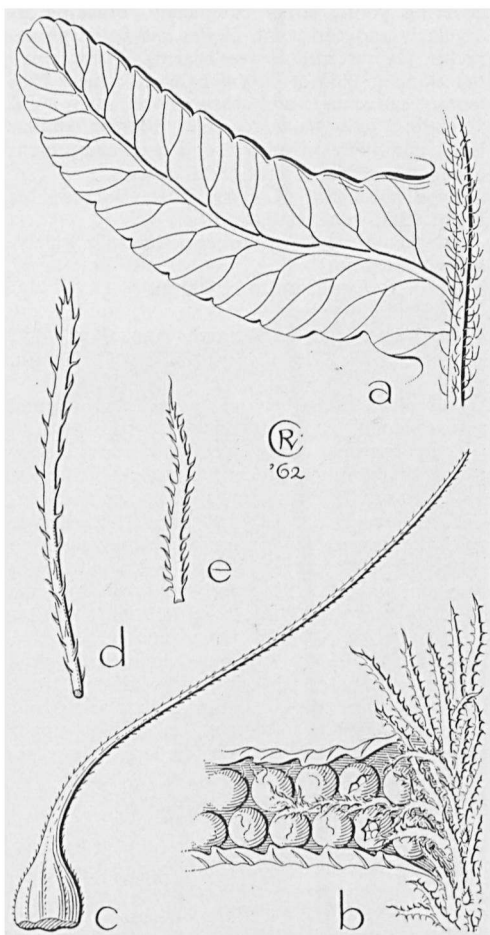


Fig. 23. *Cyathea procera* BRAUSE. a. Segment of a pinnule, upper surface, $\times 6$, b. part of costa and fertile segment, showing scales and sori, $\times 6$, c. spine from base of stipe, $\times 4$, d. flattened tip of stipe-spine, $\times 13$, e. scale from pinna-rachis, $\times 13$ (HOOGLAND & PULLEN 5502).

123. *Cyathea leucotricha* CHRIST, Ann. Jard. Bot. Btzg 20 (1905) 135; v. A. v. R. Handb. (1908) 18.—*Alsophila cyclodonta* CHRIST, Ann. Jard. Bot. Btzg 20 (1905) 137.—*C. cyclodonta* v. A. v. R. Bull. Dép. Agr. Ind. Néerl. n. 18 (1908) 1; Handb. (1908) 19.

Stipe 50 cm, minutely warty; scales mostly caducous, dark brown with concolorous marginal setae. *Pinnae*: lowest hardly reduced, longest 60 cm. *Pinnules*: largest 90–120 by 16–20 mm, sessile or nearly so, apex acuminate, 1–3 basal segments free or nearly so (lowest may be stalked), next one or more pairs of segments contracted at base on acroscopic side, rest of pinnule lobed nearly to costa; costules 4–5 mm apart; veins 10–12 pairs; segments firm, edges crenate. *Sori* nearer costule than edge, indusiate; indusium pale and thin,

covering young sorus completely, breaking irregularly and persistent. *Scales and hairs*: pinna-rachis glabrescent; costae bearing a few small flat elongate dark-setiferous pale scales near base (some caducous) and throughout many stiff spreading pale hairs; costules bearing similar hairs, and a few on veins also; a few hairs present on upper surface of costules and veins.

Type specimen: HALLIER 2302, Borneo, Mt Klam (BO; dupl. at P, L, S).

Distr. *Malaysia*: Borneo (several widely-spaced localities).

Ecol. In forest, up to c. 700 m.

124. *Cyathea strigosa* CHRIST, Ann. Jard. Bot. Btzg 15 (1898) 84, t. 13, f. 6; v. A. v. R. Handb. (1908) 24.

Stipe 45 cm long, bearing spines 3 mm long and pale setiferous scales; main *rachis* pale beneath with many spines under 1 mm long, scales mostly caducous. *Pinnae* to 20 cm long. *Pinnules*: largest 50 by 10 mm, lobed nearly to costa, sessile; costules 3 mm apart; veins 8-9 pairs. *Sori* near costules, indusiate; indusium pale, at first covering sorus, breaking irregularly and persistent. *Scales and hairs*: pinna-rachis sparsely warty, glabrescent; costae densely scaly beneath, scales mostly bullate-acuminate, pale-fringed near apex which is a long hair, grading to long pale hairs distally, near base also some narrow pale dark-setiferous scales; costules bearing similar bullate scales and hairs; no hairs on lower surface of veins; upper surface of costules bearing a few long pale hairs.

Type specimen: WARBURG 16793, summit of Mt Wawo-Karaeng (= Bonthain), 2800 m, SW. Celebes (P?; dupl. at B).

Distr. *Malaysia*: SW. Celebes (one collection).

Note. Described from duplicate specimen at Berlin, which is sterile. This species appears to be most nearly related to *C. leucotricha* of the lowlands of Borneo.

125. *Cyathea tomentosissima* COPEL. Un. Cal. Publ. Bot. 18 (1942) 219; Philip. J. Sc. 77 (1948) 123, p. 15.

Trunk to 2½ m, 16 cm ø, bearing up to 40 fronds 60-105 cm long. *Stipe* 20-30 cm, when dry light red-brown and warty after fall of scales, base densely covered with shining firm twisted brown scales to 50 by 2 mm, edges bearing irregular concolorous short setae; above the base more or less densely covered with small scales as rachis. *Rachis* covered beneath with a close felt of very small pale scales which have flexuous marginal hairs, also with larger scales: (a) elongate flat pale scales to 1 mm wide having many brown setae near apices and often pale hairs near bases, (b) very narrow pale thin flexuous scales with slender marginal hairs; all scales more or less caducous with age. Longest *pinnae* 10-16 cm. Longest *pinnules* 30 by 8 mm, lobed almost or quite to costa; costules 2 mm apart, veins 6-7 pairs; lamina-segments very rigid, their edges much reflexed and inrolled, entire or slightly crenate. *Sori* filling cavity of lower surface of a

segment; no indusium. *Scales and hairs*: lower surface of pinna-rachis and costae as main rachis but the flat scales smaller or lacking; on costules small brown bullate scales with long crisped marginal hairs; hairs on upper surface of costae pale, with a few on costules.

Type specimen: BRASS 9116, Lake Habbema, West Central New Guinea (A; dupl. at MICH, BO, L, UC).

Distr. *Malaysia*: New Guinea.

Ecol. At 3225 m, 'along streams of open grassland, in drier shrubberies, never in forest' (BRASS).

Note. This appears to be distinct in its narrow stipe-scales and small size of frond; also in the close felt of small woolly scales on lower surfaces of all rachises, though this is more or less caducous. In other characters not clearly distinguishable from *C. atrox* var. *inermis*.

126. *Cyathea atrox* C. CHR. Brittonia 2 (1937) 275; COPEL. Philip. J. Sc. 77 (1947) 115.— Fig. 1, 17, 24, 25.

var. *atrox*.

Trunk to 6 or 7 m, bearing 20-30 fronds 125-175 cm long. *Stipe* 30-50 cm, spiny, spines dark, shining, 3-5 mm; scales near base of stipe to 50 by 3-6 mm, shining brown, firm but not very rigid, edges bearing irregular concolorous or pale hairs or setae; distal part of stipe glabrescent, light brown when dry, warty and thorny. Lower *pinnae* slightly reduced; longest 30-45 cm. Largest *pinnules* commonly 65-80 by 13-15 mm, exceptionally to 100 by 20 mm, almost all segments separately adnate to costa (a few only on pinnules of upper pinnae) and constricted at base, 1-2 basal ones quite free; costules commonly 3 mm apart, on largest fronds to 4 mm; veins 8-10(-12) pairs, pale and raised on lower surface; lamina-segments rigid, edges reflexed and more or less inrolled, on distal segments entire, on largest ones rather deeply crenate, the basal free segments often deeply lobed. *Sori* nearer to costules than edge; no indusium; paraphyses short. *Scales and hairs*: pinna-rachis rather pale, warty, glabrescent, bearing residual scales as stipe but smaller; on lower surface of costae some elongate flat brown scales with dark marginal setae (these mostly caducous) and very small pale scales bearing long pale or dark marginal hairs; on costules many small brown bullate scales bearing crisped pale or dark marginal hairs; similar scales sometimes on lower surface of veins.

Type specimen: BRASS 4596, Murray Pass, Wharton Range, Papua (A; dupl. at BM, BO, BRI).

Distr. *Malaysia*: E. New Guinea.

Ecol. On edges of forest or in grassland, 2800-3600 m.

Notes. Most collections are reported as having many fronds, but two as having fronds in distinct age-groups, 6 or 7 (in a whorl) in each age-group. One of these (HOOGLAND & SCHODDE 7165) is unusually large, with pinnules 100 mm long.

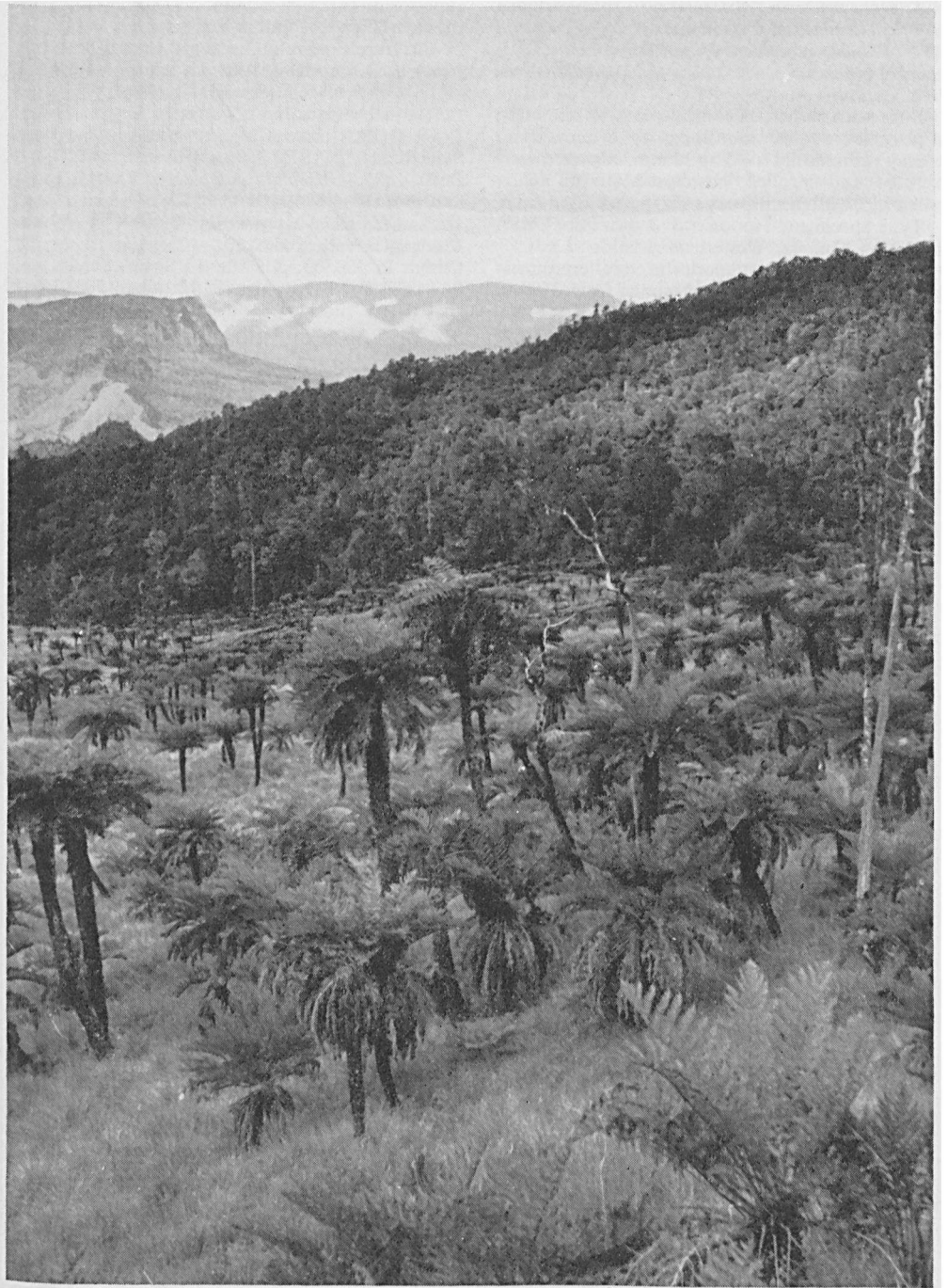


Fig. 24. *Cyathea atrox* C. CHR. var. *inermis* HOLTUM in peaty grassland, Eastern Highlands, Territory of New Guinea, 3000 m (R. D. HOOGLAND).

var. *inermis* HOLTUM, var. nov.—Fig. 24, 25.

Stipes verrucosus, vix spinosus; paleae stipitis 6–10 cm longae, ad 6 mm latae; pinnulae vulgo ad 45 × 12 mm; costulae 2½ mm inter se distantes; rhaches pinnarum subtus paleis minutis ciliatis pallidis vestitae.

Stipe with numerous conical warts ½ mm high; stipe-scales 60–100 mm long, to 6 mm wide; pinnules commonly to 45 by 12 mm, edges strongly reflexed and inrolled, costules 2½ mm apart; pinna-rachis often with very small pale fringed scale.

Type specimen: HOOGLAND & SCHODDE 7457, NE. New Guinea, Western Highlands (L).

Ecol. "Commonest species in tree-fern grassland", at 2600–2900 m. A specimen from 3500 m

(BRASS 31013) has darker, more rigid, twisted stipe-scales to 60 mm long.

Note. Two collections are reported as bearing 22–30 fronds spirally arranged, one (SCHODDE 1762) as having fronds in two whorls of 6 or 7.

127. *Cyathea sangirensis* (CHRIST) COPEL. Philip. J. Sc. 4 (1909) Bot. 37.—*Alsophila concinna* BAK. Syn. Fil. ed. 2 (1874) 459, non *C. concinna* (BAK.) JENM. 1891.—*Alsophila polyphlebia* BAK. J. Linn. Soc. Bot. 15 (1876) 104, non *C. polyphlebia* BAK. 1883.—*Alsophila sangirensis* CHRIST in Warb. Monsunia 1 (1900) 90.—*Alsophila scaberula* CHRIST in K. Sch. & Laut. Fl. Deut. Schutzgeb. Südsee (1901) 110; v. A. v R. Handb. (1908) 35.—

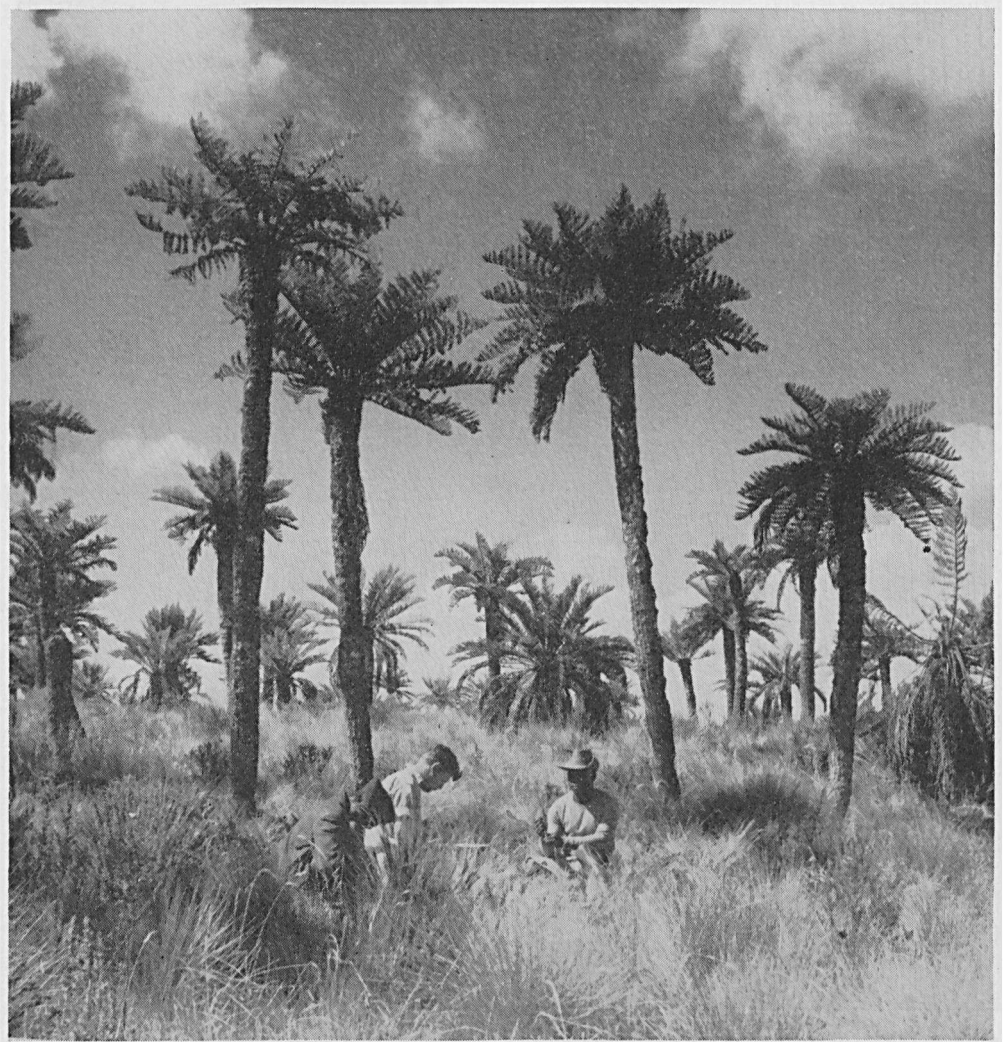


Fig. 25. *Cyathea atrox* C. CHR. var. *inermis* HOLTUM on the Sugarloaf complex, Western Highlands (R. D. HOOGLAND).

C. scabriseta COPEL. Philip. J. Sc. 9 (1914) Bot. 2; *ibid.* 77 (1947) 111.—*Alsophila okiana* v. A. v. R. Bull. Jard. Bot. Btzig II, n. 23 (1916) 4; Handb. Suppl. (1917) 494.—*Alsophila rumphiana* v. A. v. R. Philip. J. Sc. 11 (1916) Bot. 104; Handb. Suppl. (1917) 491.—*Alsophila scabriseta* v. A. v. R. Handb. Suppl. (1917) 73.—*C. rumphiana* MERR. Interpr. Rumph. Herb. Amb. (1917) 63.—*Alsophila buruensis* ROSENST. Med. Rijksherb. n. 31 (1917) 1.—*C. okiana* v. A. v. R. Bull. Jard. Bot. Btzig II, n. 28 (1918) 14.—*Alsophila scaberulipes* v. A. v. R. Nova Guinea 14 (1924) 2.—*C. eminens* DOMIN, Pterid. (1929) 262 (new name for *Alsophila concinna* BAK.); COPEL. Philip. J. Sc. 77 (1947) 116.—*C. aruensis* DOMIN, Pterid. (1929) 262 (new name for *Alsophila polyphlebia* BAK.); COPEL. Philip. J. Sc. 77 (1947) 115.—*C. scaberula* DOMIN, Pterid. (1929) 263; COPEL. Philip. J. Sc. 77 (1947) 109.—*C. brassii* COPEL. J. Agr. Arb. 10 (1929) 175; Philip. J. Sc. 77 (1947) 111.—*C. buruensis* DOMIN, Acta Bot. Bohem. 9 (1930) 102.—*C. scaberulipes* DOMIN, l.c. 174.

Trunk stout, to at least 8 m. *Stipe* long (apparently to 100 cm), pale, finely warty, persistently scaly near base; scales pale, thin but firm, finely acuminate, to c. 30 by 2 mm, edges closely set with dark setae. *Lamina* to 300 cm or more long. *Main rachis* beneath pale and finely warty, sometimes with residual spreading very narrow setiferous scales or hairs. *Pinnae*: largest about 75 cm long, lowest not greatly reduced. *Pinnules*: largest 120 by 25 mm, sessile, lowest 1 or 2 segments usually free, rest of pinnule lobed almost to costa; costules 4–4½ mm apart; veins commonly 15 pairs in largest segments; segments of lamina thin, strongly crenate (the largest crenae, where a vein is forked, slightly notched). *Sori* rather near costules; no indusium; paraphyses slender, dark at base and pale distally, a little longer than sporangia; a ring of very narrow ciliate pale scales round base of sorus. *Scales and hairs*: pinna-rachis minutely warty, glabrescent or with very small pale scales which do not bear setae; costal scales small, pale, appressed, more or less elongate, bearing pale short marginal hairs; costular scales pale bullate; a few stout pale hairs rarely present near apices of costae and costules on lower surface, these normally lacking; upper surface of costules and veins bearing scattered stout pale hairs, and similar hairs on edges of segments at apices of some veins (these latter early caducous).

Type specimen: WARBURG 16605, Sangir (= Sangahe) I. (P?; dupl. at B).

Distr. *Malaysia*: Moluccas (Sangihe I. (NE of Celebes), Buru, Ambon, Aru Is), throughout New Guinea, and Louisiades (Sudest I.).

Ecol. A large lowland tree-fern, in secondary growth and in open places in forest; often near rivers. In Sudest I. common at junction of rain-forest with mangrove (BRASS).

Note. MERRILL (*l.c.*) has suggested that *Palmifilix alba* RUMPH. (Herb. Amb. 6, 63) is to be regarded as representing this species, but the data given by RUMPHIUS are not adequate for a certain identification.

128. *Cyathea lunulata* (FORST.) COPEL. Bull. Bern. P. Bish. Mus. 59 (1929) 37; C. CHR. *ibid.* 177 (1943) 29.—*Polypodium lunulatum* FORST. Prod. (1786) 83, n. 456.—*Alsophila lunulata* R. BR. Prod. (1810) 158; HOOK. Sp. Fil 1 (1844) 51; Syn. Fil. (1868) 41, p.p.; CARR. in Seem. Fl. Vit. (1873) 333.—*Alsophila vitiensis* CARR. in Seem. Fl. Vit. (1873) 170.—*Alsophila naumannii* KUHN, Forschungsr. Gazelle 4 (1889) Farne 13; v. A. v. R. Handb. Suppl. (1917) 59.—*C. naumannii* DOMIN, Pterid. (1929) 263.—*C. vitiensis* DOMIN, Acta Bot. Bohem. 9 (1930) 170.

Stipe smooth or finely warty; scales to 30 by 1½ mm, pale, thin, with a few dark marginal setae. *Pinnules* to at least 120 by 20 mm; costules 3½–4½ mm apart; segments of lamina distinctly crenate-serrate; veins to 15 pairs. *Sori* exindusiate; paraphyses shorter than sporangia, usually dark when dry. *Scales and hairs*: pinna-rachis pale, beneath smooth or slightly prickly, quite glabrescent; costae bearing stout pale hairs distally on lower surface, scales mostly deciduous except a few very small ones; costules bearing similar hairs and also scales which are bullate and more or less fringed, or on lower pinnules may be setiferous; minute hairs sometimes visible on lower surface of veins; hairs on upper surface of costules rare.

Type specimen: FORSTER, Pacific (Göttingen; dupl. at BM).

Distr. Solomon Is, New Hebrides, Tonga, Fiji Samoa, in *Malaysia*: Bismarck Arch.

Ecol. Apparently a large tree-fern of low country.

Note. The type specimen is labelled "In Societatis Ins.?" but a distribution extending to Tahiti seems improbable.

129. *Cyathea elmeri* COPEL. Philip. J. Sc. 4 (1909) Bot. 54; Fern Fl. Philip. 2 (1960) 233.—*Alsophila comosa* (non WALL.) CHRIST, Ann. Jard. Bot. Btzig 15 (1898) 80.—*Alsophila latebrosa* (non WALL.) var. *major* CHRIST, Philip. J. Sc. 2 (1907) Bot. 183.—*Alsophila elmeri* COPEL. in Elmer, Leaf. Philip. Bot. 2 (1908) 419; v. A. v. R. Handb. Suppl. (1917) 66.—*Alsophila christii* v. A. v. R. Handb. (1908) 42 (non Sod. 1908); Suppl. (1917) 69, 70.—*C. dimorphotricha* COPEL. in Elmer, Leaf. Philip. Bot. 5 (1913) 1681; Fern Fl. Philip. 2 (1960) 230.—*Alsophila subcomosa* C. CHR. Ind. Fil. Suppl. 1 (1913) 5.—*Alsophila dimorphotricha* v. A. v. R. Handb. Suppl. (1917) 61.—*C. subcomosa* DOMIN, Pterid. (1929) 263.—*Alsophila fenicis* [non (COPEL.) C. CHR.] POSTH. in Holthuis & Lam, Blumea 5 (1942) 153, p.p.—*C. argyrolepis* COPEL. Philip. J. Sc. 81 (1952) 17; Fern Fl. Philip. 2 (1960) 227.

Stipe 30 cm or more, the base densely scaly, closely warty when scales have fallen; scales 25 by 1½ mm, medium brown, thin but firm, shining, acuminate, edges throughout closely set with short concolorous setae. *Main rachis*, lower surface, pale, closely warty, glabrescent. *Pinnae* to at least 60 cm long. *Pinnules* 90–130 by 13–25 mm, sessile, lowest 2 segments of the largest free,

next few segments separately adnate to costa, rest (whole of smaller pinnules) lobed nearly to costa; costules 3—4½ mm apart; veins 9—12 pairs; lamina-segments rather thin, strongly crenate-serrate, sinuses narrow. *Sori* near costules; no indusium; paraphyses dark, not usually longer than sporangia. *Scales and hairs*: pinna-rachis beneath pale, finely warty, glabrescent, the smallest residual scales pale with a short pale fringe, larger ones with setiferous edges; on costae near base narrow scales with long dark marginal setae, on distal half more or less abundant stout pale spreading hairs; on costules bullate-based broad scales, the larger bearing dark setae near apex, the distal ones wholly bullate and lacking setae; hairs also more or less abundant on costules; on upper surface of costules no hairs, or in some cases a few.

Type specimen: ELMER 9457, Cuernos Mts, Negros (MICH; dupl. at US, BO, F, K, P, L, U, SYD).

Distr. *Malaysia*: Philippines (Mindanao, Leyte, Negros, Biliran), Talaud Is, and N. Celebes.

Ecol. In forest at 500—1400 m.

Notes. The specimen from Talaud Is (LAM 3319), listed as *Alsophila fenicis* by HOLTHUIS & LAM, appears to lack hairs on lower surface of costae, but its setiferous scales are like those of *C. elmeri*, not of *C. sangirensis*.

The type specimen of *C. argyrolepis*, from an exposed place on Camiguin de Mindanao, has small pinnules (to 90 by 11 mm) and is more scaly than normal.

C. haenkei (PR.) MERR. from Guam is very nearly allied.

130. *Cyathea tomentosa* (BL.) ZOLL. & MOR. in Moritz, Syst. Verz. (1846) 108.—*Chnoophora tomentosa* BL. En Pl. Jav. (1828) 244.—*Chnoophora lanuginosa* JUNGH. Tijds. Nat. Gesch. & Physiol. 8 (1841) 372; Flora 30 (1847) 522.—*Alsophila tomentosa* HOOK. Sp. Fil. 1 (1844) 55; RACIB. Fl. Btzig 1 (1898) 32; v. A. v. R. Handb. (1908) 43; Suppl. (1917) 493; BACKER & POSTH. Varenfl. Java (1939) 30.—*Alsophila lanuginosa* PR. Epim. Bot. (1851) 29.—*Alsophila crinita* (non HOOK.) v. A. v. R. Handb. (1908) 40.

Trunk to 15 m, older parts showing leaf-scars 4—4½ cm ø. *Stipe* to at least 50 cm, densely scaly throughout, spines short; scales on stipe light brown, shining, firm, 30—45 by 1—3 mm, edges bearing close dark setae throughout. *Lamina* to 250 cm long; main rachis rather closely warty with more or less persistent smaller scales. *Pinnae*: largest to 70 cm or more long. *Pinnules* to 110 by 20 mm, of plants in exposed places sometimes only 60 by 10 mm wide; basal 1 or 2 segments of lowest pinnules quite free, then 1—2 pairs separately adnate to costa, rest of pinnule lobed almost to costa, apex acuminate; costules 3—4 mm apart; veins 10—12 pairs; lamina-segments very firm, edges usually reflexed when dry, crenate. *Sori* nearer costule than edge; no indusium; paraphyses slender, not longer than sporangia. *Scales and hairs*: pinna-rachis closely warty and

more or less persistently scaly on lower surface, scales strongly setiferous, the larger ones long and narrow; costae densely scaly throughout, scales near base long and narrow, flat, strongly setiferous (setae long and dark), grading to smaller long-fringed scales towards the apex; costules densely covered with pale elongate pale-fringed scales, the hairs of the fringes crisped and entangled, at least the distal scales with a bullate base; stout spreading pale hairs present on lower surface towards apices of costae and costules and scattered on lower surface of veins; a few also on upper surface of costules; hairs on upper surface of pinna-rachis always pale.

Type specimen: BLUME, Mt Gedeh, Java (L).

Distr. *Malaysia*: Java, Lesser Sunda Is (Flores).

Ecol. At 2200 m and over, in ridge forest and in open swampy places in gullies (abundant near hot springs at 2200 m on Mt Gedeh, West Java).

Note. *C. crinita* (HOOK.) COPEL., of Ceylon and South India, is very closely related to *C. tomentosa*. It occurs at lower elevations, is less scaly generally, the pinnules are wider, the lamina less rigid, the hairs on scales of costules straighter and less entangled. Specimens from Java formerly recorded as *C. crinita* are *C. tomentosa*; if the two species should be united, *C. tomentosa* is the older name.

131. *Cyathea magna* COPEL. Un. Cal. Publ. Bot. 18 (1942) 218; Philip. J. Sc. 77 (1947) 110, pl. 7.—*Alsophila tomentosa* var. *novoguineensis* ROSENST. in Fedde, Rep. 5 (1908) 34.—*C. ordinata* COPEL. Philip. J. Sc. 77 (1947) 109.

Trunk to 8 m; fronds 8—14, spirally arranged. *Stipe* 40—90 cm, medium brown when dry, near base more or less spiny, spines 3—5 mm long, finely warty between the spines; large scales abundant and persistent near base only, pale or in part medium brown, firm and shining, to 50 by 1½(—2) mm, edges closely set throughout with short dark setae; rest of stipe ± persistently covered with smaller pale to brown scales, the larger freely dark-setiferous, the smallest fringed with pale hairs. *Lamina* to nearly 300 cm long; main rachis on lower surface light brown when dry, rather closely warty and scaly as upper part of stipe. *Pinnae*: largest 90 cm long. *Pinnules* mostly rather stiffly spreading almost at right angles to pinna-rachis, largest 100—140 by 14—20 mm, sessile, acuminate, lobed almost to the costa (lowest lobe sometimes just free but adnate by its lamina); costules of large fronds 4 mm apart, of smaller ones 3 mm; veins 10—12 pairs, pale and prominent beneath, not raised above; segments of lamina thick, stiffly spreading when dry, edges often rather much reflexed on drying, finely crenate to almost entire. *Sori* nearer costule than edge; indusium lacking; paraphyses not longer than sporangia, no scales round base of sorus. *Scales and hairs*: pinna-rachis beneath pale, scaly as main rachis; costae beneath densely scaly, scales near base like the larger ones of pinna-rachis, flat and elongate, strongly setiferous, smaller and narrow scales bearing long flexuous dark marginal setae present almost throughout (smallest have pale

marginal hairs); *costules* densely scaly, scales near base narrow flat and bearing long dark setae, rest light brown with \pm bullate base and long pale flexuous marginal hairs; erect hairs present distally on costules and on lower surface of veins; upper surface of costules not hairy; hairs on upper surface of pinna-rachis dark except towards apex of frond.

Type specimen: BRASS 11278, Bele R., 18 km NE of Lake Habbema, 2250 m, W. New Guinea (A; dupl. at MICH, BO, K, BM, L, UC).

Distr. *Malaysia*: New Guinea.

Ecol. In open places in forest or in grassland, 1700–2750 m.

Note. This species is closely allied to *C. tomentosa* of Java, differing in narrower and firmer stipe scales, more rigid pinnules, and a greater preponderance of small scales bearing long dark setae, these giving a darker aspect; the hairs on upper surface of pinna-rachises are also dark.

132. *Cyathea pilulifera* COPEL. Un. Cal. Publ. Bot. 18 (1942) 219; Philip. J. Sc. 77 (1947) 112, pl. 9.

Stipe 50 cm, basal part copiously spiny, spines dark, to 5 mm; scales pale, to 25 by 2 mm, edges bearing sparse dark setae or concolorous hairs; main rachis spiny, glabrescent; pinna-rachis sparsely spiny or warty. *Lamina* c. 100 cm long; longest pinnae 45 cm. *Pinnules* to 110 by 20 mm, lowest segment just free, rest lobed almost to costa; costules 4 mm apart, distinctly curved; lamina-segments firm, close, edges crenate; veins 12–14 pairs, mostly forked, lowest basicopic vein sometimes from costa. *Sori* exindusiate; paraphyses not longer than sporangia; scales present round base of receptacle. *Scales and hairs* on lower surface of costae, costules and veins: flat pale scales with many long dark setae present near bases of costae and smaller ones distally and on costules; pale bullate scales with some setae present on distal part of costae and on costules and veins; stout pale hairs abundant on distal part of costae and on costules and veins; upper surface of costules and veins glabrous.

Type specimen: BRASS 11492, 18 km NE. of Lake Habbema, 2200 m, W. New Guinea (A; dupl. at BM, BO, MICH).

Distr. *Malaysia*: Moluccas (Ceram), New Guinea, and Louisiades.

Ecol. At 1250–2750 m; at some lower elevations reported in forest with tall trunk, at higher elevations in open places (the type in young secondary growth on old garden land, with short trunk).

133. *Cyathea curranii* COPEL. Philip. J. Sc. 3 (1909) Bot. 356; *ibid.* 4 (1910) Bot. 52; Fern Fl. Philip. 2 (1960) 231.—*Alsophila curranii* C. CHR. Ind. Fil. Suppl. I (1913) 5; v. A. v. R. Handb. Suppl. (1917) 70.

Trunk 3 m, 20 cm ϕ ; leaf-scars 3 cm ϕ . *Stipe* 35 cm, pale, warty, bearing light brown shining scales to 60 by 4 mm, their edges bearing rather few concolorous setae. *Lamina* 100 cm long. Lower

pinnae long-stalked, reduced and deflexed, largest 35 cm. *Pinnules* to 90 by 13 mm, lowest segments almost free; costules 3 mm apart; segments of lamina rigid, nearly entire, glaucous beneath; veins 8–10 pairs. *Sori* exindusiate, paraphyses present. *Scales and hairs*: pinna-rachis beneath closely warty (warts dark), with a few residual narrow light brown scales, their edges bearing concolorous setae; costae glabrescent; costules and veins beneath bearing scattered pale bullate scales and many very short hairs (probably bases of fallen scales); long hairs absent.

Type specimen: CURRAN & MERRITT FB 7925, Mt Banajao, 2000 m, Luzon (MICH; dupl. at P, US).

Distr. *Malaysia*: Philippines (Luzon).

Note. Specimens seen are in poor condition and do not include largest pinnae. The nearest relationship seems to be to *C. mertensiana* (KUNZE) COPEL. of the Bonin Is and *C. aeneifolia* (v. A. v. R.) DOMIN, and allied species of New Guinea and the Pacific.

134. *Cyathea aeneifolia* (v. A. v. R.) DOMIN, Acta Bot. Bohem. 9 (1930) 174; COPEL. Philip. J. Sc. 77 (1947) 113.—*Alsophila aeneifolia* v. A. v. R. Nova Guinea 14 (1924) 3.—*Alsophila aeneifolia* var. *subglauc* v. A. v. R. l.c. 4.—*C. curvipinnula* C. CHR. Brittonia 2 (1937) 276; COPEL. Philip. J. Sc. 77 (1947) 116.

Trunk to 4½ m. *Fron*s 9–12, 175–250 cm long. *Stipe* 50–60 cm, strongly spiny and scaly; spines dark and shining, to 6 mm; largest scales 30–60 by 3–5 mm, thin but firm and flat when young, rather pale shining brown, edges bearing scattered concolorous hairs or dark setae; *rachis* short-spiny or warty, bearing similar but smaller scales which are mostly caducous. Lower *pinnae* slightly reduced and deflexed, largest *pinnae* 30–60 cm. Largest *pinnules* 70–120 by 15–25 mm, sessile, lobed nearly to costa, a few lower segments almost or quite free; costules 3–4½ mm apart; lamina-segments very firm, almost entire, glaucous beneath; veins 10–12 pairs. *Sori* medial on veins, no indusium; paraphyses numerous, as long as sporangia; some narrow pale scales surrounding base of receptacle. *Scales and hairs*: pinna-rachis bearing \pm caducous pale brown scales to 15×1 mm, also small pale fringed scales; throughout lower surface of costae small fringed pale scales, with some elongate setiferous scales near base and bullate ones towards apex; on costules pale bullate hair-tipped scales, often with crisped marginal hairs or sometimes setae; on veins beneath small pale bullate scales more or less abundant, with lax hairs like tips of scales at apices of veins; no hairs on upper surface of costules and veins.

Type specimen: LAM 1751, W. New Guinea, near foot of Doormantop, in sunny ravine, 3240 m (BO; dupl. at US, L, U).

Distr. *Malaysia*: New Guinea.

Ecol. On forest edges or in grass-land, 2840–3240 m. LAM 1805, distinguished as var. *subglauc* v. A. v. R., was collected in a shady valley at 3200 m, and has larger thinner fronds than the type but

is otherwise similar. This species is nearly allied to *C. pilulifera* COPEL., but the latter has abundant long hairs on costae, costules and veins, and has been found at lower altitudes. Perhaps the two should be united.

var. melanacantha (COPEL.) HOLTUM, *var. nov.*—*C. melanacantha* COPEL. Un. Cal. Publ. Bot. 18 (1942) 219; Philip. J. Sc. 77 (1948) 114, pl. 10.

Stipe-scales to 15 by 2 mm, dark brown.

Type specimen: BRASS 9311, Lake Habbema, W. New Guinea (A; dupl. at BM, BO, UC, L, MICH).

Ecol. Occasional in forest-edge, at 3225 m.

var. macrophylla HOLTUM, *var. nov.*

A typo speciei differt: frondibus ad 425 cm longis, stiptibus 200 cm longis inclusis; paleis stiptitis ad 50 × 4 mm; pinnis maximis 70 cm longis, pinnulis maximis 135 × 21 mm; costulis 5 mm inter se distantibus.

Type specimen: HOOGLAND & SCHODDE 7209, Western Highlands, NE. New Guinea (L).

Ecol. In cloud-forest at 2900 m.

135. *Cyathea tengerensis* (ROSENST.) DOMIN, Acta Bot. Bohem. 9 (1930) 165.—*Alsophila haenkei var. angustata* HASSK. in Hook. J. Bot. Kew Misc. 7 (1855) 326.—*Alsophila glauca* (BL.) Hook. p.p.: V. A. V. R. Handb. (1908) 41; Suppl. (1917) 68; BACKER & POSTH. Varenfl. Java (1939) 28.—*Alsophila tengerensis* ROSENST. Med. Rijksherb. n. 31 (1917) 1.

Stipe to at least 60 cm, warty, persistently scaly near base; stipe-scales to 45 by 2½–3½ mm, shining pale brown, firm, setiferous. *Pinnae* to at least 50 cm long. *Pinnules* to 110 by 16 mm, sessile, lobed almost to costa with 1 or 2 basal segments almost free; costules 2½–3 mm apart; lamina-segments firm, edges ± reflexed when dry, lower surface probably glaucous; veins 10–12 pairs. *Sori* exindusiate, nearer to costule than to edge, pale paraphyses present. *Scales and hairs*: pinna-rachis closely warty beneath, with some residual pale scales to 7 by ½ mm, setiferous; costae with similar shorter elongate scales near base, for the most part covered with rather large pale brown bullate scales which have a few concolorous marginal hairs; near apex of costae a few long pale hairs; costules bearing similar bullate scales and occasionally hairs; no long hairs on veins but very short appressed hairs (bases of former scales?) often conspicuous; hairs on upper surface of costules rare.

Type specimen: HASSKARL, Java (L?; not seen). Cited by ROSENSTOCK: ZOLLINGER 2541, Mt Tengger, E. Java (L; dupl. at P).

Distr. *Malaysia*: East Java, Lesser Sunda Is (Flores), South Celebes.

Ecol. In open places at 1500–2300 m; locally abundant on Mt Tengger.

Note. This species was established by ROSENSTOCK by reference to the description of *Alsophila haenkei var. angustata* HASSK., without further description; HASSKARL's specimen, for which he cites no locality, is therefore the type. The above

description is largely based on several later collections from Mt Tengger.

136. *Cyathea persquamulifera* (v. A. v. R.) DOMIN, Acta Bot. Bohem. 9 (1930) 146.—*C. contaminans var. persquamulifera* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 28 (1918) 13.—*Alsophila persquamulifera* v. A. v. R. *ibid.* III, 2 (1920) 130.

Stipe scaly throughout, no long spines; basal scales to 30 by 1 mm, medium brown, shining, strongly setiferous (on a young frond). *Main rachis* closely warty beneath. *Pinnae* to at least 60 cm long, lower ones rather long-stalked. *Pinnules* to 135 by 25 mm, 1 or 2 basal segments free or contacted at base, rest of pinnule cut nearly to costa, sessile, caudate-acuminate; costules 3½–4 mm apart; segments firm, edges often ± reflexed when dry, crenate; veins to at least 12 pairs, lowest from costa or base of costule. *Sori* nearer costule than margin; no indusium, thin paraphyses not longer than sporangia. *Scales and hairs*: pinna-rachis beneath bearing very small fringed pale scales and copious narrow light brown strongly setiferous ones up to 10 mm long; costae at base as pinna-rachis, the larger scales 5–6 mm long, grading to very narrow setiferous scales and some bullate hair-pointed scales, also many very long (2 mm) stout brown hairs except near base; costules bearing copious similar hairs, sometimes narrow pale scales 2–3 mm long with marginal hairs or setae, always hair-pointed pale bullate scales; veins with a few stout erect hairs on lower surface; upper surface of costules and veins glabrous.

Type specimen: BÜNNEMEIJER 961, Mt Talamau, 2300 m, Sumatra (BO; dupl. at K, L).

Distr. *Malaysia*: Central Sumatra, throughout Java.

Ecol. On mountains at 1500–2500 m.

137. *Cyathea sarasinorum* HOLTUM, Kew Bull. 16 (1962) 61.—*Alsophila contaminans var. longepaleata* CHRIST, Ann. Jard. Bot. Btzg 19 (1904) 42.—*Alsophila glauca var. longepaleata* v. A. v. R. Handb. (1908) 41; Suppl. (1917) 69.

Main rachis pale beneath, with dark shining warts bearing dark shining setiferous scales to 15 by 1 mm. *Pinnae* to 67 cm long. *Pinnules* to 90 by 18 mm, lowest 1 or 2 lamina-segments constricted at base, rest of pinnule lobed almost to costa, apex rather shortly acuminate; costules 4 mm apart; segments of lamina thin, oblique, their rounded ends curved forwards, edges crenulate; veins 9–10 pairs. *Sori* near costules, exindusiate. *Scales* on costae beneath near base very narrow, dark shining brown, with many concolorous setae, smaller distally; pale spreading hairs also present towards apex of costae and on costules, on lower surface; scales on costules dark narrow, setiferous, also pale bullate scales bearing setae near their tips.

Type specimen: F. & P. SARASIN 2105, Si-baronga-Rücken, Central Celebes (BAS).

Distr. *Malaysia*: Central Celebes (one collection).

138. *Cyathea angiensis* (GEPP) DOMIN, Acta Bot. Bohem. 9 (1930) 90.—*Alsophila angiensis* GEPP in Gibbs, Arfak (1917) 69.

Like *C. contaminans* (WALL.) COPEL., but rather small; pinnules 100–150 by 16–20 mm; costules $3\frac{1}{2}$ mm apart, veins flat or impressed on lower surface; lamina-segments very firm, edges almost entire to crenate, glaucous beneath; more or less abundant pale flat setiferous scales present on lower surface of costae and costules; long pale spreading hairs more or less abundant towards apex of costae and on costules and veins on lower surface, rarely on upper surface of costules; paraphyses pale, longer than sporangia.

Type specimen: GIBBS 5968, Angi Lakes, 7000 ft, W. New Guinea (BM; K, P, BO).

Distr. *Malaysia*: Moluccas (Buru), New Guinea.

Ecol. Mountains, 600–2200 m.

Note. A specimen from Sepik District, Territory of New Guinea (DARBYSHIRE & HOOGLAND 8191) bears the following information: "fronds immediately fully deciduous, the leaf-scars in distinct orthostiches (8) . . . 12 fronds in 3 whorls of 4, the outer whorl old, the middle whorl young fertile, the upper whorl not yet fully expanded, within each whorl the fronds very closely of the same age". DARBYSHIRE 384 has similar information, but fronds in whorls of 5. If I have correctly identified these specimens, the following characters distinguish this species from *C. contaminans*: fronds in whorls of 4 or 5, old fronds immediately and fully caducous. The remaining specimens referred to *C. angiensis* do not bear such information.

See also under 140. *C. contaminans*.

139. *Cyathea verrucosa* HOLTUM, Kew Bull. 16 (1962) 63.

Stipe rather pale, closely warty throughout, persistently scaly near base only; scales to 40 by 3 mm, thin, pale, edges strongly dark-setiferous; main rachis, lower surface, glabrescent, closely warty (warts to 1 mm high). *Pinnae* to at least 60 cm long, lower ones with stalks 6 cm long. *Pinnules* to 110 by 20 mm, sessile or the lowest stalked, caudate-acuminate, basal 1–2 segments free or nearly so, rest cut almost to costa; costules $3\frac{1}{2}$ –4 mm apart; lamina-segments rigid, edges minutely crenate, sinuses narrow; veins to 12 pairs. *Sori* at about $\frac{1}{3}$ distance from costule to edge, marked by a depression on the upper surface, exindusiate; paraphyses pale, as long as sporangia, no scales round base of sorus. *Scales and hairs*: pinna-rachis beneath rather closely warty, bearing scattered pale setiferous scales to 10 by $1\frac{1}{2}$ mm and very small pale setiferous or short-fringed scales; costae at first bearing many narrow pale setiferous scales to 2 mm long, these mostly caducous, also much shorter pale scales which are setiferous or the smallest pale-fringed, not bullate, distal half of costae bearing copious long pale spreading hairs with few scales; costules at first bearing many narrow pale setiferous scales to 2 mm long, also flat ovate-acute setiferous or

fringed scales, and long pale spreading hairs; veins beneath bearing stout erect hairs (2 or 3 on a vein) and very short hairs which appear to be bases of fallen scales; upper surface of costules and veins glabrous.

Type specimen: MATTHEW *s.n.*, 3.2.1912, Mt Merapi, 5000 ft, Sumatra (K).

Distr. *Malaysia*: Central Sumatra (two collections).

Ecol. In open places in forest at 1600–1900 m.

Note. Closely related to *C. contaminans* but much more densely scaly, the stipe closely warty instead of rather sparsely spiny.

140. *Cyathea contaminans* (WALL. *ex* HOOK.) COPEL. Philip. J. Sc. 4 (1909) Bot. 60; v. A. v. R. Bull. Jard. Bot. Btzig II, n. 28 (1918) 13; COPEL. Philip. J. Sc. 77 (1949) 115; HOLTUM, Rev. Fl. Mal. 2 (1954) 119; COPEL. Fern Fl. Philip. 2 (1960) 230.—*Polypodium contaminans* WALL. Cat. (1828) n. 320, *nomen*.—*Chnoophora glauca* BL. En. Pl. Jav. 1828) 243 (*non C. glauca* BORY, 1804).—*Alsophila glauca* J. Sm. J. Bot. 3 (1841) 419; BEDD. Handb. (1883) 12; v. A. v. R. Handb. (1908) 41 (*incl. var. celebica, var. squamulata, var. densa, var. setulosa, and var. microloba*); KOORD.-SCHUM. Syst. Verz. 1, 2 (1912) 5; ROSENST. Hedwigia 56 (1915) 349, *incl. var. trichocarpa* ROSENST.; v. A. v. R. Handb. Suppl. (1917) 69 (*incl. var. squamulosa*); Bull. Jard. Bot. Btzig III, 2 (1920) 129; BACKER & POSTH. Varenfl. Java (1939) 28.—*Alsophila contaminans* WALL. *ex* HOOK. Sp. Fil. 1 (1844) 52, t. 18, f. 2; HASSK. in Hook. J. Bot. Kew Misc. 7 (1855) 323 (*incl. var. robusta, var. squamulata, var. densa, var. microloba and var. setulosa* HASSK.); BEDD. Ferns Br. Ind. (1865) pl. 85; HOOK. Syn. Fil. (1866) 41; SCOTT, Trans. Linn. Soc. 30 (1874) 35; CHRIST, Verh. Nat. Ges. Basel 11 (1895) 199, *incl. var. celebica* CHRIST; Farnkr. Erde (1897) 327; Ann. Jard. Bot. Btzig 15 (1898) 79, pl. XIII f. 2; DIELS in E. & P. Pfl. Fam. 1, 4 (1899) 136, *p.p.*—*Alsophila acuta* PRESL, Abh. k. Böhm. Ges. Wiss. V, 5 (1848) 343.—*Alsophila smithiana* PRESL, l.c. 342.—*Alsophila clementis* COPEL. Philip. J. Sc. 1, Suppl. 2 (1906) Bot. 143.—*C. clementis* COPEL. *ibid.* 4 (1909) Bot. 59; Fern Fl. Philip. 2 (1960) 230.—Fig. 3, 6, 22, 26.

Trunk often very tall and much thickened by adventitious roots at base, only when old showing leaf-scars in upper part. *Stipe* to 100 cm long, glaucous, purplish towards the base, usually strongly spiny, at first scaly throughout, persistently so near the base; scales of all sizes up to 45 by 3 mm, pale brown, very thin, edges bearing close dark short setae. *Main rachis* pale, spiny, at first scaly as stipe, later \pm glabrescent. *Pinnae*: lowest somewhat reduced and with stalks to 10 cm long, largest 60 cm. *Pinnules* to c. 150 by 30 mm, often smaller, lowest distinctly stalked, largest with 1–2 pairs of basal segments more or less free, rest of pinnule lobed almost to the costa; costules commonly 4– $4\frac{1}{2}$ mm apart, rarely to 5 mm; segments of lamina firm, glaucous beneath, edges \pm crenate-serrate; veins commonly 12 pairs.

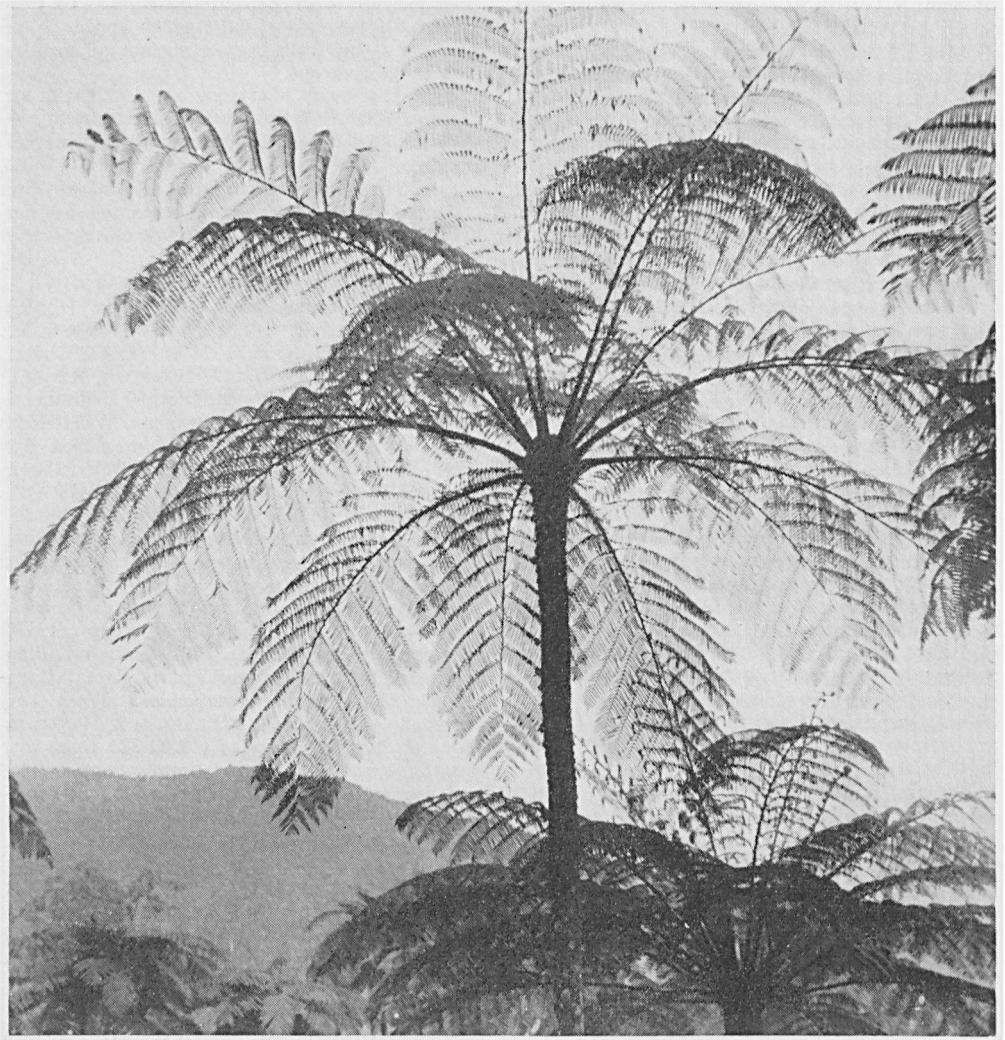


Fig. 26. *Cyathea contaminans* (WALL.) COPEL. in Tjibodas mountain garden (VAN STEENIS).

Sori near costules, lacking indusia; paraphyses pale, not longer than sporangia. *Scales and hairs*: pinna-rachis more or less spiny, pale, glabrescent; lower surface of costae at first bearing scattered pale setiferous scales to 3 by $\frac{1}{2}$ mm, shorter distally, these in most cases early caducous leaving the costae glabrous; costular scales small, \pm ovate, pale-fringed, mostly caducous, not bullate; a few hairs normally present towards apex of pinnules on both costae and costules, their abundance varying much; in a few localities (notably Mt Kinabalu, also in New Guinea) stout erect hairs, in variable number, may be present on lower surface of veins.

Type specimen: WALLICH 320, Penang (K).

Distr. Throughout *Malaysia*, in Peninsular India as far N as Mergui. Specimens so named from Hong Kong are *C. lepifera* (J. SM.) COPEL.

Ecol. In clearings and open places in forest, especially near streams, 200 to 1600 m, often very abundant.

Notes. This is the most widespread species of *Cyathea* in *Malaysia*, having no close allies at low elevations in Western *Malaysia*. In New Guinea there are several allied species, of which *C. angiensis* (GEPF) DOMIN appears to be nearest; it may perhaps better be united to *C. contaminans*. The several varieties of *C. contaminans* which have been described appear mostly to be due to the influence of environmental factors, or to be

young, and therefore unusually scaly, at the time of collection.

I have only seen one specimen of this species from NE. India; it was collected by SCOTT, who noted (*l.c.*) that typical *Alsophila contaminans* occurred there only at low altitudes. He distinguished *var. brunoniana* (*A. brunoniana* HOOK.), which is common in Sikkim at higher altitudes and has smooth (not spiny) stipes and copiously scaly costae and costules. I prefer to regard this as a distinct species, which must be called *Cyathea brunoniana* (HOOK.) CLARKE & BAK., though this name was actually used by CLARKE & BAKER for a quite different species. I hope to publish elsewhere descriptions of this and other species of the mainland of Asia.

141. *Cyathea lepifera* (J. SM.) COPEL. Philip. J. Sc. 4 (1909) Bot. 40; *ibid.* 56 (1935) 98, pl. 3, fig. 4-7; Fern Fl. Philip. 2 (1960) 228.—*Alsophila lepifera* J. SM. *ex* HOOK. Sp. Fil. 1 (1844) 54; CHRIST, Bull. Herb. Boiss. 6 (1898) 137, *incl. var. congesta* CHRIST; V. A. V. R. Handb. (1908) 39; Suppl. (1917) 65.—*Alsophila pustulosa* CHRIST, Bull. Herb. Boiss. II, 1 (1901) 1019; NAKAI, Bot. Mag. Tokyo 41 (1927) 73; ITO, Fil. Jap. III. (1944) pl. 453.—*Alsophila calocoma* CHRIST, Philip. J. Sc. 2 (1907) Bot. 182; V. A. V. R. Handb. (1908) 789.—*C. pustulosa* COPEL. Philip. J. Sc. 4 (1909) Bot. 51.—*C. calocoma* COPEL. *l.c.* 53; Fern Fl. Philip. 2 (1960) 229.—*C. umbrosa* COPEL. Philip. J. Sc. 56 (1935) 98, pl. 3, fig. 1-3.—(?) *C. pteridioides* COPEL. *l.c.* 98, pl. 4; Fern Fl. Philip. 2 (1960) 229.

Stipe 16 cm or more, almost wholly covered with scales, not spiny (wartly when scales have fallen); scales pale, thin, to 40 by 2-4 mm wide at base, apical part narrowly acuminate, edges throughout closely setiferous, narrow apical part sometimes entirely brown; smaller scales on stipe very narrow (under 1/2 mm wide), brown, with concolorous marginal setae. *Rachis* and pinna-rachis closely conspicuously warty, pale, more or less completely glabrescent, warts darker, to nearly 1 mm high. *Pinnae*: lowest somewhat reduced; largest to at least 80 cm long. *Pinnules* 100-150 by 15-22 mm, caudate-acuminate, sessile, largest with a few free or separately adnate basal segments, the rest lobed almost to the costa; costules 3-3 1/2 mm apart; veins 12-14 pairs; lamina-segments firm, entire or nearly so, glaucous beneath. *Sori* near costules; no indusia; paraphyses pale, longer than sporangia, some in form of narrow scales. *Scales and hairs*: pinna-rachis bearing some persistent appressed small pale fringed scales and occasionally longer spreading setiferous scales; costae beneath more or less densely scaly, basal scales elongate, narrow, pale with dark setae, distal ones smaller with pale marginal hairs, all flat, also some very small pale fringed scales throughout; at least the apical part of each costa also bearing stout pale hairs beneath; costules beneath bearing pale flat ovate to elongate scales bearing short pale marginal hairs, also more or

less abundant stout spreading pale hairs; upper surface of costules lacking hairs.

Type specimen: CUMING 180, Luzon (K; dupl. at BM, F, A, BO).

Distr. Ryukyu Is, Formosa, Kwangtung, Hong Kong, in *Malaysia*: Philippines (Luzon, Panay, Mindoro, Babuyan).

Ecol. In the Philippines a mountain species, but herbarium labels bear little ecological information. I have been unable to find the type specimen of *C. pteridioides* COPEL.; it is not in COPELAND's herbarium.

142. *Cyathea atrosinosa* HOLTUM, Kew Bull. 16 (1962) 52.

Trunk 6 m; fronds 350 cm long, in whorls of 4, 5 or 6, usually two whorls green at one time. *Stipe* to 125 cm long, lower part armed with dark spines to 8 mm long, also densely covered with scales which are up to 30 by 5 mm, thin, pale or pale brown, their edges bearing concolorous short hairs or dark setae. *Rachis* pale and glabrescent on lower surface, with scattered small thorns. *Pinnae* to 80 cm long. *Pinnules* to 120 by 25-30 mm, lowest on stalks up to 5 mm, lobed almost to the costa with the 1-2 lowest segments more or less free; costules 3 1/2-4 mm apart; lamina-segments crenate, apices rounded, sinuses between them about 1 mm wide; veins 13-17 pairs. *Sori* exindusiate; paraphyses numerous, longer than sporangia. *Scales and hairs*: pinna-rachises pale beneath, glabrescent or with scattered setiferous scales; scales near base of costae shining brown, ovate, flat, long-setiferous, towards apices paler fringed scales; costules bearing pale brown flat fringed scales, and a few similar smaller ones also on lower surface of veins.

Type specimen: HOOGLAND & PULLEN 6090, Western Highlands District, 2650 m, NE. New Guinea (K).

Distr. *Malaysia*: E. New Guinea.

Ecol. In mountain forest, on limestone (always?) at c. 2400-2850 m.

143. *Cyathea fugax* v. A. V. R. Bull. Jard. Bot. Btzg II, n. 7 (1912) 8; Handb. Suppl. (1917) 34; COPEL. Philip. J. Sc. 77 (1947) 116.

Trunk to 10 m; fronds up to 300 cm long; leaf-scars 4 cm ϕ , in alternate whorls of 5 (BRASS 25585, Normanby I.). *Stipe* to at least 40 cm, spiny and rather densely scaly for most of its length; spines 2 mm or more long; scales pale, thin, to 25 by 2 mm, bearing many dark marginal setae near apices. *Pinnae* to 70 cm or more long. *Pinnules* to 145 by 35 mm, lowest 1-2 segments free, then some separately adnate, rest of pinnule cut nearly to costa, apex caudate-acuminate; costules 4 1/2 mm apart; lamina-segments rigid, glaucous beneath, little over 3 mm wide, almost entire; veins to 20 pairs, basisopic basal vein from costa. *Sori* nearer costules than edge, exindusiate, with a ring of narrow fringed scales round base of receptacle; long paraphyses also present. *Scales and hairs*: pinna-rachis pale, bearing scattered short thorns, glabrescent; on costae

near base pale scales (apex dark or not) bearing dark flexuous setae, grading to smaller pale fringed scales without setae (or with a few) on costules and on veins; small scales on veins with short marginal hairs; very small hairs present on lower surface between veins; no hairs on upper surface of costules.

Type specimen: COPLAND KING 215, Papua (BO; dupl. at MICH, SYD).

Distr. *Malaysia*: E. New Guinea and adjacent islands.

Ecol. In wet ground, secondary forest and open places in forest in low country up to 1400 m.

Note. Details of trunk and stipe are taken from specimens other than type. Under type number at Sydney and Brisbane are also specimens of *C. contaminans* (WALL. ex HOOK.) COPEL., which differ notably in scales from the type.

3b. Subsection *Fourniera*

(BOMMER) HOLTUM, *stat. nov.*—*Fourniera* BOMMER, Bull. Soc. Bot. Fr. 20 (1873) xix.—Fig. 27.

Type species: *Cyathea novae-caledoniae* (METT.) COPEL.

Distr. The centre of distribution is New Guinea, with eastward and south extension to Samoa, New Caledonia and NE. Australia, westward and north to W. Java, Celebes, North Borneo (also Pulau Tioman) and Philippines.

Taxon. A distinction between species with long stipes and those with short stipes (the latter having gradually reduced lower pinnae) appears to be valid, but some collections do not include the stipe and so are not easy to place. More field study is needed in Eastern New Guinea.

Ecol. These appear all to be forest species.

KEY TO THE SPECIES

1. Pinnules 30–40 mm long; lower pinnae gradually reduced.
 2. Tertiary leaflets on stalks almost 1 mm long. Pinnae to 25 cm long. Bullate scales present on costules. **144. *C. carrii***
 2. Tertiary leaflets almost sessile. Pinnae to 45 cm long. No bullate scales on costules. **145. *C. womersleyi***
1. Pinnules commonly at least 70 mm long, in most cases much longer.
 3. Lower pinnae gradually reduced, lowest 11 cm long near base of stipe. **146. *C. auriculifera***
 3. Lower pinnae not thus reduced (sometimes 1–2 pairs of isolated small pinnae at base of stipe).
 4. Bullate scales present on costae and costules.
 5. Pinnules to 110 by 22 mm. Soral scales small, not covering sorus at maturity. **147. *C. teysmannii***
 5. Pinnules to about 65 by 16 mm. Soral scales broad, covering sorus at maturity. **148. *C. aciculosa***
 4. Bullate scales lacking.
 6. Veins and lower surface of lamina bearing finely fringed interlacing scales which cover lower surface of leaflets **149. *C. celebica***
 6. Veins bearing at most small separate scales on lower surface.
 7. Scales absent from lower surface of veins **150. *C. tripinnata***
 7. Scales present on lower surface of veins, not long-fringed nor covering lower surface of leaflets. **151. *C. macrophylla***

144. *Cyathea carrii* HOLTUM, Kew Bull. 16 (1962) 53.—Fig. 27.

Stipe c. 7 cm, covered with a felt of very small dull scales, the larger ones setiferous, surface where exposed dark and smooth; larger scales near base to 30 by hardly 1 mm, edges bearing short dark setae, apex a long dark seta; lower surface of *rachis* dark brown, smooth or finely warty, glabrescent or with sparse minute dull scales. Lowest *pinnae* c. 3 cm long, succeeding ones gradually longer, up to 25 cm long. *Pinnules* to 32 by 7 mm, fully pinnate; *tertiary leaflets* to c. 12 pairs, distinctly stalked (stalks to almost 1 mm long and 2 mm apart), to 4 by a little more than 1 mm, edges sinuous, lowest sometimes

deeply lobed at the base; veins 4–5 pairs. *Sori* up to 6 on each tertiary leaflet, covered to ripeness by broad pale lacerate overlapping scales which give the appearance of a complete indusium. *Scales and hairs*: pinna-rachis beneath dark, bearing many very small pale dull scales, some small bullate scales and scattered long narrow pale or partly dark closely setiferous scales; scales of pinnule-rachis (costa) small, brown, shining, mostly bullate and ending in a seta, some nearly flat and slightly elongate, rarely with lateral setae; scales of midribs of leaflets shining dark brown, bullate, acuminate, similar scales sometimes also on lower surface of veins; upper surface of tertiary leaflets glabrous.

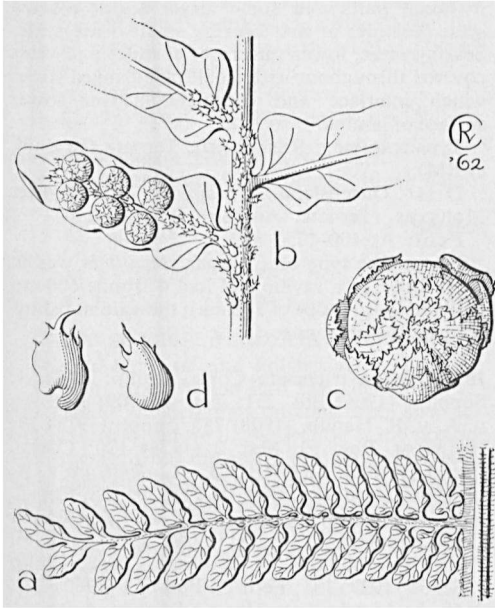


Fig. 27. *Cyathea carrii* HOLTUM. *a*. Single pinnule, upper surface, $\times 2$, *b*. part of pinnule, lower surface, showing scales and sori, $\times 6$, *c*. sorus, showing covering of overlapping scales, $\times 20$, *d*. scales from costule, $\times 30$ (CARR 13526).

Type specimen: CARR 13526, in forest, Boridi, 5000 ft, Papua (K; dupl. at BM, L).

Distr. *Malaysia*: E. New Guinea (one collection).

145. *Cyathea womersleyi* HOLTUM, Kew Bull. 16 (1962) 63.

Trunk to 8 m, fronds to 10, suberect, to 300 cm long, with pinnae gradually reduced to the base. *Stipe* 8–20 cm, sparsely spiny (spines to $2\frac{1}{2}$ mm), densely and persistently covered with scales which are pale, rather dull and soft, with a dark red seta at apex and no others, 10–20 by less than 1 mm, smaller ones 4–5 by $\frac{1}{8}$ mm; main *rachis* persistently scaly beneath, smaller scales all with setiform apex, some elongate ones with pale edges bearing dark setae. *Pinnae*: lowest 8 cm long, longest 45 cm. *Pinnules* to 40 by 10 mm, almost fully pinnate; costules (midribs of tertiary leaflets) 2 mm apart; *tertiary leaflets* mostly 4–5 mm long, hardly stalked, slightly oblique, entire, apex rounded, base unequal, veins 6–7 pairs, lowest leaflets on largest pinnules to 7 mm long, bearing at base 1 or 2 pairs of 4th order leaflets which are round and entire, 1 mm long. *Sori* covered by overlapping fringed scales. *Scales and hairs*: lower surface of pinna-rachis densely scaly, some scales dark, shining, elongate with pale sparsely fringed or setiferous edges, some smaller, light brown and sub-bullate with setiform apex; near

base of costae dark shining ovate to elongate scales with pale edges bearing some dark setae, then light brown nearly flat roundish scales with short setiform apex to pale hair-tip; on costules a few scales which usually lack setae but may bear marginal hairs; small scales sometimes on lower surface of veins.

Type specimen: WOMERSLEY & MILLAR NGF 8470, Skindewai, 5400 ft, Morobe District, NE. New Guinea (K; dupl. at L, BO, A, SYD).

Distr. *Malaysia*: E. New Guinea (3 collections).

Ecol. At 1700–2400 m; "common through the rain-forest" (BRASS), in mixed *Nothofagus* forest (SCHODDE).

146. *Cyathea auriculifera* COPEL. Philip. J. Sc. 6 (1911) Bot. 364; *ibid.* 77 (1947) 107.

Trunk to 3 m; fronds 220 cm long, lower pinnae gradually reduced. *Stipe* 10 cm, copiously spiny (spines to 3 mm long), also densely covered with pale scales 10–55 mm long, larger ones twisted and rather straight, edges closely set with short dark setae; main *rachis* beneath rather closely spiny throughout, covered with a dark brown felt of very small mostly setiferous scales and at first with elongate pale scales attached to the thorns. *Pinnae*: lowest 11 cm long, largest 54 cm. *Pinnules* slightly overlapping, to 70 by 15 mm, fully pinnate, bases of tertiary leaflets 3 mm apart; *tertiary leaflets* mostly stalked, largest 9 by $2\frac{1}{2}$ mm, several pairs near base of pinnule having 1 or 2 pairs of free quaternary leaflets, acropscopic basal tertiary leaflets deflexed across pinna-rachis; veins to 9 pairs, those in quaternary leaflets pinately branched, rest mostly forked. *Sori* nearer to costules than to edge, covered with overlapping fringed scales until nearly ripe, fringe of these scales longer than on costal scales. *Scales and hairs*: pinna-rachis scaly beneath as main rachis; costae copiously scaly, larger scales 1 mm long, ovate-acute, dark and shining with pale edges bearing dark setae, smaller ones entirely pale, either with setae or fringing hairs, no bullate scales; costules and veins beneath bearing similar smaller scales; upper surface of costules glabrous.

Type specimen: C. KING 227, Goodenough Bay, 1200 m, Papua (MICH; fragm. at BM).

Distr. *Malaysia*: New Guinea and Louisiades.

Ecol. In mountain forest or transition to mossy forest, on mainland 1200–2600 m, on the islands 750–1000 m.

147. *Cyathea teysmannii* COPEL. Philip. J. Sc. 4 (1909) Bot. 51 (new name for *C. celebica* v. A. v. R.); v. A. v. R. Handb. Suppl. (1917) 39.—*Hemitelia truncata* (non BRACK.) CHRIST, Ann. Jard. Bot. Btzg 15 (1898) 81; in Warburg, Monsumia (1900) 91.—*C. celebica* v. A. v. R. Bull. Dép. Agr. Ind. Néerl. 18 (1908) 2, non BL. 1828; Handb. (1908) 26.

Differs from *C. tripinnata* in the presence of distinctly bullate pale scales on the costules, and in thinner and smaller soral scales which do not

cover the fully developed sporangia. The specimens do not give information about characters of the stipe and its scales, which may also be distinctive.

Type specimen: TEYSMANN 13681 (BO).

Distr. *Malaysia*: SW. Celebes.

Ecol. At c. 1000 m altitude.

148. *Cyathea aciculosa* COPEL. Philip. J. Sc. 60 (1936) 104, pl. 9.—*C. arachnoidea* (non HOOK.) GREYER & WAGNER, Un. Cal. Publ. Bot. 23 (1948) 43.

Stipe 18 cm long, dark, smooth, covered with minute scales, also near base with pale scales 25 by less than 1 mm, bearing dark marginal setae near apices. *Pinnae*: lowest 10 cm long, largest 50 cm. *Pinnules* to 65 by 16 mm, fully pinnate; *tertiary leaflets* to 20 pairs, to 7 by almost 2 mm, larger ones crenate; veins 7 pairs. *Sori* covered with overlapping pale scales; no true indusium. *Scales and hairs*: pinna-rachis warty, shining, bearing many very small pale short-fringed scales and a few long narrow setiferous ones, these latter also on bases of costae; most scales on costae pale, bullate, also very small pale scales.

Type specimen: BRASS 2887, San Christoval, 900 m, Solomon Is (MICH; dupl. at L, BRI).

Distr. Solomon Is, in *Malaysia*: Admiralty Is.

Ecol. In forest, to c. 1000 m.

Note. This species is very near *C. truncata* BRACK.) COPEL. of Fiji and Samoa, differing in the much larger indusial scales.

149. *Cyathea celebica* BL. En. Pl. Jav. (1828) 245 (not v. A. v. R. 1908); TINDALE, Contr. N.S.W. Nat. Herb. 2 (1956) 338, p.p.—*Alsophila celebica* METT. Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 53; v. A. v. R. Handb. (1908) 42.—*C. arachnoidea* HOOK. Syn. Fil (1865) 24; v. A. v. R. Handb. (1908) 26; Suppl. (1917) 38.—*Alsophila truncata* var. *sagittata* CHRIST, Bull. Herb. Boiss. II, 1 (1901) 458.—*Alsophila truncata* var. *nivea* CHRIST, K. SCH. & LAUT. Nachtr. (1905) 36; v. A. v. R. Handb. (1908) 42.—*C. quadripinnatifida* COPEL. Un. Cal. Publ. Bot. 18 (1942) 218; Philip. J. Sc. 77 (1947) 108, pl. 6.

Stipe to 100 cm long, dark, bearing slender dark spines to 3 mm long, near base bearing persistent light brown scales 20–40 mm long, mostly not over 1 mm wide, firm and shining, edges bearing close short oblique concolorous setae, rest of stipe covered closely with small interlacing setiferous or fringed scales. *Pinnae*: small pinnae (5–8 cm long) sometimes present near base of stipe (seen only in two specimens); largest pinnae to 70 cm long. *Pinnules* 90–140 by 17–28 mm, fully pinnate, the lower tertiary leaflets stalked; costules (stalks of tertiary leaflets) 3–5 mm apart; *tertiary leaflets* to 15 by 2½–5 mm, sometimes dilated at the base, the largest deeply lobed near the base, the basal lobes sometimes forming free quaternary leaflets. *Sori* medial, protected when young by overlapping very thin finely fringed scales. *Scales and hairs*: pinna-rachis and costae beneath almost covered with very small irregular pale scales bearing short

marginal hairs and some larger scales bearing setae; costules at first bearing small ovate scales bearing setae, lower surface of costules and veins covered throughout with small pale fringed scales which interlace and completely cover lower surface of lamina.

Type specimen: REINWARDT, Ternate (L; dupl. at BM).

Distr. Queensland, in *Malaysia*: New Guinea, Moluccas (Ternate, Ambon), ? Celebes.

Ecol. At 100–1750 m.

Note. The type of *C. quadripinnatifida* was in open forest in a ravine and had 4 fronds 600 cm long (including stipe of 100 cm); these do not show reduced basal pinnae.

150. *Cyathea tripinnata* COPEL. Philip. J. Sc. 1, Suppl. 4 (1906) Bot. 251; *ibid.* 4 (1909) Bot. 40; v. A. v. R. Handb. (1908) 788; Suppl. (1917) 39; HOLTUM, Rev. Fl. Mal. 2 (1954) 120; COPEL. Fern Fl. Philip. 1 (1960) 208.—*C. densisora* v. A. v. R. Bull. Jard. Bot. Btzg III, 2 (1920) 138; COPEL. Fern Fl. Philip. 2 (1960) 208.—*C. leucostegia* COPEL. Philip. J. Sc. 38 (1929) 130; Fern Fl. Philip. 2 (1960) 209.—*C. leytenis* COPEL. Philip. J. Sc. 38 (1929) 131; Fern Fl. Philip. 2 (1960) 209.—*C. arachnoidea* (non HOOK.) BACKER & POSTH. Varenfl. Java (1939) 25.

Trunk to 4 or 5 m. *Stipe* to at least 40 cm, dark, bearing scattered sharp spines 1–3 mm long, covered almost throughout by a felt of very small setiferous scales; basal scales to 25 by 1 mm, thin and soft, matted together, edges with some dark setae, apex a dark seta. *Pinnae*: lowest 20–30 cm long, largest to 60 cm. *Pinnules* 90–140 by 17–25 mm, fully pinnate, lower tertiary leaflets distinctly stalked; costules 4–6 mm apart; *tertiary leaflets* to 15 by 3½ mm, the larger ones deeply lobed at the base, edges crenate; veins to 9 pairs, those in basal lobes pinnate. *Sori* near costules, covered to maturity by overlapping pale thin scales. *Scales and hairs*: lower surface of pinna-rachis covered with minute pale fringed scales; costae bearing similar scales with some longer narrow ones bearing a fringe of hairs or dark setae; on costules ovate flat brown to pale scales, setiferous or fringed; on veins no scales.

Type specimen: COPELAND 2068, Mt Mariveles, in extinct crater, 900 m, Luzon (MICH; dupl. at US, P, UC, SYD, S-PA).

Distr. *Malaysia*: West Java, Pulau Tioman (E off Malaya), N. Borneo, Philippines (Luzon to Mindanao), Moluccas (Ambon).

Ecol. In forest, 250–1700 m; the smaller forms, represented by *C. densisora*, *C. leytenis* and *C. leucostegia* probably in more exposed places.

151. *Cyathea macrophylla* DOMIN, Acta Bot. Bohem. 9 (1930) 133 (new name for *Hemitelia ledermannii* BRAUSE); COPEL. Philip. J. Sc. 77 (1947) 108.—*Hemitelia ledermannii* BRAUSE, Bot. Jahrb. 56 (1920) 60.

Differs from *C. tripinnata* in firmer texture of lamina and in presence of more or less abundant small scales on lower surface of veins, these scales

bearing short dark setae or short pale hairs, never long-fringed nor covering lower surface of lamina.

Type specimen: LEDERMANN 12533, Sepik Region, E. New Guinea (B).

Distr. *Malaysia*: New Guinea.

Ecol. In forest, from sea-level to 1500 m.

var. quadripinnata HOLTUM, *var. nov.*

A typo speciei differt: stipitibus c. 10 cm longis;

foliolis tertiariis maximis 18 mm longis, omnino profunde lobatis, segmentis infimis interdum liberis et stipitulatis.

Type specimen: WOMERSLEY NGF 13959, Morobe Distr., NE. New Guinea (K).

Ecol. "Short tree-fern in under-storey of the forest. Trunk not more than 2 feet tall. Fronds 5 feet", 2000 m.

4. Section *Schizocaena*

(J. SM.) HOLTUM, *stat. nov.*—*Schizocaena* J. SM. in Hook. Gen. Fil. (1838) t. 2; Lond. J. Bot. 1 (1842) 661, *p.p.*; COPEL. Gen. Fil. (1947) 99, *p.p.*—Fig. 8c, 28-30.

Type species: *Schizocaena brunonis* J. SM. = *Cyathea moluccana* R. BR.

Distr. *Malaysia* and *Polynesia*.

Taxon. The division into two subsections is perhaps not sharp, but extreme examples of *subsect. Sarcopholis* are strikingly different from species of *subsect. Schizocaena* from Western *Malaysia*. The characteristic feature of the section is the position of the basal basicopic vein of each vein group; this vein springs from the costa, not from the costule (or in *C. moluccana* from the midrib of the pinna). This condition is correlated with the relatively shallow lobing of the pinnules; similar lobing in *subg. Cyathea sect. Gymnosphaera* is usually not associated with this vein-character.

The species *C. sinuata* HOOK. and *C. hookeri* THW., of Ceylon, included here by J. SMITH and COPELAND, have flabelloid scales; in my opinion their nearest relatives are in the group of *C. borbonica* DESV. of Madagascar.

4a. Subsection *Schizocaena*

Distr. *Malaysia*, except *Moluccas* and *New Guinea*.—Fig. 8c, 28-29.

Taxon. In *Borneo* and the *Philippines* species of this subsection are often difficult to characterize clearly, appearing to vary in size and in distribution of scales and hairs on axes.

KEY TO THE SPECIES

1. Fronds simply pinnate, pinnae entire or at most serrate-crenate.
2. Apex of frond a deltoid deeply lobed lamina. Outer veins of each group joining to form a single excurrent vein. Pinnae sessile, base truncate or subcordate 152. *C. capitata*
2. Apex of frond a pinna of same shape as other pinnae. No anastomosis. Pinnae usually stalked.
3. Pinnae not over 15 mm wide, base narrowly cuneate, stalkes to 12 mm long. Sori in 1-2 rows on each side of costa, fully indusiate 153. *C. angustipinna*
3. Pinnae 2-4 cm wide, base rather broadly cuneate, stalked or not. Sori in fully fertile fronds in more than 2 rows, indusiate or not.
4. Pinnae not long-acuminate, upper usually sessile 154. *C. moluccana*
4. Pinnae long-acuminate, all stalked 155. *C. arthropoda*
1. Fronds simply pinnate with deeply lobed pinnae, or bipinnate.
5. Fronds simply pinnate with deeply lobed pinnae, the largest sometimes with free pinnules at their base.
6. Lower surface of pinna-midribs covered near base with long hairs; no free pinnules. 156. *C. deminuens*
6. Lower surface of pinna-midrib lacking hairs; some free pinnules on largest pinnae.
7. Indusium present (sometimes hidden by mature sorus).
8. Lower pinnae little narrowed at base, free leaflets as long as lobes, apex not long-acuminate; pinnae commonly 25 cm long 157. *C. alternans*
8. Lower pinnae narrowed to base so that free leaflets are very small, apex long-acuminate; pinnae to 18 cm long 158. *C. binuangensis*
7. Indusium lacking.
9. Pinnae commonly 25 cm long; no long pale hairs on rachis 157. *C. alternans*
9. Pinnae much shorter; main rachis bearing long pale hairs 159. *C. elliptica*
5. Fronds amply bipinnate.
10. Pinnules entire or with crenate edges.
11. Indusia present; pinnules sessile 157. *C. alternans*
11. Indusia lacking; pinnules stalked 160. *C. obliqua*
10. Pinnules distinctly lobed.
12. Sori indusiate.
13. Pinnules of larger pinnae not lobed more than $\frac{3}{4}$ to costa throughout, no free basal pinnules, or sometimes one on lowest pinnule of lower pinnae.

14. Bullate scales lacking on costules 161. *C. integra*
 14. Bullate scales present on costules.
 15. Basal pinnules of middle pinnae with stalks to at least 4 mm long; pinnules lobed less than $\frac{1}{2}$ way to costa 162. *C. stipitipinnula*
 15. Basal pinnules sessile or nearly so; pinnules lobed more than half way to costa.
 16. Segments of pinnules acute, falcate; largest pinnules 20–30 mm wide. 163. *C. zamboangana*
 16. Segments of pinnules rounded; largest pinnules not over 20 mm wide.
 17. Indusium a disc hidden by sorus 164. *C. discophora*
 17. Indusium complete, breaking and persistent at maturity.
 18. Lower surface of costae densely scaly 165. *C. megalosora*
 18. Lower surface of costae not densely scaly 166. *C. suluensis*
 13. Pinnules of larger pinnae always with one or more free basal segments.
 19. Copious long hairs on lower surface of veins as well as costules.
 20. About half the tertiary segments free or separately adnate to costa on largest pinnules. Pinnules to 100 by 20 mm. Costae not densely scaly 167. *C. robinsonii*
 20. One or two pairs tertiary segments free on largest pinnules. Pinnules to 80 by 12 mm. Costae densely scaly.
 21. Costal scales not setiferous. Pinnules sessile 165. *C. megalosora*
 21. Costal scales strongly setiferous. Lower pinnules with stalks 2–3 mm long. 168. *C. senex*
 19. No hairs on lower surface of veins.
 22. Free basal segments of largest pinnules deeply lobed. Rachis and pinna-rachis densely persistently scaly, scales small, sub-bullate, setiferous 169. *C. sibuyanensis*
 22. Free basal segments entire. Rachises glabrescent .
 23. Pinnules sessile, to *c.* 65 by 15 mm, often smaller 170. *C. philippinensis*
 23. Pinnules stalked (stalks to 8 mm), to 100 by 25 mm 171. *C. assimilis*
 12. Sori without indusia.
 24. Long-spreading hairs abundant on lower surface of rachis and/or pinna-rachis, often also on costae.
 25. Costules and veins bearing hairs like those of costae on lower surface.
 26. Pinnules to 110 mm long, cut $\frac{2}{3}$ – $\frac{3}{4}$ to costa; costules 5 mm apart . . 172. *C. trichodesma*
 26. Pinnules to 65 mm long, cut to within 1 mm of costa; costules 3– $3\frac{1}{2}$ mm apart. 173. *C. wallacel*
 25. Costules and veins lacking hairs on lower surface.
 27. Hairs of lower surface confined, or almost confined, to main rachis . . 159. *C. elliptica*
 27. Hairs of lower surface present on pinna-rachis and costae, few or none on main rachis. 174. *C. trichophora*
 24. Long spreading hairs lacking on lower surface of rachis and pinna-rachis.
 28. Largest pinnules with a free segment at the base; pinnules on stalks to 4 mm or more long; texture firm 175. *C. polypoda*
 28. Largest pinnules lacking a free segment at the base, almost sessile.
 29. Sori on 3–4 pairs of basal veins in each group only, not on distal veins, at maturity confluent. 176. *C. obscura*
 29. Sori on almost all veins, not confluent at maturity.
 30. Bullate scales lacking on costae and costules. Pinnules cut to less than 1 mm from costa; stout erect hairs abundant on upper surface of costules and veins . . . 177. *C. agatheti*
 30. Bullate scales present on costae and costules. Pinnules less deeply lobed; hairs on upper surface of costules few 178. *C. squamulata*

152. *Cyathea capitata* COPEL. Philip. J. Sc. 12 (1917) Bot. 49; C. CHR. & HOLTUM, Gard. Bull. S. S. 7 (1934) 199, 218.—*Schizocaena capitata* COPEL. Gen. Fil. (1947) 99.—Fig. 28f–h.

Trunk 1–3 m, bearing *c.* 12 fronds. *Stipe* dark, smooth, at least 40 cm; basal scales pale brown, firm, to 25 by 3–4 mm, rather thick at the base, edges bearing rather irregular concolorous setae; pneumathodes 9–15 mm long, rather widely spaced. *Rachis* dark to medium brown, smooth; *lamina* 100 cm or more long, simply pinnate, apex of frond not like a pinna but broadly deltoid and deeply lobed, lobes grading to upper pinnae. *Pinnae* *c.* 40 pairs, sessile, jointed to rachis, largest 15–19 by 2–3 cm wide at base, lower ones somewhat smaller, edges entire except near apex, base

truncate to cordate, in the latter case more or less auricled on both sides, apex short-acuminate, crenate. *Veins* pinnate in each group, usually with 3 pairs of veinlets, outer veinlets of each group always anastomosing with outer veinlets of adjacent groups to form a single excurrent vein; basal basisopic vein of each group springing separately from the costa. *Sori* usually in 2 rows on each side of the costa (3–4 sori on each vein-group) or in narrower pinnae only one row; indusium thin and translucent, at first covering sorus, later breaking irregularly and more or less persistent.

Type specimen: CLEMENS 11033, Mt Kinabalu, N. Borneo (MICH; dupl. at A, UC, K).

Distr. *Malaysia*: Borneo (Sarawak: Mt

Murud; N. Borneo: Mt Kinabalu).

Ecol. Near a waterfall and in wet ground near a stream, in forest, 1400–2100 m.

153. *Cyathea angustipinna* HOLTUM, Kew Bull. 16 (1962) 52.

Stipe 30 cm, smooth, scaly near base, scales pale, firm and shining, to c. 20 by 1½ mm, edges bearing copious short dark setae. *Fron*d 70 cm long, simply pinnate; pinnae about 18 pairs, jointed to rachis; terminal pinna like the rest, usually with a small rudiment beside it. *Pinnae* stalked to 12 mm or more (lowest longest), to 12 cm long, fertile ones 1–1.2 cm wide, sterile to 1.6 cm, bases narrowly cuneate (of lower ones somewhat asymmetric) apices shortly acuminate, edges entire except towards apices where they are crenate; *veins* commonly in groups of three, middle one sometimes forked, basispic one separately attached to costa. *Sori* 2 or 3 on each vein-group (middle vein not always soriferous), in two rather uneven rows on each side of the costa; indusium thin and pale, covering young sorus and breaking later, more or less persistent as a disc around base of old sorus; *costae* usually quite glabrous on both surfaces.

Type specimen: RICHARDS 1675, Mt Dulit, 1200 m, Sarawak (K).

Distr. *Malaysia*: Borneo (Sarawak, two collections).

Ecol. Sandy bank of a stream, near waterfall, in shade; trunk 50 cm.

154. *Cyathea moluccana* R. BR. in Desv. Mém. Soc. Linn. Paris 6 (1827) 322; v. A. v. R. Handb. (1908) 15; COPEL. Philip. J. Sc. 4 (1909) Bot. 32; v. A. v. R. Bull. Jard. Bot. Btzg II, n. 28 (1918) 12.—*Schizocaena brunonis* J. SM. ex HOOK. Gen. Fil. (1838) t. 2; J. SM. Hist. Fil. (1875) 243.—*C. brunonis* WALL. ex HOOK. Sp. Fil. 1 (1844) 15; Syn. Fil. (1865) 16; BEDD. Ferns Br. Ind. (1865) pl. 87; Handb. (1883) 5; CHRIST, Farnkr. Erde (1897) 318; DIELS in E. & P. Pfl. Fam. 1, 4 (1899) 127; COPEL. Sarawak Mus. J. 2 (1917) 345, 347; HOLTUM, Rev. Fl. Mal. 2 (1954) 117.—*C. pinnata* ROXB. Calc. J. Nat. Hist. 4 (1844) 517; Fl. Ind. ed. Clarke (1874) 762.—*Schizocaena gaudichaudii* FÉE, Gen. Fil. (1852) 354.—*C. pseudobrunonis* COPEL. Philip. J. Sc. 12 (1917) Bot. 50.—*C. fuscopaleata* COPEL. l.c. 50.—*C. kinabaluensis* COPEL. l.c. 51; C. CHR. Gard. Bull. S.S. 7 (1934) 218.—*Schizocaena moluccana* COPEL. Gen. Fil. (1947) 99.—*Schizocaena kinabaluensis* COPEL. l.c. 99.—Fig. 28a–e.

Trunk usually not over 50 cm tall. *Stipe* commonly 20–30 cm, dark, scaly near base and finely warty when scales have fallen; scales medium brown, firm, 15–30 by ½–3 mm, edges bearing setae little darker than scale. *Lamina* to 150 cm or more long (largest frond reported, stipe with lamina 308 cm), simply pinnate, apical pinna usually like the rest (sometimes with a rudiment at its base), all pinnae articulate to rachis. *Pinnae* stalked or the upper ones sessile (stalks variable in length, the lowest 5–10 mm), 12–28 by 2–4 cm, edges parallel for most of their length, base asym-

metric (rounded on acroscopic side, broadly cuneate on basispic side), apex shortly acuminate and crenate, edges otherwise entire, rarely slightly lobed with one lobe to each vein-group; *veins* in groups of 3 from the costa (basispic one usually separate from the other two), the median one forked once or twice to give a group of 3–6 (rarely to 10) veins at the edge, veins all free and all ending close to the margin, or sometimes the acroscopic vein ending in a sorus or joining with another vein. *Sori* in 1–3 (rarely more) rows on each side of the midrib, commonly 4–6 on each vein-group, exceptionally to 10 (in such cases the edge usually lobed), covered when young by a thin translucent indusium which breaks at maturity and is more or less persistent, or in some cases the indusium forming a disc which is hidden by the mature sporangia; lower surfaces of rachis, costae and veins usually glabrous, occasionally a few persistent small ciliate or setiferous scales present.

Type specimen: C. SMITH, Moluccas (BM).

Distr. *Malaysia*: Central Sumatra, Malay Peninsula, Lingga, Borneo (excluding south and south-west), South & Central (?) Celebes, Moluccas (Ceram, Ambon).

Ecol. In forests, 0–900 m.

Notes. Fronds bearing imperfect indusia appear to be most common in Borneo, but occur also in the Malay Peninsula. COPELAND described the three species *C. pseudobrunonis*, *C. fuscopaleata* and *C. kinabaluensis* as lacking indusia, but I have not found a specimen totally devoid of indusia, though in old specimens only small fragments remain (VAN ALDERWERELT made the same observation, 1918 l.c.). COPELAND thought that species could also be distinguished by size and colour of stipe-scales, but, after seeing a very large number of specimens, I cannot see any clear distinction into groups based on such characters. COPELAND's fourth species, *C. arthropoda*, is here regarded as distinct in shape of pinnae.

R. BROWN described this species, but did not name it, in 1810 (Prod. Fl. N. Holl. 158); DESVAUX supplied a name, copying the information provided by BROWN. The type must be the specimen seen from the Moluccas by BROWN, though it is not named by him.

155. *Cyathea arthropoda* COPEL. Philip. J. Sc. 6 (1911) Bot. 134, t. 13; v. A. v. R. Handb. Suppl. (1917) 22.—*Schizocaena arthropoda* COPEL. Gen. Fil. (1947) 99.

*Fron*ds simply pinnate; lamina to c. 70 cm long, apical pinna like the rest. *Pinnae* jointed to rachis, always stalked (stalks of upper pinnae c. 5 mm, of lower ones 12–15 mm), 12–20 cm long, fertile to 2½ cm wide, sterile to 3½ cm, base almost equally cuneate, apex caudate-acuminate (cauda to 4 cm long), sides for the most part not parallel. *Sori* in 1–3 irregular rows on each side of the costa; indusium a narrow irregular ring, hidden by sporangia, or lacking.

Type specimen: BROOKS 8, Bungo Range, Sarawak (MICH; dupl. at BM).

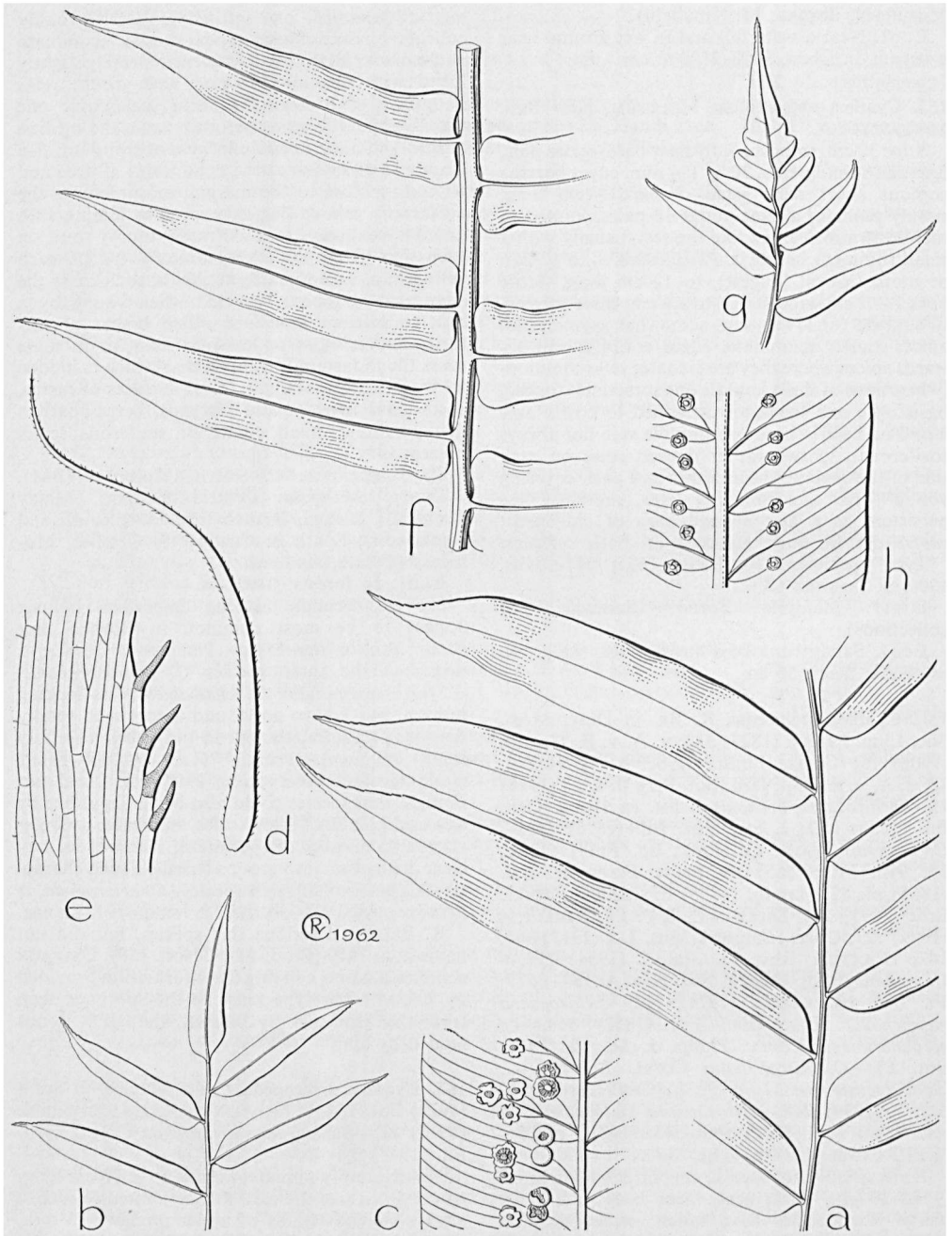


Fig. 28. *Cyathea moluccana* R. BR. *a.* Middle part of rachis with pinnae, $\times \frac{1}{2}$, *b.* apex of frond, $\times \frac{1}{2}$, *c.* part of pinna, showing venation and sori, $\times 1\frac{1}{2}$, *d.* scale from stipe, $\times 4$, *e.* edge of stipe-scale, $\times 40$. —*C. capitata* COPEL. *f.* Middle part of rachis with pinnae, $\times \frac{1}{2}$, *g.* apex of frond, $\times \frac{1}{2}$, *h.* part of pinna showing venation and sori, $\times 1\frac{1}{2}$ (*a-e* CUMING 378, *f* CLEMENS 27959, *g* JACOBS 5790, *h* CLEMENS 11033).

Distr. *Malaysia*: Sarawak (neighbourhood of Kuching).

Ecol. In lowland forest.

Note. This seems to be the most distinct of the "exindusiate" species described by COPELAND from Sarawak (see *C. moluccana*). Field study is necessary to decide whether or not it is connected by intermediate with typical *C. moluccana*, which occurs in the same district.

156. *Cyathea deminuens* HOLTUM, *nom. nov.*—*Alsophila parvifolia* HOLTUM, J. Mal. Br. R. As. Soc. 6 (1928) 19.

Trunk to 75 cm. *Stipe* to 15 cm; scales at base pale brown, rather firm, 10–15 mm by 1½ mm, edges closely set with dark setae. *Lamina* to 65 cm long, simply pinnate, pinnae pinnatifid, lower ones gradually reduced, lowest 3½ cm long. *Rachis* densely covered beneath throughout with stout pale spreading hairs to 3 mm long. Largest *pinnae* 9 by 2 cm, lobed ⅔ towards the costa; costules 5 mm apart; veins 6–7 pairs, basal basicopic vein from costa; lower surface of costae hairy towards base, and a few hairs on lower costules, no bullate scales seen; a few long hairs present on upper surface of costules and veins. *Sori* at about one third distance from costule to edge; no indusia; long paraphyses, with dark walls between the cells, present.

Type specimen: BODEN KLOSS 14579, Siberut, Mentawai Is (S; dupl. at BO; K).

Distr. *Malaysia*: Sumatra (two collections, the second from S. Sumatra).

Ecol. In lowland forest.

157. *Cyathea alternans* (WALL. ex HOOK.) PRESL, Abh. K. Böhm. Ges. Wiss. V, 5 (1848) 347; BEDD. Handb. Suppl. (1892) 2; v. A. v. R. Handb. (1908) 17; RIDL. J. Mal. Br. R. As. Soc. 4 (1926) 5, *incl. var. serrata* RIDL.; DOMIN, Acta Bot. Bohem. 9 (1930) 90, *incl. var. sarawakensis* (HOOK.) DOMIN and *var. lobbiana* (HOOK.) DOMIN; HOLTUM Rev. Fl. Mal. 2 (1954) 119.—*Polypodium alternans* WALL. Cat. (1829) n. 329, *nom. nud.*—*Hemitelia alternans* HOOK. Ic. Pl. (1844) t. 622; Sp. Fil. 1 (1844) 29.—*Amphicosmia alternans* MOORE, Ind. Fil. (1857) civ; BEDD. Handb. (1883) 10.—*C. lobbiana* HOOK. Syn. Fil. (1865) 24.—*C. sarawakensis* HOOK. l.c. 23; HOSE, J. Str. Br. R. As. Soc. 32 (1899) 35.—*Alsophila alternans* HOOK. Syn. Fil. (1866) 41; BEDD. Ferns Br. Ind. (1867) t. 236.—*Schizocaena alternans* J. Sm. Hist. Fil. (1875) 244; COPEL. Gen. Fil. (1947) 99.—*Alsophila janseniana* v. A. v. R. Bull. Jard. Bot. Btzig III, 5 (1922) 179.—*C. janseniana* DOMIN, Acta Bot. Bohem. 9 (1930) 126.

Trunk usually less than 2 m. *Stipe* to 60 cm, dark, persistently scaly near base, otherwise glabrescent and smooth; scales medium brown, firm, shining, to 30 by 2 mm, edges closely setiferous. *Pinnae* articulate to rachis, lowest somewhat reduced, largest commonly 25 by 4–5 cm, sometimes to 40 by 9 cm (in type of *C. sarawakensis* 50 by 16 cm), deeply lobed throughout or with few to many of the lobes separately joined by the more or less contracted base of their lamina to the

axis of the pinna, rarely the lowest one or two forming true pinnules with lamina quite free; costules of lobed pinnae 7–9 mm apart, of pinnae in which the lobes are free up to 15 mm apart; lobes which are not free usually entire and rounded at apex, free lobes acute at the apex or with margins sometimes broadly crenate, one crenation to each vein-group. *Veins* in the narrower, lobed, pinnae to c. 10 pairs in each lobe, individual veins forked once or twice; in free lobes the veins in small lateral pinnate groups. *Sori* usually in one row on each side of the costule of a lobe of a pinna, in the largest free lobes occasionally an incomplete second row; indusium varying greatly, in a minority of cases completely covering the young sorus and persistent, in most cases forming a disc of irregular width covered by the mature sorus, sometimes only detectable as small fragments; long pale paraphyses present. *Scales* on lower surface of pinna-midribs, costules and veins usually rather sparse, elongate, narrow and strongly setiferous, pale to medium brown, in some cases also bullate scales on costules; in some cases stout pale hairs present on distal parts of costae and costules and a few on veins.

Type specimen: WALLICH 329, Penang (K).

Distr. *Malaysia*: Sumatra (Karo plateau, Benkulen Distr.), Malay Peninsula (Penang, Perak, Negri Sembilan, Pahang, Trengganu, Kelantan), Sarawak and North Borneo.

Ecol. In forest, often near streams, at 300–1300 m.

Note. This species is usually found growing in association with *C. moluccana* R. Br. and always within the range of *C. moluccana*. The variable *C. alternans* has the appearance of being a series of hybrids between *C. moluccana* and either *C. squamulata* or *C. ridleyi* (which are bipinnate and exindusiate) with many possible combinations of characters of pinna-shape and of indusia and scales and hairs. The type specimen of *C. alternans* has pinnae to about 6½ cm wide, with 3 pairs of free adnate lobes, a few lobes longer than adjacent ones, as in the type of *Alsophila janseniana* v. A. v. R.; the sori have disc-shaped indusia, as shown in HOOKER, Ic. Pl. t. 622, though HOOKER stated later (Syn. Fil. 41) that "a depression formed by the sorus on the lobe was mistaken by the artist for an involucre". Hairs occur on the lower surface of costules in some Peninsular specimens (especially MOH. NUR 11269); I have not seen any on Bornean ones. Bullate scales appear more common in Peninsular than in Bornean specimens.

158. *Cyathea binuangensis* v. A. v. R. Bull. Jard. Bot. Btzig III, 2 (1920) 136; COPEL. Fern Fl. Philip. 2 (1960) 206.

Stipe 20 cm, densely scaly at base only; scales pale, thin, to 20 by 2 mm, edges bearing concolorous hairs. *Lamina* 50 cm long, simply pinnate. *Pinnae*: lowest slightly reduced; largest 18 by 4 cm, lobed to 3–4 mm from costa except at base where one segment is usually almost free; bases of pinnae conspicuously narrowed (free segment always smaller than rest), apex rather long-acuminate; lobes falcate, almost entire, their costules

to 9 mm apart; veins to about 10 pairs, mostly forked. *Sori* medial; indusium thin, breaking and persistent; paraphyses very dark. *Scales* on costae of pinnae very few, very narrow, pale, bearing sparse short concolorous hairs; no hairs seen on lower surface of pinnae, on upper surface present only near base of costae.

Type specimen: RAMOS & EDAÑO, BS 28779, Mt Binuang, Luzon (BO; dupl. at US, MICH, K).

Distr. *Malaysia*: Philippines (Luzon, one collection).

Note. This specimen has the aspect of a prematurely fertile plant of *C. integra* J. SM. ex HOOK., but it lacks the characteristic scales of that species. It has the same degree of division of the frond as *C. alternans* (WALL.) PRESL, but is very different in shape of pinnae, and in paraphyses. It might be a hybrid of *C. integra*, but I cannot suggest what other parent is likely.

159. *Cyathea elliptica* COPEL. Philip. J. Sc. 12 (1917) Bot. 51.—*C. subbipinnata* COPEL. *ibid.* 56 (1935) 471, pl. 1.—*C. holttumii* COPEL. *l.c.* 472, pl. 2.—*Gymnosphaera subbipinnata* COPEL. Gen. Fil. (1947) 99.—*Gymnosphaera holttumii* COPEL. *l.c.* 99.

Stipe scaly throughout, also bearing on abaxial surface some long spreading hairs, the latter sometimes very abundant and to 10 mm long; scales medium to light brown, shining, edges setiferous; main *rachis* similarly scaly and hairy, scales sometimes deciduous. *Pinnae*: lower ones not greatly reduced, largest 30–45 cm long. Largest *pinnules* 4.5–6.5 cm long, 10–14 mm wide, sessile, lobed half way to costa; costules 3½–4 mm apart; veins to 5 pairs; lamina-segments rather thin, entire, ends rounded. *Sori* medial; no indusia; paraphyses not longer than sporangia. *Scales and hairs*: lower surface of pinna-rachis lacking hairs or a few present near the base; costae bearing sparse narrow pale scales and sometimes a few hairs; costules bearing pale hair-pointed bullate scales.

Type specimen: CLEMENS 10859, Mt Kinabalu, N. Borneo, (MICH; dupl. at UC).

Distr. *Malaysia*: North Borneo.

Ecol. In forest, 900–1800 m.

Note. The type-collection of *C. holttumii* has much more abundant hairs on all parts of the frond than the other specimens referred to this species. The type of *C. subbipinnata* was collected at 1800 m, and is small, with largest pinnae only 10 cm long, having only one or two pairs of small free pinnules; the specimen is old and has lost most of its scales and hairs. It seems doubtful whether *C. elliptica* should be maintained as distinct from 174. *C. trichophora* COPEL.

160. *Cyathea obliqua* COPEL. in Elmer, Leaf. Philip. Bot. 4 (1911) 1150.—*Alsophila obliqua* C. CHR. Ind. Fil. Suppl. 1 (1913) 5; v. A. v. R. Handb. Suppl. (1917) 54.—*Gymnosphaera obliqua* COPEL. Gen. Fil. (1947) 98; Fern Fl. Philip. 2 (1960) 236.

Stipe unknown. *Pinnae* to 30 cm long. *Pinnules* to 72 by 10 mm, the lowest on stalks to 5 mm long,

articulate to rachis, base very unequally cuneate (narrow on basisopic side), apex caudate-acuminate, edges broadly crenate, lamina rather thin; veins in pinnate groups each with up to 4 pairs, lowest basisopic vein of each group springing from the costa. *Sori* 1–3 on each vein-group; no indusia; paraphyses as long as sporangia. *Scales and hairs*: pinna-rachis glabrous on lower surface; costal scales rather sparse, flat and ovate-acute to bullate and acuminate, light brown, most with a short fringe of pale hairs, some bearing dark setae.

Type specimen: ELMER 12354, Sibuyan I., Philippines (MICH; dupl. at K, A, BO, US, FI, S-PA, SYD, L).

Distr. *Malaysia*: Philippines (Sibuyan I., once collected), at 600 m.

161. *Cyathea integra* J. SM. ex HOOK. Ic. Pl. (1844) t. 638, *incl.* also var. *petiolata* HOOK. *l.c.* t. 638, fig. 2; Sp. Fil. 1 (1844) 26; Syn. Fil. (1865) 23; v. A. v. R. Handb. (1908) 20 (not Suppl. 25, which is *C. urdanetensis* COPEL.); COPEL. Philip. J. Sc. 4 (1909) Bot. 35; Fern Fl. Philip. 2 (1960) 200.—*Trichopteris falcata* LLANOS, Fragm. Pl. Filip. (1851) 111 (*fide* MERRILL, Sp. Blanc. 1918, 41).—*C. hypocateriformis* v. A. v. R. Bull. Jard. Bot. Btzig II, n. 7 (1912) 9; Handb. Suppl. (1917) 39; COPEL. in Elmer, Leaf. Philip. Bot. 5 (1913) 1680.—*C. bulusanensis* COPEL. in Elmer, Leaf. Philip. Bot. 9 (1920) 3109; Fern Fl. Philip. 2 (1960) 201.—*C. arguta* COPEL. Philip. J. Sc. 38 (1929) 133; Fern Fl. Philip. 2 (1960) 203.—*C. breviloba* COPEL. Philip. J. Sc. 81 (1952) 13; Fern Fl. Philip. 2 (1960) 201.—Fig. 29a, b.

Stipe 20–40 cm, base with spines 2 mm long; scales at base of stipe thin, pale, edges closely setiferous, to 25 by 1½ mm; also above base a more or less persistent cover of very small pale fringed or setiferous scales. Main *rachis* medium brown when dry, in basal part bearing scattered short spines, otherwise smooth and glabrescent. *Pinnae*: lowest c. 15 cm long, largest 60 cm. *Pinnules* on larger pinnae 80–120 by 15–25 mm, sessile or lowest stalked to 2 mm (rarely to 4 mm), apex acuminate (not caudate), in lowest pinnules on lower pinnae the basal segment sometimes just free, otherwise whole pinnule lobed to 2–3 mm from costa; costules 6 mm apart; veins 6–8 pairs; lamina-segments firm, edges almost entire or distinctly crenate towards apices, apex bluntly to acutely pointed at end of falcate costule. *Sori* medial; indusium at first complete, thin and translucent but firm, breaking and persisting at maturity; paraphyses abundant, as long as sporangia, pale. *Scales and hairs*: pinna-rachis beneath glabrescent, smooth or sparsely warty, residual scales small, pale, fringed or some with setae; on costae near base narrow pale scales with dark marginal setae, smaller ones with irregular fringe of pale hairs; on costules scales like smaller ones on costae, not bullate; stout spreading hairs rarely present on lower surface of costae and costules near apex of pinnule, not on upper surface of costules.

Type specimen: CUMING 120, Luzon (K; dupl. at US).

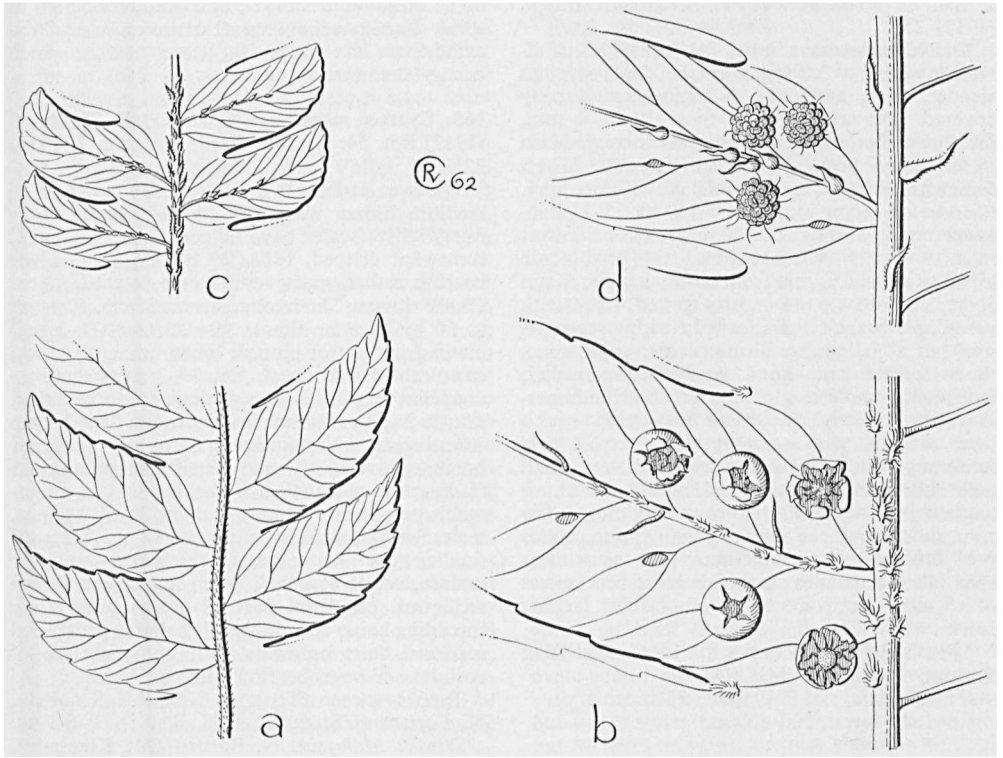


Fig. 29. *Cyathea integra* J. Sm. *a.* Part of pinnule, upper surface, $\times 2$, *b.* lower surface showing scales and sori, $\times 6$.—*C. squamulata* (Bl.) Copel. *c.* Part of sterile pinnule, lower surface, $\times 2$, *d.* part of fertile pinnule showing sori and scales, $\times 6$ (*a-b* SINCLAIR 9539, *c* SINCLAIR 10336, *d* KIAH 32179).

Distr. *Malaysia*: Philippines (Luzon, Mindoro, Panay, Samar, Catanduanes, Basilan, Biliran, Mindanao).

Ecol. In forest at low and medium altitudes; range reported 500–1200 m, but few specimens bear relevant information.

Notes. With the original description of this species, HOOKER cited first a specimen from Ambon, then CUMING 120 from Luzon; his figure was certainly prepared from the Luzon specimen, which I therefore regard as the type. The Ambon specimen is quite distinct in shape of lamina-segments and details of scales; it belongs to *C. tripinnatifida* ROXB.

There is considerable variation in size, shape and marginal teeth of the segments of the pinnules in *C. integra*; there is also variation in the presence of hairs on the lower surface of costae and in length of stalks of lower pinnules. I have not observed clear correlation of such characters, and do not think that *var. petiolata* HOOK. can be regarded as a distinct variety.

fallen; larger scales to 25 by 3 mm, shining brown with paler edges bearing many dark setae, also minute pale irregularly fringed scales; main rachis smooth, glabrescent. *Pinnae* to 45 cm long. *Pinnules* almost at right angles to rachis, to 65 by 12 mm, lobed less than half way to costa, lobes rounded and entire, texture coriaceous, the lowest pinnules with cordate bases and on stalks to 4 mm long; costules $3\frac{1}{2}$ –4 mm apart; veins 3–4 pairs, thick. *Sori* usually 3 to each lobe, medial; indusia pale, firm, complete, breaking irregularly and persistent; paraphyses dark. *Scales and hairs*: scales near base of costae ovate-acute, flat, light brown, with numerous crisped marginal hairs or the larger with some setae, grading to light brown bullate scales (often fringed near apices) on costules and on veins.

Type specimen: CLEMENS 33156, Mt Kinabalu, N. Borneo (K; dupl. at BO, A, UC, L).

Distr. *Malaysia*: N. Borneo (Mt Kinabalu, several collections).

Ecol. In open places in forest, 1200–1500 m.

162. *Cyathea stipitipinnula* HOLTUM, Kew Bull. 16 (1962) 62.

Stipe to more than 30 cm, medium dull brown, rather persistently scaly, warty where scales have

163. *Cyathea zamboangana* COPEL. Philip. J. Sc. 30 (1926) 325; Fern Fl. Philip. 2 (1960) 201.—*C. urdanetensis* COPEL. Philip. J. Sc. 38 (1929) 132; Fern Fl. Philip. 2 (1960) 203.—*C. integra* (*non*

J. Sm. *ex* Hook.) v. A. v. R. Handb. Suppl. (1917) 25.

Trunk: leaf-scars elliptic, 2½ cm wide, in alternate whorls of 3. *Stipe* 30 cm, base spiny (spines slender, dark, abundant, 1–3 mm) and densely covered with scales; scales to c. 10 by 1 mm, mostly smaller, edges with close dark setae. Main *rachis* spiny, pale, glabrescent. *Pinnae*: lowest somewhat reduced, largest to 60 cm or more long. *Pinnules* on larger pinnae 100–130 by 25–35 mm, lower ones on stalks 3–4 mm long, one lowest segment sometimes just free, rest of pinnule lobed to about 2½ mm from costa; costules 6 mm apart; veins to 8 pairs, mostly forked, a few with acroscopic branch again forked; lamina-segments thin but firm, apices falcate, acute, edge sometimes serrate near apex. *Sori* almost medial; indusium complete, globose, breaking and persistent at maturity. *Scales and hairs*: pinna-rachis pale, smooth, with some residual narrow pale setiferous scales; on costae scattered very small pale short-fringed scales and near base a few narrow pale setiferous scales, sometimes a few stout pale hairs near apex of pinnule; on costules pale bullate scales, sometimes with setae near apex, also sometimes stout pale hairs near apices of segments; upper surface of costules lacking hairs.

Type specimen: COPELAND 1646, near San Ramon, Mindanao (MICH).

Distr. *Malaysia*: Philippines (Mindanao).

Ecol. In forest, 500–800 m.

164. *Cyathea discophora* HOLTUM, Kew Bull. 16 (1962) 54.

Stipe finely warty throughout, persistently scaly near base; scales pale, to 25 by 2 mm, edges closely set with short dark setae; *rachis* light brown, glabrescent, sparsely and finely warty. *Pinnae* to 50 cm long, pinnules rather widely spaced. *Pinnules* sessile, to 8 by 1½ cm, lobed ⅓ towards the costa except at the very base, lowest segment not free; costules 4–4½ mm apart; lamina-segments rather thin, edges crenulate, apex broad, sinuses narrow; veins 6–7 pairs. *Sori* medial; indusium at length a thin brown disc of irregular shape, sometimes excentric, completely covered by mature sorus; paraphyses dark, a little longer than sporangia. *Scales and hairs*: pinna-rachis glabrescent beneath; costae rather densely scaly, scales at base pale, flat, elongate with short rather stiff pale marginal hairs, grading through similar scales bullate at base to rather large pale bullate scales with or without marginal hairs near their acuminate apices; a few long pale hairs on costa near apex of pinnule; costules bearing large pale bullate acuminate scales and few hairs; upper surface of costules glabrous.

Type specimen: CLEMENS 31698, Mt Kinabalu, N. Borneo (B; dupl. at US, BO).

Distr. *Malaysia*: N. Borneo (Mt Kinabalu, once collected).

Ecol. In open place in forest, 2400 m.

Note. This occurs within the altitudinal range

of *C. megalosora* COPEL., and is intermediate in soral characters between *C. megalosora* and the exindusiate *C. squamulata* (BL.) COPEL. which occurs at lower altitudes.

165. *Cyathea megalosora* COPEL. Philip. J. Sc. 12 (1917) Bot. 54; C. CHR. Gard. Bull. S.S. 7 (1934) 221.

Trunk to at least 2 m. *Stipe* c. 30 cm, pale to medium brown when dry, densely scaly, finely warty where scales have fallen; scales thin, pale, somewhat crisped, to c. 25 by 1½ mm, edges bearing rather sparse dark setae towards apex. *Pinnae*: lowest 20 cm long, largest 35 cm. *Pinnules* to 60 by 12 mm, almost sessile; lowest 1–2 segments free, rest of pinnule lobed nearly to costa; costules 4–5 mm apart; veins 5–7 pairs; lamina-segments very firm, edges crenate, apices rounded, sinuses narrow. *Sori* medial; indusium firm, brown-translucent, quite covering sorus to maturity, breaking irregularly and persistent; paraphyses as long as sporangia. *Scales and hairs*: pinna-rachis persistently densely scaly on lower surface, scales long, pale, entire or nearly so, bases of smaller ones bullate; costae densely scaly on lower surface, scales elongate, pale, almost entire, not setiferous, on distal part of costae many long spreading hairs; costules bearing similar hairs, and scattered hairs on veins also; upper surface of costules and veins bearing long pale hairs.

Type specimen: TOPPING 1759, Mt Kinabalu, N. Borneo (US; dupl. at A, K, SING, S-PA).

Distr. *Malaysia*: N. Borneo (Mt Kinabalu).

Ecol. In mossy forest on ridges, 2200–2900 m. At the highest altitudes the lamina of fronds may be only 40 cm long, pinnae to 10½ by 2½ cm, with about 5 pairs of free pinnules which are lobed half-way to the costa.

166. *Cyathea suluensis* BAK. J. Bot. 17 (1879) 65; v. A. v. R. Handb. (1908) 18; COPEL. Philip. J. Sc. 4 (1909) Bot. 35; Fern Fl. Philip. 2 (1960) 202. —*C. sessilipinnula* COPEL. Philip. J. Sc. 38 (1929) 134; Fern Fl. Philip. 2 (1960) 202.

Stipe to more than 30 cm, minutely spiny to the base; no scales seen. *Pinnae*: lowest about 10 cm long, largest 30 cm. *Pinnules* on larger pinnae 50–70 by 13–18 mm, sessile, short-acuminate, lobed ½–¾ towards the costa, no free basal segments; costules 4–5 mm apart; veins 4–7 pairs, strongly oblique; lamina-segments thin, slightly crenate near rounded apices, sinuses narrow. *Sori* medial; indusium complete, thin, pale, breaking irregularly and persistent. *Scales and hairs*: pinna-rachis beneath glabrescent, residual scales small, pale, short-fringed; on costae near base narrow flat pale dark-setiferous scales, throughout brown bullate scales, often with setae near apex, distally some stout pale hairs; on costules bullate scales, pale brown, and a few hairs; no hairs on upper surface of costules.

Type specimen: BURBIDGE *s.n.*, 1877–78, Sulu Is (K).

Distr. *Malaysia*: Philippines (Mindanao, Basilan, Sulu Is), Moluccas (Ternate ?).

Ecol. At c. 600 m.

Note. Specimens from Ternate placed tentatively in this species are young and sterile; they agree in form of pinnules, venation and scales, but differ in having rather numerous stout hairs on the upper surface of costules.

167. *Cyathea robinsonii* COPEL. Philip. J. Sc. 6 (1911) Bot. 145; v. A. v. R. Handb. Suppl. (1917) 30; COPEL. Fern Fl. Philip. 2 (1960) 203.—*C. pseudoalbizzia* COPEL. Philip. J. Sc. 38 (1929) 135; Fern Fl. Philip. 2 (1960) 203.

Stipe to at least 40 cm, warty where scales have fallen; scales pale to brownish, shining, to 20 mm long, edges setiferous; *main rachis* finely warty, bearing some hairs throughout, densely hairy towards apex of frond, hairs mixed with small pale scales. *Pinnae* to 40 cm long. *Pinnules* to 100 by 20 mm, the lowest with stalks 5–10 mm long; at base of larger pinnules 1–2 pairs of free tertiary leaflets, then several pairs of segments separately adnate by narrow bases to costa, rest of pinnule lobed nearly to costa; costules on larger pinnules 5–7 mm apart; lamina-segments firm, dark on upper surface when dry, edges almost entire; veins 5–6 pairs. *Sori* medial; indusium at first complete, rather firm, breaking irregularly and persistent. *Scales and hairs*: pinna-rachis and costae densely hairy and scaly on lower surface, hairs spreading, pale, 2 mm long, scales narrow, pale, sometimes setiferous; on lower surface of costules and veins abundant pale spreading hairs, no scales.

Type specimen: ROBINSON BS 9394, Mt Binuang, Luzon (MICH; dupl. at K, US, P, UC).

Distr. *Malaysia*: Philippines (Luzon).

Ecol. At 875–1150 m.

Note. The type of *C. pseudoalbizzia* is small, with pinnules to 70 by 12 mm.

168. *Cyathea senex* v. A. v. R. Bull. Jard. Bot. Btztg II, n. 16 (1914) 4; Handb. Suppl. (1917) 34.

Stipe densely scaly throughout, scales to 30 mm long, mostly not over 1 mm wide, pale, edges closely set with dark setae; *main rachis* similarly scaly near base only. *Pinnae* to 40 cm long; lowest pinnae somewhat reduced. *Pinnules* to 80 by 12 mm, lowest 1 or 2 segments almost free, rest of pinnule lobed to within 1 mm of costa; costules 3½ mm apart; lamina-segments firm, dark above when dry, edges crenate, sinuses narrow; veins to 6 or 7 pairs. *Sori* medial, indusium at first thin and complete, breaking and persistent; paraphyses pale. *Scales and hairs*: pinna-rachis bearing pale spreading hairs and many small pale setiferous scales; scales at base of costae narrow, pale, setiferous, grading to acuminate bullate scales at apex, spreading hairs present throughout; a few bullate scales present on costules, with many hairs; erect pale hairs also present on lower surface of veins; thick curved hairs scattered on upper surface of costules and veins.

Type specimen: MATTHEW 526-A, Mt Singgalang, Sumatra (BO; dupl. at K).

Distr. *Malaysia*: Central Sumatra.

Ecol. At 1500–1800 m.

Note. MATTHEW gave the number 526 also to specimens of *C. sumatrana* BAK., which are at Kew, from the same locality.

169. *Cyathea sibuyanensis* COPEL. in Elmer, Leaf. Philip. Bot. 4 (1911) 1150; v. A. v. R. Handb. Suppl. (1917) 38; COPEL. Fern Fl. Philip. 2 (1960) 204.

Stipe not known. *Main rachis* closely warty on lower surface, bearing many very small dull scales. *Pinnae* to 35 cm long. *Pinnules* to 90 by mostly to 20 mm (on a lower pinna to 25 mm), lowest 1–2 pairs of segments quite free (lowest sometimes stalked) and deeply lobed at the base, then several segments contracted at the base and separately adnate to the costa, rest of pinnule lobed almost to the costa; costules 5–6 mm apart, decidedly oblique; lamina-segments firm, edges almost entire to crenate; veins 6–7 pairs, the lowest in lobes of basal segments pinnately branched. *Sori* medial; indusium pale and translucent, at first completely covering sorus, breaking and persistent. *Scales and hairs*: pinna-rachis closely warty and covered with very small dull scales, the largest setiferous, hairs also mixed with the scales, at least towards apex of pinna; costae scaly near base, hairy in apical half, scales mostly ovate-acute, hardly 1 mm long, brown, edges with a few setae or short hairs near tip, none bullate; costules bearing hairs on lower surface, but no hairs on veins; costules glabrous on upper surface.

Type specimen: ELMER 12513, Mt Giting-Giting, Sibuyan I. (MICH; dupl. at K, A, FI, US, BO, P, SYD, U, L).

Distr. *Malaysia*: Philippines (Sibuyan, one collection).

Ecol. Altitude 1450 m.

170. *Cyathea philippinensis* BAK. Ann. Bot. 5 (1891) 186; v. A. v. R. Handb. (1908) 16, 783; COPEL. Philip. J. Sc. 4 (1909) Bot. 111, *incl. var. nuda* COPEL.; v. A. v. R. Handb. Suppl. (1917) 23; COPEL. Fern Fl. Philip. 2 (1960) 205.—*C. bicolorana* COPEL. in Elmer, Leaf. Philip. Bot. 9 (Mar. 1920) 3108; Fern Fl. Philip. 2 (1960) 204.—*C. ramosiana* v. A. v. R. Bull. Jard. Bot. Btztg III, 2 (June 1920) 137; COPEL. Fern Fl. Philip. 2 (1960) 206.—*C. heteroloba* COPEL. Philip. J. Sc. 38 (1929) 134; Fern Fl. Philip. 2 (1960) 204.—*C. bontocensis* COPEL. Philip. J. Sc. 46 (1931) 209; Fern Fl. Philip. 2 (1960) 205.

Stipe 12–35 cm, base dark and warty; scales pale to brownish, to 25 by 2 mm, edges bearing concolorous setae. Lowest *pinnae* 4–10 cm long, largest to 30 cm. *Pinnules* to 65 by 15 mm, lowest 2–3 segments of larger pinnules free or nearly so, rest of pinnule lobed ½–¾ towards costa; costules 3½–5½ mm apart; lamina-segments entire, apex broadly rounded; veins 4–6 pairs. *Sori* nearer to costule than edge; indusium complete, thin, translucent, breaking and persistent. *Scales and hairs*: on lower surface of pinna-rachis narrow

pale setiferous scales; on costae at base elongate flat scales with pale fringe or dark setae, grading to pale bullate scales, pale thick hairs also usually present near apex of costa; on costules bullate scales, some fringed near apices, and usually also a few hairs; no hairs on upper surface of costules and veins.

Type specimen: *ex* Hort. Veitch, cult. Kew, origin Philippines, Feb. 1878 (K).

Distr. *Malaysia*: Philippines (Luzon, Mindoro).

Ecol. In mountain forest (only altitude records are 1400–1500 m).

Note. The type specimen is a frond of a small cultivated plant, bearing pinnules only 20 by 6 mm, but in general shape and in scales and sori it resembles the type specimens of the other species above cited, from which the present description is prepared.

171. *Cyathea assimilis* Hook. Syn. Fil. (1865) 24; v. A. v. R. Handb. (1908) 20; COPEL. Philip. J. Sc. 4 (1909) Bot. 49.—*C. beccariana* CESATI, Atti Ac. Napoli 7^a (1876) 3.—*C. dulitensis* BAK. Kew Bull. (1896) 40; v. A. v. R. Handb. (1908) 16; COPEL. Philip. J. Sc. 4 (1909) 33.—*C. ampla* COPEL. Philip. J. Sc. 6 (1911) Bot. 361; v. A. v. R. Handb. Suppl. (1917) 26; non HOLTUM, Rev. Fl. Mal. 2 (1954) 135.—*C. stipitulata* COPEL. Philip. J. Sc. 6 (1911) Bot. 362; v. A. v. R. Handb. Suppl. (1917) 29.

Stipe to 65 cm, medium to dark brown, finely warty, persistently scaly near base; scales medium brown, shining, firm, 15–20 by 1–2 mm, edges closely setiferous. *Lamina* to almost 200 cm long; largest *pinnae* to 55 cm long, more or less distinctly articulate to rachis, the lower *pinnae* with stalks to 4 cm long. Largest *pinnules* 80–90 by 25 mm, the lowest with stalks 4–8 mm, basal 1–2 lamina-segments quite free, next 1–2 pairs sometimes free with adnate base, rest of pinnule lobed to 1–2 mm from costa, apex evenly attenuate; in somewhat smaller pinnules only the basal basiscopic segment free, or no free segments; costules 5–7 mm apart; lamina-segments firm, edges more or less crenate, apices rounded; veins 8–10 pairs. *Sori* medial; indusium at first quite covering sorus, pale and thin, breaking irregularly and persistent. *Scales and hairs*: pinna-rachis beneath glabrous or with a few small setiferous scales; costae beneath near base bearing narrow strongly setiferous scales grading to small bullate setiferous scales distally and on costules; no hairs on lower surfaces of pinna-rachis, costae and costules.

Type specimen: LOBB *s.n.*, 1857, hills, Sarawak (K).

Distr. *Malaysia*: S. Sumatra (Mt Dempo), Borneo (Sarawak).

Ecol. Forests, 300–2000 m, the more coriaceous specimens in ridge-forest on sandstone.

Notes. The type collection of *C. dulitensis* was a small plant with largest *pinnae* only just pinnate at base; the later collection of RICHARDS from the same locality has amply bipinnate fronds, agreeing in other characters, and probably re-

presents the full development of the species. All specimens from Mt Dulit are much darker in all parts than those from elsewhere in Sarawak (*e.g.*, the type of *C. assimilis*) and have a thicker lamina, but do not differ in other characters. The specimen from Mt Dempo in Sumatra is dark like those from Dulit.

The type collection of *C. stipitulata* is an unusually small specimen, with pinnules 70 by 17 mm, costules 4½ mm apart and veins 6–7 pairs; it was found on Mt Matang, near Kuching, at 300 m.

In HOLTUM, Rev. Fl. Mal. 2 (1954) 135, the name *C. ampla* is wrongly given to a specimen of *C. polypoda* which has unusually wide pinnules; this latter species is quite exindusiate.

C. assimilis is closely related to *C. philippinensis* BAK. and appears to differ chiefly in the consistently larger size of all parts of the frond.

172. *Cyathea trichodesma* (SCORT.) COPEL. Philip. J. Sc. 4 (1909) Bot. 55.—*Alsophila trichodesma* SCORT. in Bedd. J. Bot. 25 (1887) 321; BEDD. Handb. Suppl. (1892) 3; v. A. v. R. Handb. (1908) 35.—*Alsophila margarethae* SCHROET. *ex* CHRIST, Ann. Jard. Bot. Btzg 20 (1905) 136; v. A. v. R. Handb. (1908) 33.—*C. margarethae* COPEL. Philip. J. Sc. 4 (1909) Bot. 38; C. CHR. Gard. Bull. S.S. 7 (1934) 220.—*C. burbridgei* [non (BAK.) COPEL.] HOLTUM, Rev. Fl. Mal. 2 (1954) 124.

Trunk slender, to 4½ m. *Stipe* fairly long, near base densely scaly (not hairy), finely warty when scales have fallen; scales medium to light brown, shining, firm, rather dark brown when dried, to about 25 by 2 mm, edges closely set with short dark setae. *Frond* including stipe 2–3½ m long. *Pinnae*: lowest slightly reduced, largest about 60 cm long. *Pinnules* commonly to 90 by 15 mm, largest seen 110 by 20 mm, nearly sessile, shortly acuminate, lobed to about 2 mm from costa, no free basal segments; costules 4½–5 mm apart; veins 6–8 pairs; lamina-segments thin, crenate, sinuses narrow. *Sori* medial, often confluent at maturity; no indusium; paraphyses a little longer than sporangia. *Scales and hairs*: pinna-rachis, costae, costules and veins on lower surface bearing many pale spreading hairs 1–2 mm long; scales on costae and costules sparse, pale, some narrow and flat, some bullate, most bearing dark setae; hairs present on upper surface of costules and veins.

Type specimen: SCORTECHINI *s.n.*, Perak (BM).

Distr. *Malaysia*: Malay Peninsula (central part), Borneo (Sarawak, N. Borneo).

Ecol. Lowland forest, sometimes by rivers, to 1500 m in N. Borneo.

Notes. Bornean specimens are all smaller than those from the Malay Peninsula, the largest having pinnules to 70 by 15 mm; they also lack hairs on the upper surface of costules. In size, the Bornean specimens are nearer to *C. trichophora*, but the distribution of hairs is different.

In the Malay Peninsula has been found a specimen rather intermediate between *C. trichodesma* and *C. alternans*, both of which species were growing near it.

173. *Cyathea wallacei* (METT. in KUHN) COPEL. Philip. J. Sc. 4 (1909) Bot. 48.—*Alsophila wallacei* METT. in Kuhn, Linnaea 36 (1869) 153; v. A. v. R. Handb. (1908) 36.—*Alsophila burbridgei* BAK. J. Bot. 17 (1879) 38; v. A. v. R. Handb. (1908) 33.—*C. burbridgei* COPEL. Philip. J. Sc. 4 (1909) Bot. 55; non HOLTTUM, Rev. Fl. Mal. 2 (1954) 124, which is *C. trichodesma*.—*Gymnosphaera burbridgei* COPEL. Gen. Fil. (1947) 99.

Stipe 30 cm or more, pale and smooth above the base; scales at base light brown, firm, to 15 by 2 mm, setiferous; main *rachis* finely hairy on abaxial surface in apical part. Largest *pinna* seen 38 cm long. *Pinnules* to 65 by 13 mm, sessile, apex abruptly narrowed, lobed to within 1 mm of costa, lowest segment almost free; costules 3–3½ mm apart; lamina-segments thin, slightly crenate, sinuses narrow; veins 4–6 pairs, mostly simple. *Sori* medial, lacking indusia. *Scales and hairs*: lower surface of pinna-rachis, costae, costules and veins bearing pale spreading hairs 1 mm long; pale bullate scales present on costae and costules; upper surface of costules and veins bearing scattered long spreading hairs.

Type specimen: WALLACE *s.n.*, 1857, Borneo (original lost ?; dupl. at Kew).

Distr. *Malaysia*: Borneo (Sarawak; N. Borneo).

Ecol. In lowland forest, at least sometimes on poor sandstone soil.

Notes. The pinnules of this species are more deeply cut than those of other species of *sect. Schizocaena*, and have closer costules; they have the aspect of *sect. Sphaeropteris*, but are much smaller than normal in that section, and have hairiness like that of some members of *sect. Schizocaena*.

Alsophila wallacei was credited to METTENIUS by CHRISTENSEN, Ind. Fil., but it was described without author's name in the original paper.

174. *Cyathea trichophora* COPEL. Philip. J. Sc. 6 (1911) Bot. 363.—*C. poiensis* COPEL. l.c. 362.—*Alsophila poiensis* v. A. v. R. Handb. Suppl. (1917) 56.—*Alsophila trichophora* v. A. v. R. l.c. 72.—*C. mollis* COPEL. Philip. J. Sc. 12 (1917) Bot. 52; C. CHR. Gard. Bull. S.S. (1934) 220.—*C. ramosii* COPEL. Philip. J. Sc. 30 (1926) 325.—*Alsophila ramosii* C. CHR. Ind. Fil. Suppl. 3 (1934) 23.—*C. bipinnatifida* COPEL. Philip. J. Sc. 56 (1935) 97, pl. 2 (not *C. bipinnatifida* (BAK.) DOMIN, 1929).—*Gymnosphaera bipinnatifida* COPEL. Gen. Fil. (1947) 99.—*Gymnosphaera mollis* COPEL. l.c. 99.—*Gymnosphaera trichophora* COPEL. l.c. 99; Fern Fl. Philip. 2 (1960) 236.

Trunk to 50 cm. *Stipe* 25–50 cm, at least the basal part persistently scaly, scales to 20 by 3 mm, light brown, shining, edges setiferous; main *rachis* bearing more or less abundant narrow pale setiferous scales and also spreading hairs 2 mm long. *Pinnae*: lowest reduced and deflexed, largest 25–30 cm long. *Pinnules* 30–55 by 10–14 mm, lobed half-way to costa; costules 3½–4 mm apart; veins 3–5 pairs; lamina-segments thin, entire, ends rounded. *Sori* medial; no indusia; paraphyses not longer than sporangia. *Hairs* rather abundant on lower

surface of pinna-rachis and costae, sometimes on costules; some pale bullate scales present on costules.

Type specimen: RAMOS 949, Prov. Laguna, Luzon (MICH; dupl. at FI, UC).

Distr. *Malaysia*: Philippines (throughout), Borneo (Sarawak and N. Borneo).

Ecol. Apparently in low country forest, highest record 1200 m.

Notes. The type of *C. bipinnatifida* (from Basilan I.) is from a young plant, with simply pinnate frond bearing few sori; the upper pinnae are closely similar to pinnules of other specimens referable to *C. trichophora*. It may be that *C. trichophora* and *C. elliptica* should be united; the latter has a different distribution of hairs and has apparently only been found at higher altitudes.

175. *Cyathea polyropa* BAK. Trans. Linn. Soc. II, Bot. 4 (1894) 250; v. A. v. R. Handb. (1908) 18; C. CHR. Gard. Bull. S.S. 7 (1934) 219; HOLTTUM Rev. Fl. Mal. 2 (1954) 122.—*C. kemberangana* COPEL. Philip. J. Sc. 12 (1917) Bot. 52; C. CHR. Gard. Bull. S.S. 7 (1934) 219.—*Alsophila kemberangana* C. CHR. Ind. Fil. Suppl. 3 (1934) 22.—*Gymnosphaera dinagatensis* COPEL. Philip. J. Sc. 81 (1952) 19, pl. 14; Fern Fl. Philip. 2 (1960) 235.—*C. ampla* (non COPEL.) HOLTTUM, Rev. Fl. Mal. 2 (1954) 125.—*Gymnosphaera glabra* (non BL.) COPEL. Fern Fl. Philip. 2 (1960) 235.

Trunk to 3 m, covered with persistent leaf-bases; small branches often borne on lower part of trunk. *Stipe* to 80 cm, pale (green when living) to rather dark, densely scaly near base, finely warty after scales have fallen; scales shining medium brown, firm, to 30 by 2 mm, edges bearing close concolorous setae; *rachis* and pinna-rachis glabrescent on lower surface. *Pinnae* to 60 cm long, lower ones long-stalked, not greatly reduced. *Pinnules* commonly 85 by 20 mm, sometimes to 110 by 27 mm, all stalked, stalks of lowest to 9 mm; basal 1–2 segments of lowest pinnules of largest pinnae quite free, then sometimes a pair with lamina adnate at base but free, rest of pinnule (whole of smaller pinnules) lobed to 1–2 mm from costa; costules 4½–5½ (sometimes to 6½) mm apart; veins 7–9 pairs, forked, acroscopic branch sometimes forked again; lamina-segments rather thick and rigid when dry, edges crenate, apices rounded, sinuses narrow except near base of largest pinnules. *Sori* nearer to costule than to edge; no indusium; paraphyses a little longer than sporangia. *Scales and hairs*: small dark to medium brown setiferous scales near base of costae; bullate scales, often setiferous, on costules, all scales often early caducous.

Type specimen: HAVILAND 1479, Mt Kinabalu, N. Borneo (K).

Distr. *Malaysia*: Malay Peninsula, Borneo (Sarawak, N. Borneo), Philippines (Panay, Mindanao).

Ecol. In open places on ridge-crests and summits, 600–2200 m; specimens from the higher elevations are decidedly coriaceous.

Note. BAKER described this species as indusiate;

he had a young frond on which bullate scales in some cases partly cover the immature sori.

176. *Cyathea obscura* (SCORT.) COPEL. Philip. J. Sc. 4 (1909) Bot. 37; HOLTUM, Rev. Fl. Mal. 2 (1954) 124.—*Alsophila obscura* SCORT. in BEDD. J. Bot. 25 (1887) 321, t. 278, fig. 2; Handb. Suppl. (1892) 3; v. A. v. R. Handb. (1908) 34; Suppl. (1917) 57.—*Alsophila subobscura* v. A. v. R. Bull. Jard. Bot. Btzig II, n. 20 (1915) 1, t. 1; Handb. Suppl. (1917) 57.—*C. bartlettii* COPEL. Un. Cal. Publ. Bot. 14 (1929) 371.—*C. pulchra* COPEL. l.c. 372.—*C. subobscura* DOMIN, Pterid. (1929) 263.—*Alsophila bartlettii* C. CHR. Ind. Fil. Suppl. 3 (1934) 20.—*Alsophila pulchra* C. CHR. l.c. 23.—*Gymnosphaera pulchra* COPEL. Gen. Fil. (1947) 99.

Stipe dark to medium brown, densely scaly towards the base, finely warty where scales have fallen; scales 20–40 by 2–3½ mm, shining, pale brown, edges closely setiferous. *Pinnae*: lowest somewhat reduced (sometimes only 10 cm long), largest 50 cm long. *Pinnules*: largest commonly 60–70 by 12–13 mm, largest seen 80 by 15 mm, on stalks 1–2 mm long, apex shortly acuminate, edges lobed ½–⅔ distance to costa; costules 3½–4 mm apart; veins about 6 pairs; lamina-segments firm, edges almost entire, apices bluntly pointed and asymmetric. *Sori* medial, on about 3 pairs of basal veins only, becoming quite confluent at maturity; no indusium; paraphyses copious, pale, much longer than sporangia. *Scales and hairs*: main rachis and pinna-rachis minutely warty and glabrescent beneath or bearing small setiferous scales; costae near base bearing very narrow dark-setiferous scales; costules bearing pale bullate scales often with dark setae near their apices; no hairs on lower surface; no hairs on upper surface of costules and veins.

Type specimen: SCORTECHINI *s.n.*, Perak (BM; dupl. at K, SING).

Distr. *Malaysia*: Sumatra and Malay Peninsula. Ecol. In forest, 900–1400 m.

177. *Cyathea agatheti* HOLTUM, Kew Bull. 16 (1962) 51.

Trunk hardly 5 cm high. *Stipe* 35–75 cm, dark towards base which is covered with scales, slightly warty where scales have fallen, distal part and rachis pale (green when living), smooth and glabrous; scales on base of stipe to 10 by 2–2½ mm, light brown with somewhat paler edges which bear many rather long dark setae. *Lamina* 50–60 cm long; *pinnae* distinctly articulate to rachis, lowest somewhat reduced, largest 18–25 cm long. *Pinnules* to 35 by 10 mm, abruptly narrowed at apex, lobed to within 1 mm of costa, lowest on stalks 1 mm long; costules 3 mm apart; lamina-segments thin, almost entire, sinuses narrow; veins 4–5 pairs, simple. *Sori* medial on veins; no indusia; paraphyses dark, shorter than sporangia. *Scales and hairs*: lower surface of costae bearing scattered spreading pale hairs, and a very few hairs on costules; scales very few, only seen on young frond, narrow, pale, ciliate; upper surface of costae, costules and veins bearing scattered long spreading

hairs in addition to the usual antrorse hairs on costae.

Type specimen: KOSTERMANS 12870, W. Kutai, E. Borneo (BO; dupl. at K, L).

Distr. *Malaysia*: E. Borneo (one collection).

Ecol. In *Agathis*-forest on water-logged white acid sand, 600 m.

178. *Cyathea squamulata* (BL.) COPEL. Philip. J. Sc. 4 (1909) Bot. 37; HOLTUM, Rev. Fl. Mal. 2 (1954) 122, fig. 49.—*Gymnosphaera squamulata* BL. En. Pl. Jav. (1828) 243; COPEL. Gen. Fil. (1947) 99; Fern Fl. Philip. 2 (1960) 235.—*Alsophila squamulata* HOOK. Sp. Fil. 1 (1844) 51, *p.p.*; METT. Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 52; RACIB. Fl. Btzig 1 (1898) 33; v. A. v. R. Handb. (1908) 33; Suppl. (1917) 56.—*Alsophila comosa* WALL. ex HOOK. Sp. Fil. 1 (1844) 53; Syn. Fil. (1865) 41; BEDD. Ferns Br. Ind. (1865) pl. 84; Handb. (1883) 13.—*Alsophila laeta* KUNZE, Bot. Zeit. 4 (1846) 476, *p.p.*—*Alsophila oligosora* MIQ. Verh. Kon. Ned. Inst. Wet. 3, pt 4 (1851) 43.—*Alsophila ridleyi* BAK. Ann. Bot. 8 (1894) 122; v. A. v. R. Handb. (1908) 32.—*C. ridleyi* COPEL. Philip. J. Sc. 4 (1909) Bot. 36.—*C. brooksii* COPEL. *ibid.* 6 (1911) Bot. 135, pl. 16, not *C. brooksii* MAXON, 1904.—*C. paraphysata* COPEL. l.c. 135, pl. 15.—*Alsophila sarawakensis* C. CHR. Ind. Fil. Suppl. (1913) 5.—*Alsophila xantholepia* v. A. v. R. Bull. Jard. Bot. Btzig II, n. 23 (1916) 1; Handb. Suppl. (1917) 489, not *Alsophila xantholepis* CHRIST, 1899.—*Alsophila paraphysata* v. A. v. R. Handb. Suppl. (1917) 58.—*Alsophila allocota* v. A. v. R. Bull. Jard. Bot. Btzig III, 5 (1922) 180.—*Alsophila glabrescens* v. A. v. R. l.c. 181.—*C. deuterobrooksii* COPEL. Philip. J. Sc. 38 (1929) 131.—*C. allocota* DOMIN, Acta Bot. Bohem. 9 (1930) 89.—*C. glabrescens* DOMIN, l.c. 119.—*C. xanthina* DOMIN, l.c. 172.—*Alsophila xanthina* C. CHR. Ind. Fil. Suppl. 3 (1934) 24.—*Gymnosphaera sarawakensis* COPEL. Gen. Fil. (1947) 99.—Fig. 8c, 29c-d.

Trunk to c. 2 m. *Stipe* 40–60 cm, densely and persistently scaly for most of its length (main rachis sometimes also persistently scaly); scales firm, medium brown, largest 30 by 2–3 mm (rarely to 40 by 4 mm), edges closely set with dark setae. *Frond* to c. 150 cm long. *Pinnae*: lowest somewhat reduced, variable; largest 50 cm long. *Pinnules* commonly to 80 by 15 mm, largest seen 100 by 20 mm, lower ones on stalks 1–2 mm long, apex shortly acuminate, edges lobed ½–⅔ distance towards costa, no free basal segments but pinnules on exceptionally large pinnae sometimes lobed nearly to costa at base; costules 3½–4½ mm apart; veins 6–9 pairs, of smaller pinnules mostly simple, of larger ones mostly forked; lamina-segments rather thin, edges almost entire, apices rounded and asymmetric. *Sori* a little nearer to costule than to edge; no indusia; pale paraphyses usually longer than sporangia. *Scales and hairs*: pinna-rachis glabrescent beneath, finely warty, sometimes with residual small setiferous scales; on costae, near base, usually narrow flat brown strongly setiferous scales, grading to bul-

late ones distally; on costules pale bullate scales, the larger ones acuminate and setiferous near apices; a few stout hairs on upper surface of costules.

Type specimen: KUHLE & VAN HASSELT, Pasir Ipi, W. Java (L).

Distr. *Malaysia*: Sumatra, Malay Peninsula, Java, Borneo, S. Philippines (Sulu Arch.).

Ecol. A small tree-fern of forest, not in open places, in lowlands and to c. 1500 m (rarely above 1000 m in the Peninsula); specimens from 2500 m

have been found on Mt Kinabalu, N. Borneo, and are small, with exceptionally scaly rachis, but do not appear to differ significantly in other ways.

Note. The type specimens of *Alsophila comosa* and *A. ridleyi* are both from Singapore I. The latter is only distinct in smaller size and less deeply lobed pinnules. Similar differences characterize the other species reduced to synonymy. The type collection of *C. squamulata* includes a small frond only 60 cm long in all, with pinnae to 8 cm long and very few free pinnules, but fertile.

4b. Subsection *Sarcopholis*

HOLTUM, *subsect. nov.*—Fig. 30.

A subsectione Schizocaena differt: paleis stipitis carnosis ascendentibus, apices versus planis setiferisque.

Type species: *Cyathea rosenstockii* BRAUSE.

Distr. *Malaysia*: Moluccas and New Guinea to Polynesia.

Taxon. Fleshy upcurved bases of stipe-scales (fig. 30) are the distinctive character of this subsection; distally these fleshy bases are more or less abruptly flattened to scales which have setiferous margins. The flat distal parts are often eroded from herbarium specimens; a careful morphological and developmental study from good fresh material is needed. Some species have the fleshy bases less developed, and I am not sure that there is a sharp distinction from *subsect. Schizocaena*. The scale-bases in *C. pulcherrima* COPEL. (*subsect. Sphaeropteris*) are comparable developments, but they are slender, rigid, and spread at right angles to the surface of the stipe.

KEY TO THE SPECIES

1. Pinna-rachis hairy on the lower surface.
 2. Scales on costae setiferous.
 3. Few or no bullate scales. Pinnules lobed to 2 mm from costa 179. *C. fusca*
 3. Bullate scales present. Pinnules lobed to within 1 mm from costa 180. *C. setifera*
 2. Scales on costae not setiferous. 181. *C. rosenstockii*
1. Pinna-rachis not hairy on lower surface.
 4. Indusium quite lacking.
 5. Pinnules almost sessile, to 28 mm wide 182. *C. marginata*
 5. Pinnules long-stalked, to 45 mm wide 183. *C. mesosora*
 4. Indusium present.
 6. Pinnules on stalks to 6 mm long. Stipe to 60 cm 184. *C. papuana*
 6. Pinnules sessile or on much shorter stalks. Stipe much shorter.
 7. Pinnules to 35 mm wide, larger ones with lowest 1–2 lamina-segments free. No bullate scales. 185. *C. inaequalis*
 7. Pinnules rarely over 25 mm wide, lowest segments not free. Bullate scales usually present on costules.
 8. Pinnules lobed only in basal half 186. *C. parvipinna*
 8. Pinnules deeply lobed throughout.
 9. Pinnules not over 20 mm wide, lobed to c. 3 mm from costa 187. *C. wernerii*
 9. Pinnules on largest pinnae in most cases over 20 mm wide, lobed to 1–2 mm from costa.
 10. Scales on costae and costules bullate, mostly entire 188. *C. insularum*
 10. Scales on costae mostly small and fringed or setiferous; bullate scales on costae and costules mostly fringed.
 11. Pinnules of largest pinnae 22–28 mm wide.
 12. Segments of lamina narrowed rather evenly from base to pointed apex, sinuses thus triangular. Scales on costae not setiferous; bullate scales few. Lowest pinnae not greatly reduced. 189. *C. tripinnatifida*
 12. Segments of lamina with rounded apex. Scales on costae often setiferous, bullate scales usually present. Lowest pinnae small, stipe very short 190. *C. runensis*
 11. Pinnules of largest pinnae less than 20 mm wide 191. *C. moseleyi*

179. *Cyathea fusca* BAK. in Beccari, Malesia 3 (1886) 31; v. A. v. R. Handb. (1908) 19; Suppl. (1917) 25; COPEL. Philip. J. Sc. 77 (1947) 100.

Trunk to 2 or 3 m; fronds to 150 cm long. *Stipe* to 15 cm, bearing thick fleshy scales which have dark setae on their edges (at least when young); *rachis* bearing similar scales near base, also short hairs on lower surface. *Pinnae*: lowest c. 8 cm long, largest 40 cm. *Pinnules* to c. 90 by 20 mm, lobed to 2–3 mm from costa, lowest segment not free; costules 5 mm apart; lamina-segments firm, almost entire, apices rounded; veins c. 6 pairs. *Sori* medial, indusiate; indusium complete, pale, breaking and largely persistent. *Scales and hairs*: pinna-rachis densely hairy on lower surface, hairs spreading, c. 1/2 mm long; some similar hairs on bases of costae; scales on costae very small, bearing long dark setae; a few similar scales on costules, none bullate; no hairs on upper surface of costules and veins.

Type specimen: D'ALBERTIS *s.n.*, Fly R., Papua (K).

Distr. Malaysia: Eastern New Guinea.

Ecol. Casual in undergrowth of forest near river (BRASS).

Note. This species is very near *C. wernerii* ROSENST., but appears to differ from it in presence of abundant hairs on lower surface of pinna-rachis and in absence of bullate scales.

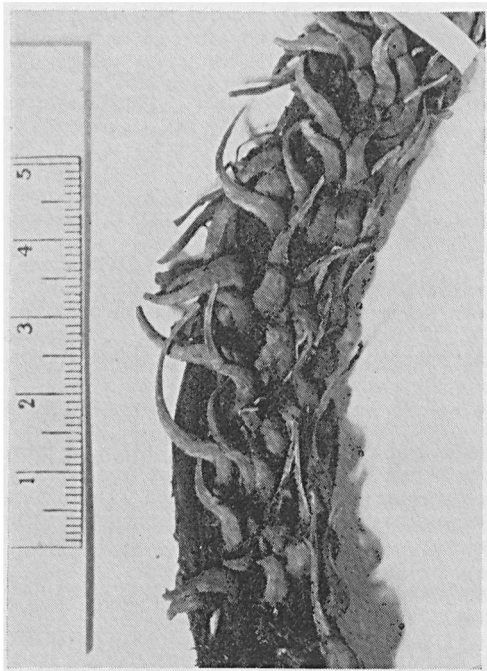


Fig. 30. *Cyathea rosenstockii* BRAUSE. Base of stipe, showing fleshy scales; scale in cm (PULLE 509, Mt Perameles, 1100 m, BM).

180. *Cyathea setifera* HOLTUM, Kew Bull. 16 (1962) 62.

Stipe 10 cm, covered with thick dark pale-edged scales 20 by 1 1/2 mm, their edges (at least near apex) bearing dark setae; also covered, between the large scales, with a thin dark felt of small scales of irregular shape, some with dark setae; scales of very young fronds very thick at their bases which have internal air-spaces. *Rachis* bearing scattered narrow dark scales 10 mm long and also thick hairs, and the remains of a felt of small scales as on the stipe. *Pinnae*: lowest about 4 cm long, largest 40 cm. *Pinnules* to 70 by 16 mm, sessile, very shortly acuminate, lobed nearly to the costa; basal 1–2 segments contracted at base; costules 4–4 1/2 mm apart, at 60° to the costa; lamina-segments rigid but not very thick, entire or slightly crenulate, ends rounded; veins 6–7 pairs, strongly raised on lower surface, forked rather far from costule. *Sori* nearer to edge than to costules; indusium thin and pale, breaking and persistent; paraphyses dark, longer than sporangia. *Scales and hairs*: upper part of main rachis and pinna-rachis bearing thick pale hairs on lower surface, also scattered dark strongly setiferous scales of various sizes, to 5 mm long; costae densely covered beneath with elongate brown setiferous scales, grading to brown bullate scales setiferous near their apices; bullate scales distally on costae and on costules brown, pale-fringed at apices; hairs on upper surface of costules few (not more than 1 on a costule).

Type specimen: MAIN & ADEN 1306, Morotai, N. Moluccas (BO; dupl. at K, L).

Distr. Malaysia: Moluccas (Morotai), one collection.

Ecol. At 1000 m.

181. *Cyathea rosenstockii* BRAUSE, Bot. Jahrb. 56 (1920) 49; COPEL. Philip. J. Sc. 77 (1947) 101.— Fig. 30.

Trunk 1 1/2–2 m, bearing 6–8 fronds. *Stipe* 10–15 cm, covered with thick ascending fleshy scales to 45 by 4 mm wide at base; main *rachis* almost smooth, glabrescent, pale. *Pinnae*: lowest 3–5 cm long, increasing upwards, largest 30 cm. *Pinnules* to 85 by 23 mm, sessile, lowest segment a little constricted at base, rest of pinnule lobed to 1 mm from costa; costules 5–5 1/2 mm apart, distinctly oblique; lamina-segments rigid, edges slightly crenate, sinuses wider in fertile than in sterile pinnules; veins 7–10 pairs, much raised on upper surface, less so beneath. *Sori* nearer costule than edge; indusium thin, at first complete, later breaking and sometimes almost disappearing. *Scales and hairs*: lower surface of pinna-rachis throughout bearing many pale thick crisped hairs; scales on lower surface of costae and costules dark, bullate, sometimes very few.

Type specimen: LEDERMANN 11264, Sepik area, E. New Guinea (B).

Distr. Malaysia: New Guinea.

Ecol. In mossy forest, or rain forest, at 1300–1750 m.

182. *Cyathea marginata* (BRAUSE) DOMIN, Acta Bot. Bohem. 9 (1930) 134.—*Alsophila marginata* BRAUSE, Bot. Jahrb. 56 (1920) 63.

Trunk to 3 m tall; fronds 150–200 cm long. *Stipe* to at least 35 cm, warty, with one pair of reduced pinnae near base; stipe-scales not seen. *Pinnae*: lowest 18 cm long, largest 42 cm. *Pinnules* to 125 by 28 mm, sessile, acuminate, lobed to 2–3 mm from costa, lowest segment not free; costules 6–7 mm apart; lamina-segments rather thick and rigid, crenulate, apices rounded, sinuses narrow; veins 11–12 pairs. *Sori* medial; no indusium; receptacle large. *Scales and hairs*: pinna-rachis beneath light brown, smooth, with a few persistent pale thin scales bearing irregular long flexuous setae; costal scales few, thin, ovate, bearing long dark setae; no scales seen on costules.

Type specimen: LEDERMANN 12586, Sepik region, E. New Guinea (B).

Distr. *Malaysia*: E. New Guinea (one collection).

Ecol. In mountain forest at 1400–1500 m.

183. *Cyathea mesosora* HOLTUM, Kew Bull. 16 (1962) 57.

Trunk slender, to 3 m. *Fronks* few, 150–220 cm long. *Stipe* to 10 cm, dull, spines to 1 mm, rather abundant; scales to c. 15 by 1¼ mm, slightly thickened at base, dark, edges bearing irregular flexuous setae or hairs. *Pinnae*: lowest 3–5 cm long, simply pinnate (sometimes widely separated from next); largest 42 cm long. *Pinnules* widely spaced, to 110 by 45 mm, lowest on stalks to 8 mm long, lobed throughout to 3–4 mm from costa; costules 7½–9 mm apart; lamina-segments very firm, edges crenate (more strongly towards apex) and thickened, apex rounded; veins 10–12 pairs on largest pinnules, mostly rather narrowly forked, strongly raised on lower surface. *Sori* medial, usually at the fork of a vein, sometimes one sorus in middle of each branch of lowest vein; no indusium; receptacle large, often very broad; paraphyses short, pale, slender. *Scales and hairs*: pinna-rachis beneath smooth and glabrous; no scales seen on lower surface of costae and costules; minute hairs (bases of former scales?) sometimes abundant on lower surface of veins; no hairs on upper surface of costules and veins.

Type specimen: CARR 15720, Lala River, Papua (BM; dupl. at K, L, MICH).

Distr. *Malaysia*: Eastern New Guinea (three collections).

Ecol. In forest at 1400–1750 m.

184. *Cyathea papuana* (RIDL.) v. A. v. R. Handb. Suppl. (1917) 487; COPEL. Philip. J. Sc. 77 (1947) 121.—*Alsophila papuana* RIDL. Trans. Linn. Soc. II, Bot. (1916) 252.—*Gymnosphaera papuana* COPEL. Gen. Fil. (1947) 98.

Stipe to 60 cm, reduced basal pinnae lacking; spines and scales as *C. mesosora*. *Pinnae* to more than 40 cm long. *Pinnules* to 90 by 22 mm, lobed to 3 mm from costa, lowest on stalks to 6 mm long; costules 5–7 mm apart; lamina-segments firm, edges thick, crenate; veins to 8 or 9 pairs, thick

and raised on lower surface. *Sori* medial, indusiate; indusium thin and translucent, at first complete, breaking and in part persistent; paraphyses short, thin, pale. *Scales and hairs*: residual scales on pinna-rachis and costae few, narrow with irregular long dark setae; no hairs on upper surface of costules and veins.

Type specimen: BODEN KLOSS, Mt Carstensz, Camp III, Jan. 1913, W. New Guinea (BM; dupl. at K).

Distr. *Malaysia*: West New Guinea (two collections).

Ecol. At 700–1100 m.

185. *Cyathea inaequalis* HOLTUM, Kew Bull. 16 (1962) 56.

Trunk 4–6 m, 5–6 cm ø; leaf-scars in alternate whorls of 5. *Stipe* 24 cm, copiously thorny and scaly near the base; thorns 1 mm, acute; scales ascending, fleshy at their bases and thinner distally, to 20 by 1½ mm, dark and shining except for the thin pale edges of the distal part which bear dark setae; scales above base of stipe very small, brown, the larger ones setiferous. *Pinnae*: lowest 8 cm long, pinnatifid, largest 50 cm long. *Pinnules* to 130 by 35 mm, lowest with stalks 3 mm long, apex acuminate, base very unequal (acroscopic segment much larger than basisopic), 1–2 basal segments of largest pinnules free or nearly so, rest of pinnule lobed to 2 mm from costa; costules 7½–8½ mm apart; lamina-segments thin, almost entire, apex bluntly pointed and slightly falcate; veins to 9 pairs. *Sori* medial; indusia complete, thin, breaking and persistent. *Scales and hairs*: pinna-rachis minutely warty beneath, glabrescent; near base of costae a few small flat elongate setiferous scales; no scales seen on costules; no hairs on lower surface of pinnules, nor on upper surface of costules.

Type specimen: BRASS 23547, Mt Dayman, Milne Bay Distr., Papua (L; dupl. at A).

Distr. *Malaysia*: E. New Guinea (once collected).

Ecol. In rain forest ravine, at 700 m.

186. *Cyathea parvipinna* HOLTUM, Kew Bull. 16 (1962) 60.

Trunk 1 m tall. *Stipe* 20 cm; spines on stipe and basal part of rachis many, sharp, 1 mm; scales on stipe sparse, to 10 by 2 mm, thick at base, narrowed and thinner distally with paler edges bearing dark setae; also on stipe very small brown scales, the larger setiferous. *Pinnae*: lowest 3½ by 1 cm, on stalks 8 mm long, lamina simple; largest 40 cm long. *Pinnules* to 90 by 18 mm, sessile, acuminate, apical half subentire, basal half gradually more deeply lobed, at base lobed more than half-way to costa, lobes almost entire, thin; costules 5 mm apart; veins in basal lobes 6–7 pairs. *Sori* medial; indusia thin, translucent, breaking and in part caducous; paraphyses pale. *Scales and hairs*: pinna-rachis glabrescent beneath, residual scales small, brown, sparingly setiferous; a few rigid brown setiferous scales at bases of costae; on distal part of costae small dark thick bullate scales; no scales seen on costules; no hairs on lower

surface of costae and none on upper surface of costules.

Type specimen: BRASS 25837, Normanby I., Papua (L; dupl. at K, US).

Distr. *Malaysia*: E. New Guinea (once collected).

Ecol. On banks of stream in forest at 270 m.

187. *Cyathea wernerii* ROSENST. in Fedde, Rep. 5 (1908) 34; v. A. v. R. Handb. (1908) 786; COPEL. Philip. J. Sc. 77 (1947) 101.—*C. kingii* ROSENST. in Fedde, Rep. 9 (1911) 422, *non* (CLARKE) COPEL. 1909; v. A. v. R. Handb. Suppl. (1917) 25; COPEL. Philip. J. Sc. 77 (1947) 100.

Trunk to 3½ m, bearing c. 8 fronds to 2½ m long. *Stipe* 8–25 cm; scales to 20 by 1½ mm, thick at base, pale and thin distally with setae on the edges. *Pinnae*: lowest 3–8 cm long, longest to at least 50 cm. *Pinnules* to 100 by 20 mm, sessile, acuminate, lobed to c. 3 mm from costa; costules 5½–6½ mm apart; lamina-segments almost entire, distinctly narrowed from the base so that sinuses are triangular. *Sori* medial; indusium complete, thin, breaking and persistent; paraphyses dark. *Scales and hairs*: pinna-rachis glabrescent beneath or with small residual scales, not hairs; scales on costae near base small, bearing some dark setae, usually grading to bullate scales distally and on costules; a few thick hairs sometimes near apex of costae on lower surface.

Type specimen: WERNER 66, Damun, NE. New Guinea (S-PA; dupl. at P).

Distr. *Malaysia*: S. & E. New Guinea.

Ecol. In forest at 200–1200 m.

Notes. WAKEFIELD has noted that plants are often fertile when juvenile (*i.e.* bearing only simply pinnate fronds). Some specimens lack bullate scales, and are then intermediate between this species and *C. fusca*; possibly the two should be united.

188. *Cyathea insularum* HOLTUM, Kew Bull. 16 (1962) 57.

Trunk 3–5 m, 3½–6 cm ø after decay of leaf-bases; leaf-scars 18–25 mm ø, in 3 rather steep spirals. *Fronds* numerous, 165–200 cm long. *Stipe* 10–15 cm, near base covered with scales; scales 10–15 by 1 mm, dark and thick at the base, distal part dark with pale edges bearing dark setae; rest of stipe sparsely covered with very small pale short-fringed scales. Lowest *pinnae* less than 5 cm long, rest gradually larger, largest 45 cm. Largest *pinnules* 65–90 by 18–22 mm, sessile, acuminate, lobed to 1–2 mm from costa; costules 5–6 mm apart; lamina-segments slightly crenate towards obtusely pointed apex; veins 8–9 pairs. *Sori* medial; indusium complete, thin, pale, breaking and persistent. *Scales and hairs*: pinna-rachis below bearing small thin pale finely fringed scales; scales on costae throughout pale, bullate, rather large, mostly entire; similar scales on costules; a few thick hairs towards apex of costa on lower surface, no hairs on upper surface of costules.

Type specimen: BRASS 27419, Misima Island, Louisiades (L).

Distr. *Malaysia*: Louisiade Arch. (on 4 islands). Ecol. In forest, near streams, at 100–350 m.

189. *Cyathea tripinnatifida* ROXB. Calc. J. Nat. Hist. 4 (1844) 518.—*C. integra* J. SM. *ex* HOOK. Ic. Pl. (1844) t. 638, *p.p. excl. ic.*—*C. nigrospinulosa* v. A. v. R. Bull. Jard. Bot. Btzg II, n. 28 (1918) 15.

Stipe to 25 cm (sometimes much shorter?), bearing scattered thick scales to 20 by 1½ mm, setiferous near their apices; stipe also covered with very small dull fringed scales. *Pinnae* to at least 55 cm long. Largest *pinnules* 90–110 by 20–28 mm, lobed to 1½–2 mm from costa, sessile, short-acuminate; costules 6–7 mm apart; lamina-segments thin but firm, narrowed from the base to broadly pointed apex and so separated by triangular sinuses, edges crenate to almost entire; veins to 8 or 9 pairs. *Sori* nearer to costule than to edge; indusia rather thin, at first complete, breaking and persistent; paraphyses dark, as long as sporangia. *Scales and hairs*: lower surface of pinna-rachis bearing small pale fringed scales, hairs lacking; scales on costae small, fringed with pale hairs, not bullate; a few bullate scales on costules, sometimes caducous; a few thick hairs sometimes present on lower surface of costae and costules near apex of pinnule.

Type specimen: Herb. Wallich n. 7076, Moluccas (CAL ?; dupl. at K, BM).

Distr. *Malaysia*: Moluccas (Ambon).

Ecol. In lowland forest.

Notes. HOOKER cited a specimen of this species, from Ambon, with his original description of *C. integra*, but his illustration was prepared from a Philippine specimen, which is thus taken as type of *C. integra*.

Most specimens of *C. tripinnatifida* lack the stipe. One from Ambon, collected by REINWARDT (L) has a stipe at least 25 cm long, and does not show lower pinnae.

190. *Cyathea runensis* v. A. v. R. Bull. Dép. Agr. Ind. Néerl. n. 18 (1908) 1; Handb. (1908) 22.—*C. versteegii* CHRIST, Nova Guinea 8 (1909) 161; v. A. v. R. Handb. Suppl. (1917) 25.

Stipe short, warty; scales dull, dark, more than 1 cell thick at base not fleshy as in *C. rosenstockii*. Lowest *pinnae* short, gradually increasing upwards, largest at least 50 cm long. *Pinnules* to 120 by 25 mm (rarely to 30 mm), lowest segment of largest pinnules free or nearly so, rest lobed to 2 mm from costa; costules 6–7 mm apart; segments of lamina almost entire or slightly crenate, apices rounded, separated by sinuses 1–2 mm wide; veins to 8 pairs. *Sori* medial; indusium complete, thin, persistent, breaking irregularly; paraphyses dark, as long as sporangia. *Scales and hairs*: pinna-rachis glabrescent on lower surface, hairs on upper surface short and dark; scales on lower surface of costae small, brown, of rather irregular shape, edges set closely with short spreading rather stiff concolorous hairs or darker setae; bullate scales on costules few, small.

Type specimen: TEYSMANN, Pulu Roon, W. New Guinea (BO; dupl. at L).

Distr. *Malaysia*: W. New Guinea, Bismarck Arch. Ecol. In lowland forest.

Note. This species is very close to *C. tripinnatifida*, and I am not sure of a clear distinction. It seems probable however that a short stipe is invariable in *C. runensis*, that of *C. tripinnatifida* being longer, but very few specimens show this character.

191. *Cyathea moseleyi* BAK. J. Linn. Soc. Bot. 15 (1876) 104.

Stipe short; stipe and lower part of rachis bearing scales to 20 by 1½ mm, dark and somewhat thickened in the middle with pale edges bearing dark setae. *Pinnæ*: lowest gradually reduced, largest to at least 45 cm long. Largest *pinnules* to 80 by 18 mm, lobed to c. 1 mm from costa, sessile, acuminate; costules 5–6 mm apart; lamina-segments rather thin, edges more or less crenate, apices bluntly pointed; veins 8–10 pairs. *Sori* medial; indusium pale, thin, at first complete, breaking and persistent; paraphyses dark. *Scales and hairs*: pinna-rachis beneath smooth, usually with some residual very small dull brown fringed scales; small fringed scales present on lower surface of costae, with small fringed bullate scales, the latter also abundant on lower surface of costules; a few thick hairs present on upper surface of costules but not on lower surface.

Type specimen: MOSELEY, Admiralty Is (K).

Distr. *Malaysia*: Admiralty Is, Bismarck Arch. Ecol. In lowland forest.

Note. *C. brackenridgei* METT., of the Solomon Is, appears to be closely related to this species, but to differ in wider pinnules (to 24 mm wide) and in very abundant scales throughout the stipe and lower part of rachis.

Doubtful species

Alsophila hallieri ROSENST. Med. Rijksherb. n. 31 (1917) 2.—*C. hallieri* DOMIN, Acta Bot. Bohem. 9 (1930) 120.

The specimens of HALLIER (735, 737, 738, 4726, 4727) cited with the description have not been found in the Rijksherb. at Leiden. The brief description does not permit the species to be identified with certainty.

Alsophila matthewii CHRIST, J. Linn. Soc. Bot. 39 (1909) 213.—*C. matthewii* DOMIN, Pterid. (1929) 263.

I have only seen the specimen from the type collection at Kew; it is a small sterile frond, evidently from an immature plant, said to have been borne on a slender trunk 60 cm high. As the specimen was found in a much-collected locality (Mt Maquilang, Luzon, at 1100 m), it probably belongs to a species already known, possibly *C. heterochlamydea* COPEL., but I am very uncertain of this.

Alsophila philippinense Hort. Veitch, Gard. Chron. II, 4 (1875) 179, *nomen*.—*C. veitchiana* DOMIN, Acta Bot. Bohem. 9 (1930) 168.

A cultivated plant, described as follows: "a handsome new fern, with regularly crimped pinnae from the Philippine Islands". There is no specimen in Kew Herbarium, and no reference to the plant in Hortus Veitchii.

Alsophila speciosa [non (MEYEN) PRESL] GOLDMANN, Nova Acta 19, Suppl. I (1843) 465.

The type of MEYEN's species came from Brazil; GOLDMANN's brief Latin description of a Philippine fern is inadequate for identification.

Cyathea adeno-chlamys CHRIST, Bull. Herb. Boiss. II, 6 (1906) 1008; v. A. v. R. Handb. (1908) 785.

I have not found the type specimen at Paris. CHRIST described the indusia as persistent, rigid, green, covered densely with pale sessile glands, opening transversely; I have not seen any *Cyathea* with such indusia.

Cyathea grata DOMIN, Acta Bot. Bohem. 9 (1930) 120, *nomen*.

Under this name is cited *C. frondosa* ROSENST. in Fedde, Rep. 12 (1913) 163, but no such species is there described, nor have I found any other reference to *C. frondosa* ROSENST. Provenance New Guinea.

Species not occurring in Malaysia

Alsophila truncata BRACK. in Wilkes, U.S. Expl. Exped. 16 (1854) 289; v. A. v. R. Handb. (1908) 42.

Malaysian specimens referred to this species are *C. celebica* BL. or an allied species.

Cyathea aneitensis HOOK. Syn. Fil. (1865) 26; v. A. v. R. Handb. (1908) 16.

After citing specimens from Aneitijum, HOOKER added "Ternate, Herb. Hort. Calc." There is no Ternate specimen at Kew, and I have seen no Malaysian specimens referable to this species.

Cyathea rumphii DESV. Mém. Soc. Linn. Paris 6 (1827) 323.—*Polypodium arboreum* LOUR. Fl. Coch. (1790) 831, *non* LINN.

DESVAUX published a new name for LOUREIRO's species, without description; like LOUREIRO, he also cited a plate by RUMPHIUS. LOUREIRO described a fern from Indo-China, not Amboin; neither his description, nor RUMPHIUS's plate is clearly identifiable. Therefore I cannot agree with MERRILL's suggestion that the name *C. rumphii* DESV. should replace *C. amboinensis* (v. A. v. R.) MERR. (see Trans. Am. Phil. Soc. Philad. n.s. 24, 1935, 57).

Excluded from *Cyathea*

Alsophila dielsii BRAUSE, Bot. Jahrb. 56 (1920) 67.—*C. dielsii* DOMIN, Acta Bot. Bohem. 9 (1930) 111.

The type specimen belongs to the genus *Diplazium*.

Alsophila dryopteroides BRAUSE, Bot. Jahrb. 56 (1920) 70.—*C. atrispora* DOMIN, Acta Bot. Bohem. 9 (1930) 95.—*Dryopteris atrispora* C. CHR. Brittonia 2 (1937) 296.—*Lastrea dryopteroides* COPEL. Gen. Fil. (1947) 138.

The type is a Thelypteroid fern; generic limits in this group need to be clarified.

Alsophila gazellae KUHN, Forschungs. Gazelle 4 (1889) 13.—*C. gazellae* DOMIN, Pterid. (1929) 262.

I have seen the type specimen, and identified it as *Pleocnemia cumingiana* PRESL (see Reinwardtia 1, 1951, 188).

Alsophila tristis (BL.) BL. ex MOORE, Ind. Fil. (1857) 58, based on *Aspidium triste* BL. En. Pl. Jav. (1828) 169 = *Stenolepia tristis* (BL.) v. A. v. R. Bull. Dép. Agr. Ind. Néerl. n. 27 (1909) 45.

Alsophila warburgii CHRIST, Ann. Jard. Bot. Btzg 15 (1897) 80, from Celebes = *Dryopteris* sp.

Alsophila xantholepis CHRIST ex DIELS in E. & P. Pfl. Fam. 1, 4 (1899) 138; v. A. v. R. Handb. (1908) 44.—*C. xantholepis* DOMIN, Pterid. (1929) 263; Acta Bot. Bohem. 9 (1930) 172 = *Dryopteris* sp.

Cyathea aspidioides (BL.) ZOLL. & MOR. Syst. Verz. (1846) 108 = *Diacalpe aspidioides* BL.

Cyathea woodlarkensis COPEL. Philip. J. Sc. 9 (1914) Bot. 1; *ibid.* 77 (1947) 124.—*Alsophila woodlarkensis* C. CHR. Ind. Fil. Suppl. 2 (1917) 4.

This is a large species of *Thelypteris*, apparently near *T. immersa* (BL.) CHING. There are specimens in Herb. Copel. (MICH) and at Paris.

2. DICKSONIA

L'HÉRIT. Sert. Angl. (1788) 30, *p.p.*; CHRIST, Farnkr. Erde (1897) 313, *p.p.*; DIELS in E. & P. Pfl. Fam. 1, 4 (1899) 119; UNDERW. Mem. Torr. Bot. Cl. 6 (1899) 259, 278; C. CHR. Ind. Fil. (1905) xvi, 220; MAXON, J. Wash. Ac. Sc. 12 (1922) 454; COPEL. Gen. Fil. (1947) 48.—*Balantium* KAULF. En. Fil. Chamisso (1824) 288, *p.p. typ.*; PRESL, Tent. Pterid. (1836) 134 (*excl. Balantium brownianum*).—*Dicksonia* subg. *Balantium* HOOK. Sp. Fil. 1 (1844) 66, *p.p.*—*Dicksonia* § *Eudicksonia* HOOK. & BAK. Syn. Fil. (1868) 50, *p.p.*—Fig. 31.

Stem arborescent, bearing numerous fronds in several spiral series, the vascular tissue supported both internally and externally with strong bands of sclerenchyma; leaf-bases usually persistent; young leaves, and at least the bases of stipes, persistently covered with long hairs; *stipes* usually short, vascular system complex, in two continuous or divided transverse arcs concave adaxially; *pinnae* numerous, the lower ones gradually reduced; pinnules usually bearing free deeply lobed tertiary leaflets which are dimorphous, sterile and fertile; upper surfaces of rachises and axes of leaflets raised, bearing rather stiff antrorse hairs, lower surfaces variously hairy; fertile leaflets more deeply lobed than sterile and with reduced lamina, each lobe bearing one sorus at the end of the vein or of the basal acroscopic branch if the vein is branched; *sori* each protected by a reflexed marginal lobe of the lamina and by a somewhat thinner inner indusium joined to the receptacle on its basiscopic side (fig. 31c); free surface of receptacle slightly elevated and distinctly elongated transverse to the end of the vein; *paraphyses* numerous, hair-like, multiseptate, each with a red-brown terminal cell; sporangia distinctly stalked, with complete oblique annulus indurated round the base, the stomium lateral; spores trilete, surfaces variously sculptured or almost smooth, exospore more or less thickened at the angles.

Type species: *Dicksonia arborescens* L'HÉRIT. (St Helena).

Distr. About 25 *spp.* St Helena; S. America and north to Mexico; New Zealand, E. Australia and Tasmania, New Caledonia, Samoa, Fiji; in *Malaysia*: New Guinea, Celebes, Philippines, N. Borneo, Java, and Sumatra.

Morph. The trunk of *Dicksonia* is closely similar in form and anatomy to that of *Cyathea*, from which *Dicksonia* differs by the indument consisting entirely of hairs. For comment on the possible relationships between the very different soral forms in the two genera, see p. 69.

Cytol. Chromosome counts have been made by BROWNLIE for two New Zealand species; both showed

$n = 65$ (New Phytol. 56, 1957, 207). MANTON found the same number for *D. arborescens* (type species of genus) in cultivation at Kew (J. Linn. Soc. Bot. 56, 1958, 84).

Taxon. The history of the varied use of the generic name *Dicksonia* is summarized by MAXON, *l.c.* Earlier authors confused not only *Dicksonia*, *Culcita* and *Cibotium*, but also *Dennstaedtia* and other genera now recognized as distinct. Within the genus, the discrimination of species is difficult because the soral form is so constant and the variation in shape of tertiary leaflets as between those on larger or smaller pinnules in one species may be considerable. The character of the hairs on the stipe appears to be one of the clearest distinctions between species, as are scale-characters in *Cyathea*; but the differences between one hair and another are less easily defined than those between different scales. The species in New Guinea are particularly difficult to discriminate, and the present account can only be regarded as tentative; more field observation is needed.

KEY TO THE SPECIES

1. Base of stipe clothed with dark red spreading hairs 30–50 mm long; hairs of under-coat pale, slender or flaccid, much shorter.
2. Hairs of under-coat of stipe-base, and most hairs on lower surface of pinna-rachis and costae, pale, slender, rigid, spreading, not flaccid. Spores smooth 1. *D. blumei*
2. Hairs of under-coat of stipe-base, and smaller hairs on lower surface of pinna-rachis (in some cases also of costa) short, pale, flaccid, their lateral walls collapsed. Spores verrucose.
3. Hairs on costae almost all flaccid, pale, \pm antrorse, matted 2. *D. mollis*
3. Hairs on costae mostly rigid, each cell evenly cylindrical.
4. Hairs on costae: some flaccid, some spreading, mostly pale 3. *D. sciurus*
4. Hairs on costae ascending, mostly dark red 4. *D. archboldii*
1. Base of stipe clothed mainly with soft matted red-brown hairs, with or without a smaller number of stout rigid dark red hairs.
5. Some stout rigid spreading dark red hairs present near base of stipe, and scattered also on pinna-rachis; pinna-rachis mainly clothed with a close layer of pale matted flaccid hairs. 5. *D. hieronymi*
5. No stout rigid spreading dark red hairs mixed with softer hairs on stipe-base.
6. Pinna-rachis rather dark and \pm glabrescent; costae bearing flaccid pale hairs \pm mixed with thicker dark hairs with pale bases 6. *D. grandis*
6. Pinna-rachis brown, persistently hairy beneath; costae bearing entirely pale flaccid hairs. 7. *D. lanigera*

1. *Dicksonia blumei* (KUNZE) MOORE, Ind. Fil. (1860) 190; v. A. v. R. Handb. (1908) 47; BACKER & POSTH. Varenfl. Java (1939) 22.—*Balanium blumei* KUNZE, Bot. Zeit. 6 (1848) 214.—*Balanium chrysotrichum* HASSK. Obs. Fil. Jav. 1 (1856) 53.—*D. chrysotricha* MOORE, Ind. Fil. (1860) 190; HOOK. & BAK. Syn. Fil. (1868) 50; RACIB. Fl. Btztg 1 (1898) 121; DIELS in E. & P. Pfl. Fam. 1, 4 (1899) 121; CHRIST, Ann. Jard. Bot. Btztg 19 (1904) 41.—Fig. 31a–c.

Trunk to 6 m; stipes to 60 cm or more, clothed at the base with spreading red-brown shining hairs 30–50 mm long, with an under-coat of much finer short pale hairs; upper part of stipe and main rachis dark, finely and closely warty, bearing sparse short pale hairs; lamina to 300 cm long; pinnae to 70 cm long, pinna-rachis bearing pale spreading hairs on lower surface, with a few red ones; pinnules to 100 by 15–20 mm; costules of tertiary leaflets 4 mm apart; largest fertile tertiary leaflets lobed throughout almost to the costule, with 4–5 pairs of soriferous lobes, the lowest lobes usually bilobulate with forked vein, sterile lobule not longer than fertile; largest sterile tertiary leaflets less deeply lobed, veins in lowest lobe pinnate, in rest forked or simple; hairs on lower

surface of costae and costules pale, firm (cell-walls not collapsed), spreading; spores almost smooth.

Type specimen: ZOLLINGER 1894, Java (B?; dupl. at P, L); also cited SPORLEDER, Java.

Distr. *Malaysia*: Sumatra (north to Karo Plateau), Java, Central Celebes (SARASIN 2030). Ecol. In mountain forest, 1500–2500 m.

2. *Dicksonia mollis* HOLTUM, Kew Bull. 16 (1962) 64.—*D. blumei* [non (KUNZE) MOORE] C. CHR. Gard. Bull. S.S. 7 (1934) 223; COPEL. Fern Fl. Philip. 1 (1958) 84.—Fig. 31d–e.

Differs from *D. blumei* as follows: hairs of under-coat on the stipe shorter, thicker, but flaccid with walls collapsed when dry; hairs on lower surface of pinna-rachis and costae more numerous, appressed, flaccid, mostly ascending; spores bearing conspicuous more or less coalescent warts.

Type specimen: ELMER 9874, Dumaguete (Cuernos Mts) Negros Oriental, Negros (K; dupl. at L, P, MICH, US).

Distr. *Malaysia*: NE. Borneo, Central Celebes (?), Philippines (Mindanao to S. Luzon).

Ecol. Mountain forests, 1500–2000 m. The Celebes specimen, much smaller than those from

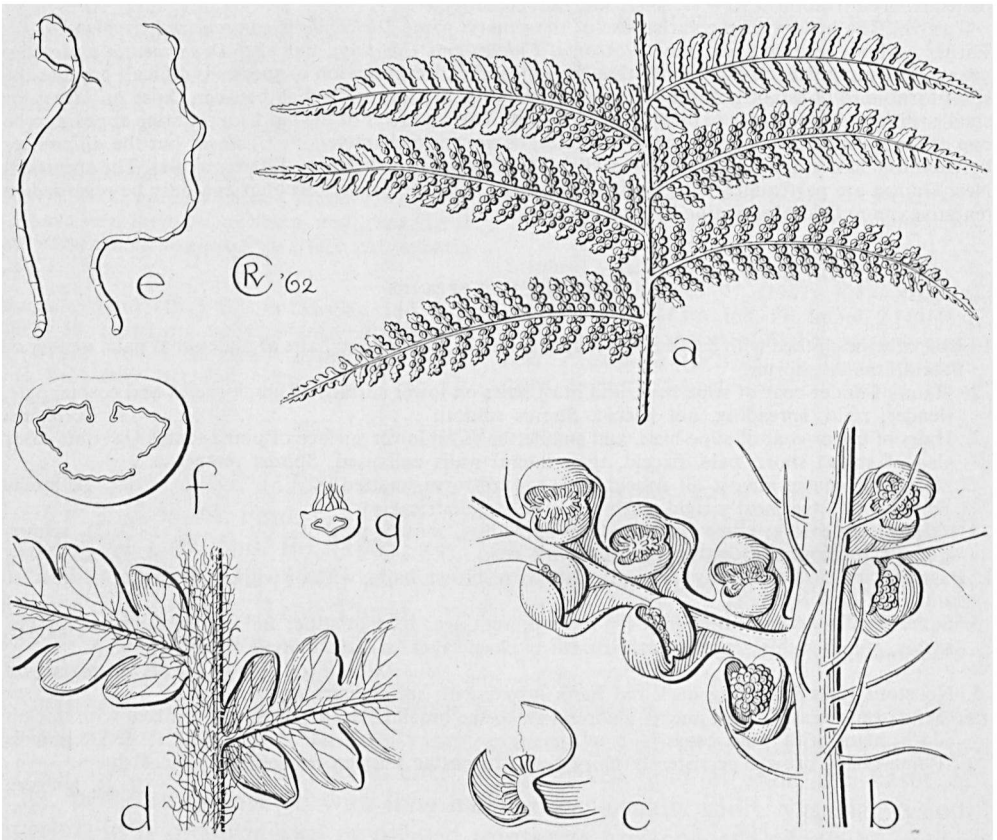


Fig. 31. *Dicksonia blumei* (KUNZE) MOORE. *a.* Part of pinna, showing sterile and fertile pinnules, $\times \frac{2}{3}$, *b.* part of pinnule, lower surface, showing sori and rigid hairs, $\times 6$, *c.* section of sorus, $\times 8$.—*D. mollis* HOLTUM. *d.* Part of sterile pinnule, lower surface, showing flaccid hairs, $\times 6$, *e.* hairs from lower surface, $\times 30$.—*D. antarctica* LABILL. *f.* Section of stipe (hairs omitted), $\times 2$, *g.* section of pinna-rachis, $\times 4$ (*a* DE VRIESE *s.n.*, *b-c* MATTHEW *s.n.*, *d* SINCLAIR 9005, *e* ELMER 9874, *f-g* cult. R. B. G. Kew).

Borneo and the Philippines, was found at 2900 m, in dry open vegetation (EYMA 959); it lacks a stipe. It agrees better with *D. mollis* than with New Guinea species (it is certainly not *D. blumei*), but without more complete material its status is doubtful.

3. *Dicksonia sciurus* C. CHR. *Brittonia* 2 (1937) 283; COPEL. *Philip. J. Sc.* 78 (1949) 6.

Stipe 35 cm, the base covered with spreading red-brown hairs 25–40 mm long, with an undercoat of short pale flaccid hairs; upper part of stipe and lower surface of main rachis more sparsely clothed with similar but shorter red-brown hairs and short flaccid pale ones; longest *pinnæ* 60 cm long, rachis dark brown, its lower surface bearing rather sparse spreading reddish hairs and a more or less abraded cover of short flaccid pale hairs;

pinnules to 150 mm long (on type not over 80 mm), costules of tertiary leaflets 4–5 mm apart, hairs on lower surface of costae and costules mostly pale, some flaccid and some spreading; *tertiary leaflets* to 20 mm long, fertile ones lobed almost to costule, basal lobes of largest fertile leaflets having a bluntly-toothed sterile lobule exceeding the fertile one, sterile tertiary leaflets less deeply lobed than fertile, lobes mostly with pinnately arranged veins and bluntly toothed edges.

Type specimen: BRASS 4991, Mt Tafa, Papua (BM; dupl. at BO, MICH, BRI, UC).

Distr. *Malaysia*: E. New Guinea (several collections).

Ecol. Plentiful in ridge forest, at 1800–2400 m.

4. *Dicksonia archboldii* COPEL. *Philip. J. Sc.* 78 (1949) 6, pl. 1.

Stipe cm, base clothed with spreading rather soft red-brown hairs 25 mm or more long, with short flaccid pale hairs also; leafy part of frond to c. 300 cm long; lower *pinnae* gradually reduced, lowest 15 cm long, longest 65 cm, pinna-rachis beneath dark, clothed rather sparsely with dark red rigid hairs, the smallest ones with a pale inflated basal cell, also short pale flaccid hairs; *pinnules* to 140 mm long, costa covered beneath with rigid flexuous antrorse dark red hairs, some with a pale base, and on distal part a few pale flaccid ones; costules of tertiary leaflets 5–6 mm apart; sterile *tertiary leaflets* to 20 mm long, lobed to costule at base, lobes to 6 pairs, veins pinnate in each, edges toothed; fertile tertiary leaflets lobed throughout to costule, lobes to 5 pairs, each with a sorus, the basal ones also with an acute sterile tooth.

Type specimen: BRASS 10970, Lake Habbema, 2750 m, near Mt Wilhelmina, W. New Guinea (MICH; dupl. at L).

Distr. *Malaysia*: West New Guinea, only known from the type collection and a much smaller one from Mt Arfak, Anggi Lakes (SLEUMER & VINK BW 14193).

Ecol. "Abundant in forest of lower slopes, stem 4 m high, 13 cm \varnothing under the leaves and thickened downwards; leaves 10, spreading".

Note. This is near *D. sciurus* C. CHR. (an earlier name) and the two should perhaps be united. The type of *D. archboldii* is larger than that of *D. sciurus* in all parts of the frond, and the hairs on the costae are mostly red and ascending; the fertile tertiary leaflets of *D. sciurus* have in some cases a larger sterile portion, but this varies according to position on the frond, and whole fronds of each type are not available for comparison.

5. *Dicksonia hieronymi* BRAUSE, Bot. Jahrb. 56 (1920) 48; C. CHR. Brittonia 2 (1937) 282; COPEL. Philip. J. Sc. 78 (1949) 6.

Stipe 20–30 cm, covered near the base with soft dull brown matted hairs with a few longer rigid shining dark red-brown ones; upper part of stipe and main rachis dark, rather persistently covered with appressed soft brown matted hairs with a few rigid shining ones; largest *pinnae* 30–60 cm long; pinna-rachis dark brown, hairy on under surface as main rachis; largest *pinnules* 70–120 mm long, costa pale distally, dark near base, covered beneath with flaccid \pm appressed light brown hairs, some with rigid dark apical portion; largest *tertiary leaflets* 10–20 mm long, fertile lobed to the costule, fertile lobes 3–5 pairs, the larger with forked vein and a sterile lobule which is rarely larger than the fertile one; sterile tertiary leaflets deeply lobed at base, less deeply upwards, larger lobes containing pinnately branched veins, edges of lobes almost entire.

Type specimen: LEDERMANN 12851, Sepik region, 1400–1500 m, E. New Guinea (B).

Distr. *Malaysia*: New Guinea (several localities) including Louisiade Arch.

Ecol. In mossy forest, at 1400–3000 m; fronds usually few.

6. *Dicksonia grandis* ROSENST. in Fedde, Rep. 5 (1908) 34; COPEL. Philip. J. Sc. 78 (1949) 5.—*D. schlechteri* BRAUSE, Bot. Jahrb. 49 (1912) 11; COPEL. Philip. J. Sc. 78 (1949) 6.—*D. ledermannii* BRAUSE, Bot. Jahrb. 56 (1920) 46; COPEL. Philip. J. Sc. 78 (1949) 5.

Stipe at least 30 cm, nearly black, lower part covered with fine soft light brown hairs, longest 25 mm, all of same texture; *pinnae* to 100 cm long, pinna-rachis beneath very dark, minutely warty, more or less glabrescent, with vestiges of short appressed hairs which are mostly lax and pale brown, with some firm and reddish (the latter sometimes with pale bases); *pinnules* to 140 mm long, costa hairy beneath as pinna-rachis, dark at base and paler distally; *tertiary leaflets* to 20 mm long, fertile ones deeply lobed, lobes to 5 pairs, each lobe of largest leaflets with a pinnate vein bearing a sorus on its basal acroscopic branch, of smaller leaflets sometimes with simple vein bearing a sorus; sterile tertiary leaflets lobed almost to costule at base, less deeply upwards, each lobe of larger ones containing a pinnately branched vein, edges of lobes almost entire.

Type specimen: WERNER 79, in forest, 1000 m, Mt Gelu, E. New Guinea (also distributed as ROSENST. Fil. Novoguin. excis. n. 50 (B; dupl. at L, P, US, UC).

Distr. *Malaysia*: New Guinea (several localities).

Ecol. In forest, most specimens at 1000–1800 m; one (PULLE 939, Mt Hellwig) from 2500 m, a small plant but agreeing in hairiness.

7. *Dicksonia lanigera* HOLTUM, Kew Bull. 16 (1962) 64.

Stipe to at least 30 cm, densely hairy throughout, hairs uniform, soft, medium brown, to 15 mm, the shorter hairs of same texture, no thick firm red hairs present; *lamina* c. 150 cm long; *rachis* beneath red-brown when dry, covered with matted short hairs like those of the stipe; *pinnae* to 40 cm long, pinna-rachis persistently hairy as rachis on lower surface; largest *pinnules* 80 mm long, costules 5½ mm apart; costa beneath brown-hairy almost to apex; *tertiary leaflets* to 15 mm long, sterile ones deeply lobed near the base and less deeply upwards, larger lobes each with a pinnate vein, edges toothed; fertile tertiary leaflets deeply lobed throughout, vein in larger lobes forked, acroscopic branch bearing a sorus, sterile part of lobe not longer than fertile.

Type specimen: PULLE 1010, Mt Wichman, 3000 m, SW. New Guinea (L; dupl. at BM).

Distr. *Malaysia*: W. & E. New Guinea.

Ecol. In forest, at 2500–3000 m.

Excluded from *Dicksonia*

Dicksonia ampla BAK. J. Linn. Soc. Bot. 22 (1886) 223 = *Dennstaedtia ampla* (BAK.) BEDD.

Dicksonia cuneata HOOK. Sp. Fil. 1 (1844) 80 = *Dennstaedtia cuneata* (HOOK.) MOORE.

Dicksonia deltoidea HOOK. Sp. Fil. 1 (1844) 80 = *Dennstaedtia scabra* (WALL.) MOORE.

Dicksonia erythrorachis CHRIST, Ann. Jard. Bot. Btzg 15 (1897) 86 = *Dennstaedtia erythrorachis* (CHRIST) DIELS.

Dicksonia flaccida (FORST.) SW. in Schrader, J. Bot. 1800, ii (1801) 90 = *Dennstaedtia flaccida* (FORST.) BERNH.

Dicksonia glabrata CES. Rend. Ac. Napoli 16 (1877) 24, 28 = *Dennstaedtia glabrata* (CES.) C. CHR.

Dicksonia gomphophylla BAK. J. Linn. Soc. Bot. 22 (1886) 223 = *Dennstaedtia gomphophylla* (BAK.) C. CHR.

Dicksonia japonica Sw. in Schrader, J. Bot. 1800, ii (1801) 92 = *Microlepia strigosa* (THUNB.) PRESL.

Dicksonia kingii BEDD. Handb. Suppl. (1892) 6 = *Orthopteris kingii* (BEDD.) HOLTUM.

Dicksonia linearis CAV. Descr. (1802) 274 = *Tapeinidium pinnatum* (CAV.) C. CHR.

Dicksonia moluccana BL. En. Pl. Jav. (1828) 239 = *Dennstaedtia moluccana* (BL.) MOORE.

Dicksonia neglecta FÉE, Gen. Fil. (1850-52) 335 = *Dennstaedtia smithii* (HOOK.) MOORE.

Dicksonia nephrolepioides CHRIST, Verh. Nat. Ges. Basel 11 (1895) 241 = *Nephrolepis dicksonioides* CHRIST.

Dicksonia remota CHRIST, Verh. Nat. Ges. Basel 11 (1896) 423 = *Dennstaedtia remota* (CHRIST) DIELS.

Dicksonia rhombifolia BAK. J. Bot. 28 (1890) 105 = *Dennstaedtia rhombifolia* (BAK.) C. CHR.

Dicksonia scabra WALL. ex HOOK. Sp. Fil. 1 (1844) 80 = *Dennstaedtia scabra* (WALL.) MOORE.

Dicksonia scandens BL. En. Pl. Jav. (1828) 240 = *Dennstaedtia scandens* (BL.) MOORE.

Dicksonia smithii HOOK. Sp. Fil. 1 (1844) 80 = *Dennstaedtia smithii* (HOOK.) MOORE.

Dicksonia strigosa THUNB. Trans. Linn. Soc. 2 (1794) 341 = *Microlepia strigosa* (THUNB.) PRESL.

Dicksonia zippeliana KUNZE, Bot. Zeit. 3 (1845) 838 = *Dennstaedtia scandens* (BL.) MOORE.

3. CYSTODIUM

J. SM. in Hook. Gen. Fil. (1841) t. 96; Hist. Fil. (1875) 258.—Fig. 32.

Stem massive, usually creeping, covered with long hairs. Fronds tufted, bipinnate; stipe grooved on adaxial surface, vascular tissue arranged as in *Dicksonia*; upper surface of *pinna*-rachis antrorsely hairy and grooved, the groove not open to admit the grooves of midribs of pinnules; pinnules slightly dimorphous, sterile ones serrate, fertile ones with slightly narrower lamina and teeth enlarged to protect sori; veins in pinnules pinnately arranged, oblique, often forked in larger pinnules, simple in smaller ones except for the basal pair which may be pinnate; *sori* terminal on veins, receptacle slightly raised, round in section, tooth of lamina reflexed and enlarged, forming an outer indusium, inner indusium smaller and thinner, attached only at the base of the sorus; *paraphyses* abundant, as simple multiseptate hairs lacking a terminal glandular cell; *sporangia* stalked, stalk as long as body of the sporangium, annulus complete and slightly oblique but not indurated at base where it passes the stalk; spores trilete.

Distr. Monotypic, *Malaysia*: from NE. Borneo to New Britain & Louisiades.

Notes. The single species agrees with *Dicksonia* in hairs and their distribution, in arrangement of vascular tissue in the frond, and in form of sori; it differs from *Dicksonia* (1) in normally prostrate position of stem, (2) in grooved upper surface of rachis, *pinna*-rachis and costules, (3) in shape of pinnules, which are crenate or serrate (not deeply lobed as in *Dicksonia*), (4) in circular transverse section of receptacle of sorus, (5) in smaller sporangia on longer stalks, and (6) almost vertical annulus, not indurated at the base.

JOHN SMITH (*l.c.* 1875) stated that the pinnules are jointed to the rachis (a character to which he attached great importance), but they are not so.

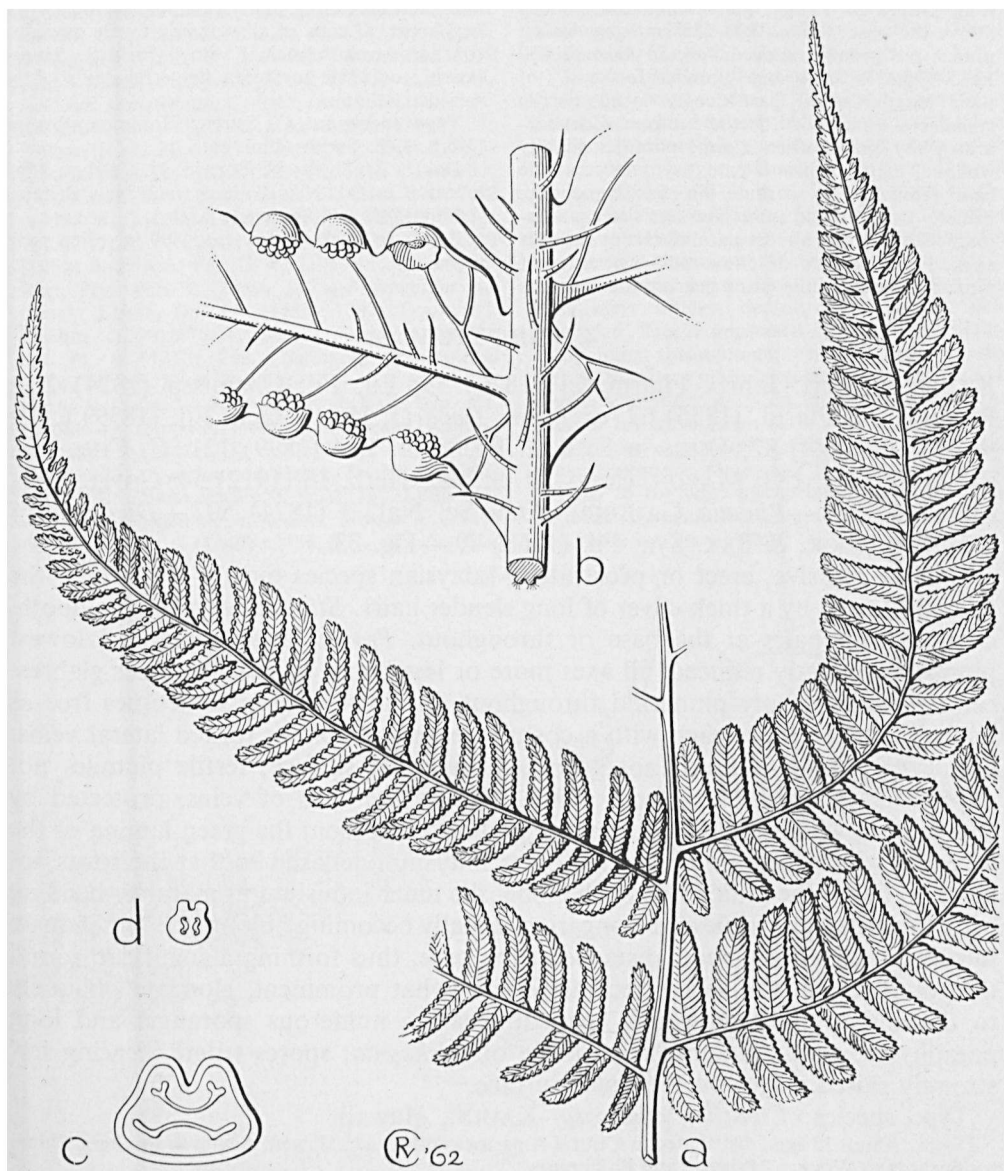


Fig. 32. *Cystodium sorbifolium* (SM.) J. SM. *a*. Middle part of rachis with pinnae, $\times \frac{2}{3}$, *b*. lower surface of part of pinna, near its base; sporangia removed from one sorus to show inner indusium, $\times 6$, *c*. section of stipe, $\times 4$, *d*. section of pinna-rachis, $\times 4$ (C. HOSE 217).

1. *Cystodium sorbifolium* (SM.) J. SM. in Hook. Gen. Fil. (1841) t. 96; COPEL. Sarawak Mus. J. 2 (1917) 344; C. CHR. Gard. Bull. S.S. 7 (1934) 239; Ind. Fil. Suppl. 3 (1934) 66; COPEL. Philip. J. Sc. 78 (1950) 7.—*Dicksonia sorbifolia* SM. in Rees, Cyclop. 11 (1808) n.p.; Hook. Sp. Fil. 1 (1844) 72, t. 25A; Hook. & BAK. Syn. Fil. (1868) 52; CHRIST, Ann. Jard. Bot. Btzg 15 (1898) 87; V. A. V. R. Handb. Suppl. (1917) 74.—*Dicksonia*

moluccana ROXB. Calc. J. Nat. Hist. 4 (1844) 517.—*Dicksonia papuana* F. v. M. Descr. Not. 4 (1876) 76; COPEL. Philip. J. Sc. 6 (1911) Bot. 69.—*Saccoloma sorbifolia* CHRIST, Farnkr. Erde (1897) 309; C. CHR. Ind. Fil. (1905) 612; V. A. V. R. Handb. (1908) 282.—Fig. 32.

Stem usually creeping (once reported erect, $\frac{1}{2}$ m high), densely covered like the bases of the stipes with soft golden brown shining hairs c. 3 cm

long. *Stipes* to 75 cm, glabrescent and smooth above the base; *lamina* 100–250 cm long, lowest pinnae not greatly reduced; *largest pinnae* 20–30 by 5–9 cm, bearing free pinnules for $\frac{1}{2}$ – $\frac{2}{3}$ of their length, apical part deeply lobed; sterile *pinnules* 6–8 mm wide, fertile 5–6 mm wide, separated by gaps of c. 2 mm; pinnules slightly oblique, their costules falcate, asymmetric at the base (rounded to cordate on basiscopic side, broadly truncate and sometimes auricled on acroscopic side), edges almost parallel except towards apex; lower surface of pinna-rachis, costules of pinnae and sometimes veins bearing more or less

abundant spreading hairs 1 mm long. *Sori* $1\frac{1}{2}$ –2 mm apart, at ends of all veins on fertile pinnules (on acroscopic branch if vein is forked). *Spores* bearing on their surface a fine irregular slightly raised reticulum.

Type specimen: C. SMITH, Honimoa, Ceram (Herb. J. E. Smith; dupl. at K).

Distr. *Malaysia*: N. Borneo, N. Celebes, Moluccas (Ceram), New Guinea (incl. New Britain, Admiralty Is and Louisiade Arch.).

Ecol. In lowland forest, to 400 m, often near rivers.

4. CIBOTIUM

KAULFUSS, Berl. Jahrb. Pharm. 21 (1820) 53; En. Fil. Chamisso (1824) 229; PRESL, Tent. Pterid. (1836) 67, *excl. syn. Deparia*; HOOK. Gen. Fil. (1839) t. 25; Sp. Fil. 1 (1844) 82; DIELS in E. & P. Pfl. Fam. 1, 4 (1899) 121; C. CHR. Ind. Fil. (1905) xvi, 183; MAXON, Contr. U. S. Nat. Herb. 16 (1912) 54; COPEL. Gen. Fil. (1947) 49.—*Pinonia* GAUDICH. Ann. Sc. Nat. 3 (1824) 507.—*Dicksonia* § *Cibotium* HOOK. & BAK. Syn. Fil. (1868) 49.—Fig. 33.

Caudex massive, erect or prostrate (Malaysian species mostly the latter), the apex protected by a thick cover of long slender hairs. *Stipes* always long, smooth, covered with hairs at the base or throughout. *Fronds* large, bipinnate, lowest pinnae not greatly reduced, all axes more or less hairy, or in some cases glabrescent; *pinnules* deeply pinnatifid throughout, the lowest lobes sometimes free as tertiary leaflets, lobes each with a costule bearing simple or forked lateral veins; costae of pinnules raised (not grooved) on upper surface; fertile pinnules not different in shape or size from sterile. *Sori* at the ends of veins, protected by two indusia which are alike in texture and different from the green lamina of the lobes on which they are borne, the outer indusium deflexed so that the sorus appears to be on the under side of the lobe, the inner indusium at maturity bending back towards the costule and elongating, usually becoming oblong, the two indusia joined together for a short distance at the base, thus forming a small cup round the receptacle of the sorus; receptacle somewhat prominent, elongate obliquely to the end of the vein which bears it, bearing numerous sporangia and long paraphyses; sporangia similar to those of *Dicksonia*; spores trilete, bearing few strongly raised ridges on the outer surface.

Type species: *Cibotium chamissoi* KAULF., Hawaii.

Distr. About 12 spp., distributed in Central America and Mexico, Hawaii, Assam to southern China, southwards to Western Malaysia and Philippines.

KEY TO THE SPECIES

- 1. Sori 2 or more pairs on each pinnule-lobe of larger fronds. Largest pinnules 20–35 mm wide; pinnules on the two sides of a pinna not greatly different in length. Hairs on lower surface of costae and costules almost always thin and flaccid, never spreading 1. *C. barometz*
- 1. Sori never more than 2 pairs on each pinnule-lobe. Largest pinnules 15–25 mm wide; pinnules on basiscopic side of lower pinnae much shorter than those on acroscopic side. Some rigid hairs usually present with flaccid ones on lower surface of costae, the rigid hairs sometimes spreading.
- 2. Always one pair of sori. Spreading hairs usually present on lower surface of costae; hairs normally absent on lower surface of lamina between veins 2. *C. cumingii*
- 2. Always two pairs of sori on large fronds. Spreading hairs lacking, but rigid (often red) appressed hairs always present and sometimes abundant; small flaccid hairs present on lower surface of lamina between veins 3. *C. arachnoideum*

1. *Cibotium barometz* (L.) J. SM. Lond. J. Bot. 1 (1842) 437; BEDD. Handb. (1883) 24; Suppl. (1892) 6; DIELS in E. & P. Pfl. Fam. 1, 4 (1899) 121; CHRIST, Philip. J. Sc. 2 (1907) Bot. 117, incl. var. *sumatranum* CHRIST, l.c. 118; v. A. v. R. Handb. (1908) 48, 792, p.p.; Suppl. (1917) 77; HEYNE, Nutt. Pl. (1927) 103; BURK. Dict. (1935) 536; BACKER & POSTH. Varenfl. Java (1938) 23, f. 7; TARD.-BLOT & C. CHR. Fl. Gén. I.-C. 7, 2 (1939) 78, f. 10; HOLTUM, Rev. Fl. Mal. 2 (1954) 114, f. 45; A. F. TRYON, Miss. Bot. Gard. Bull. 43 (1955) n. 2; Am. Fern J. 47 (1957) 1; CHING, Fl. Rep. Pop. Sin. 2 (1959) 197.—*Polypodium barometz* LINNÉ, Sp. Pl. (1753) 1092; LOUR. Fl. Coch. (1790) 675.—*Aspidium barometz* WILLD. Sp. Pl. 5 (1810) 268.—*Balantium glaucescens* LINK, Fil. Sp. Hort. Berol. (1841) 40.—*Dicksonia barometz* LINK, l.c. 166; HOOK. & BAK. Syn. Fil. (1868) 49 (*barometz*).—*C. glaucescens* KUNZE, Farnkr. 1 (1841) 63, t. 31; HOOK. Sp. Fil. 1 (1844) 82.—*C. assamicum* HOOK. Sp. Fil. 1 (1844) 83, t. 29B; CHRIST, Philip. J. Sc. 2 (1907) Bot. 117.—*Dicksonia assamicum* GRIFF. Notul. 2 (1849) 607; Ic. Pl. As. 2 (1849) t. 136, f. 2.—*C. djambianum*

HASSK. Obs. Fil. Jav. 1 (1856) 61.—*C. glaucum* [non (SM.) HOOK. & ARN.] BEDD. Ferns Br. Ind. (1865) t. 83.—Fig. 33a-c.

Caudex usually prostrate; hairs near apex shining, brown, to 4 cm or more long. *Stipes* to at least 120 cm, base densely hairy, rest smooth when old, softly short-hairy when young. *Lamina* to 200 cm long; longest pinnae 80 cm long. Largest *pinnules* 150 by 20–35 mm, lobed almost to the costa, often with 1–2 pairs of free tertiary leaflets at the base; costules $3\frac{1}{2}$ – $4\frac{1}{2}$ mm apart; segments of lamina glaucous beneath, edges where sterile crenate-serrate; lower surface of costae and costules more or less densely covered with pale entangled flaccid appressed hairs (young plants softly hairy throughout); veins oblique, usually forked, in largest pinnules sometimes twice forked. *Sori* 2–4 or more pairs on largest fronds, at the ends of lower veins on each lobe of the lamina, soriferous veins usually unbranched; receptacle rather oblique to the end of the vein so that it is parallel to the edge of the lobe; outer indusium permanently round, inner elongating at maturity and more or less oblong.

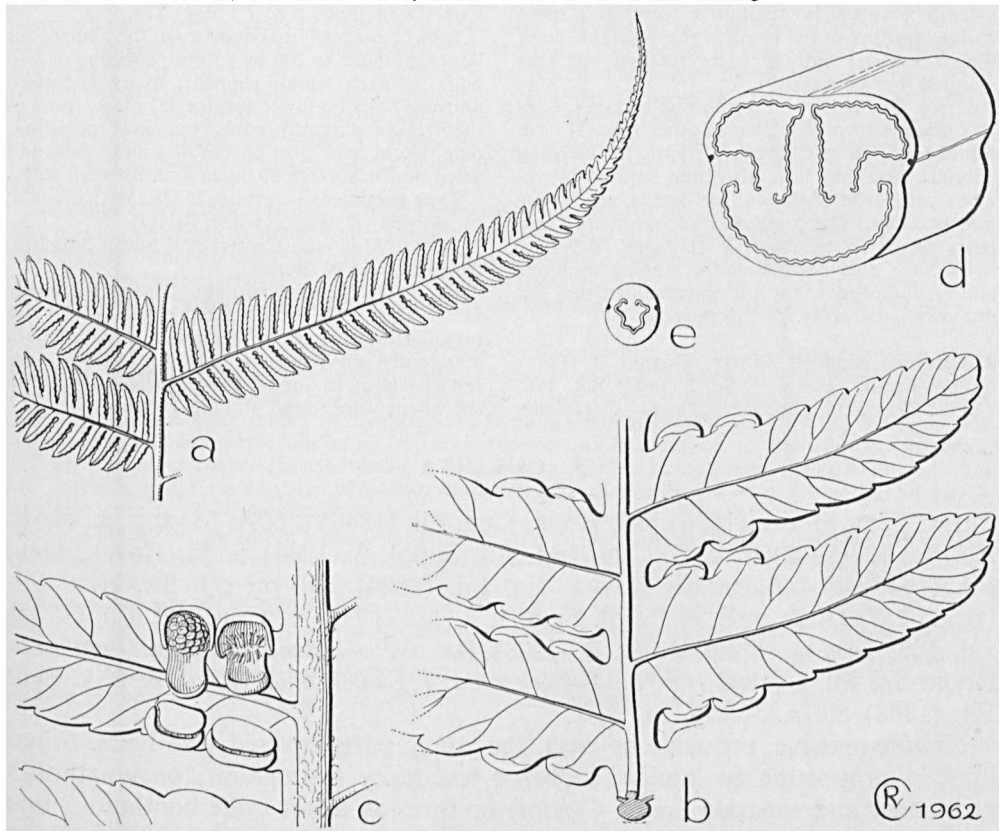


Fig. 33. *Cibotium barometz* (L.) J. SM. a. Part of pinna-rachis with pinnules, $\times \frac{2}{3}$, b. part of pinnule, upper surface, showing venation (unbranched basal veins lead to sori) $\times 6$, c. part of pinnule, lower surface, showing sori; 2 sori covered by indusia, 2 with inner indusium reflexed and extended, $\times 6$.—*C. regale* LINDEN. d. Section of stipe, nat. size, e. section of pinna-rachis, nat. size (a–c CURTIS 3103, d–e cult. R. B. G. Kew).

Type specimen: none in Linnean Herbarium. LINNAEUS stated that he had a specimen from China, and the identity is not in doubt.

Distr. NE. India to S. China and Formosa, southwards to Malaysia, in *Malaysia*: Sumatra, Malay Peninsula, and Java.

Ecol. Amongst non-calcareous rocks and on steep ground in mountain forest, from near sea-level to 1600 m, in the Malay Peninsula and Sumatra; in Java only known from Mt Slamet at 1600 m. I have seen young plants of this species growing on a bare earth bank in a rather open place, above a path recently cut through forest on a mountain slope; perhaps in nature the species chiefly spreads by the establishment of new plants on land-slides. A specimen from Fraser's Hill (E. SMITH 802) bears the note "frond 4 m, [incl.] stipe 2 m". Young plants are soft-hairy all over.

Note. The name *barometz* was derived from the story of the vegetable lamb of Tartary (see A. F. TRYON, *l.c.*); but whatever plant gave rise to the strange fable of the vegetable lamb, it was not *Cibotium*. LINK, KUNZE, and some later botanists have noted that *baranetz* (from the Russian *baran*, a lamb; *baranets*, a diminutive form) is a more correct spelling of the name of the vegetable lamb than *barometz*; but the latter spelling was that adopted by LINNAEUS.

Uses. The hairs on the rhizome of this species of *Cibotium* (probably also of other species) have long been used in China as a styptic for bleeding wounds, and they have also been so used by various peoples in Malaysia; for details, see HEYNE and BURKILL. The common trade-name for these hairs seems to be *Pënaraw* (*D*)*jambi*. *Cibotium* hairs have also been used for stuffing cushions and for upholstery, but it is reported that they are not very satisfactory for this purpose.

2. *Cibotium cumingii* KUNZE, Farnkr. 1 (1841) 64, 65; CHRIST, Philip. J. Sc. 2 (1907) Bot. 118; COPEL. Fern Fl. Philip. 1 (1958) 84.—*C. glaucum*

[*non* (SM.) HOOK. & ARN.] J. SM. in Hook. J. Bot. 3 (1841) 418.—*C. baranetz* var. *cumingii* v. A. v. R. Handb. Suppl. (1917) 77.—*C. crassinerve* ROSENST. Med. Rijksherb. n. 31 (1917) 4.

Habit as in *C. barometz*, but fronds probably never quite so large; pinnules to 180 mm long, rarely over 20 mm wide, those on basisopic side towards base of a pinna much shorter than those on acrosopic side (often less than half as long), distal pinnules and those of upper pinnae more equal; sori always one pair at the base of each fertile segment of a pinnule; hairiness of lower surface of costae and costules variable, usually some stiff spreading hairs (pale or reddish) present along with appressed flaccid hairs, in some cases either the one or the other kind predominating.

Type specimen: CUMING 123, Luzon (K; dupl. at P, US).

Distr. *Malaysia*: Philippines (Luzon, Mindoro, Mindanao).

3. *Cibotium arachnoideum* (C. CHR.) HOLTUM, *comb. nov.*—*C. cumingii* var. *arachnoideum* C. CHR. Gard. Bull. S.S. 7 (1934) 224.

Like *C. cumingii* in asymmetry of the pinnae, but larger; pinnules to 200 by 25 mm; sori one or two pairs to each lamina-segment; many appressed antrorse hairs on lower surface of costae, some of them rigid and usually reddish but never spreading; pale flaccid hairs also on costules and veins, and often on the surface of the lamina between veins.

Type specimen: HOLTUM 25378, Mt Kinabalu, N. Borneo (K; dupl. at BM, SING).

Distr. *Malaysia*: Central and South Sumatra, Sarawak, and N. Borneo.

Ecol. On Mt Kinabalu abundant in secondary forest at c. 1000 m, on steep slopes which are periodically cleared by burning for cultivation, apparently surviving the burning; fronds were reported as up to 4 or 5 m in total height. Sumatran specimens were found at 1200–2000 m.

5. CULCITA

PRESL, Tent. Pterid. (1836) 135; HOOK. Gen. Fil. (1840) t. 60A; MAXON, J. Wash. Ac. Sc. 12 (1922) 454; C. CHR. Ind. Fil. Suppl. 3 (1934) 5, 57; COPEL. Gen. Fil. (1947) 49.—*Balantium* KAULF. En. Fil. (1824) 228, *p.p.*; J. SM. Hist. Fil. (1875) 257; DIELS in E. & P. Pfl. Fam. 1, 4 (1899) 119; C. CHR. Ind. Fil. (1905) xvi, 148; COPEL. Philip. J. Sc. 3 (1908) Bot. 301.—*Dicksonia* subg. *Balantium* HOOK. Sp. Fil. 1 (1844) 66, *p.p.*—*Dicksonia* § *Eudicksonia* HOOK. & BAK. Syn. Fil. (1868) 50, *p.p.*—Fig. 34.

Caudex massive, prostrate or erect, the young parts covered with hairs. *Stipes* long in proportion to lamina, more or less hairy throughout; pneumathodes prominent and separate (subg. *Culcita*) or forming a not quite continuous line along each side (subg. *Calochlaena*, fig. 34d). *Lamina* of large fronds quadripinnate, deltoid, pinnae and pinnules also deltoid, all branches of the frond asymmetric at the base, acrosopic sub-branch longer and at a broader angle than basisopic; all axes and midribs of leaflets grooved on adaxial surface, the groove on a

larger axis open to admit grooves of smaller ones borne upon it (fig. 34c). *Sori* at the ends of veins, receptacle elongate at right angles to the vein-end, protected by a small reflexed lobe of the lamina (the outer indusium) and by a thinner inner indusium attached to the base of the receptacle; sporangia about as in *Dicksonia*, accompanied by many hair-like paraphyses; spores trilete, outer surface verrucose (Malaysian species).

Type species: *Culcita macrocarpa* PRESL (based on *Dicksonia culcita* L'HERIT.).

Distr. *Subg. Culcita*: Madeira and Azores, tropical America. *Subg. Calochlaena*: Australia, New Caledonia, New Hebrides, Fiji, Samoa, Solomon Islands, Malaysia; in *Malaysia*: Java, Lesser Sunda Is, Borneo, N. Celebes, Philippines, New Guinea. The species *C. formosae* (CHR.) MAXON, of Formosa, appears to be a *Dennstaedtia*, as originally placed by CHRIST.

Nomencl. The genus *Balantium* KAULF. was founded on two species, *B. auricomum* (a synonym of *Dicksonia arborescens*, type species of *Dicksonia*) and *B. culcita*. The description was almost entirely based on the former, which was figured, and the sori of the latter were not seen by KAULFUSS. MAXON (*l.c.* 1922) therefore argued that *Balantium* KAULF. should be typified by *B. auricomum* and so regarded as a synonym of *Dicksonia*. The generic distinction between the two species of KAULFUSS was recognized by PRESL, who founded a new genus *Culcita* for *B. culcita*, but left *B. auricomum* in *Balantium*, which he construed almost as we now construe *Dicksonia*; under *Dicksonia* he placed mostly species now included in *Dennstaedtia*.

Taxon. The genus *Culcita*, as first fully assembled by MAXON, consists of two distinct parts, *subg. Culcita* and *subg. Calochlaena* MAXON. The former includes only two very closely related species, *C. macrocarpa* PR. and *C. conifolia* (HOOK.) MAXON; *subg. Calochlaena* includes several species in a quite different geographic area which includes part of Malaysia. The species of this subgenus have much smaller sori than those of *subg. Culcita*, and were not regarded as part of the genus until DIELS (1899) included *C. straminea* (LABILL.) and COPELAND (1908, 1909) *C. dubia* (R. BR.) (fig. 34d-e) and *C. javanica* (BL.) in it under the name of *Balantium*. JOHN SMITH (1875), who recognized *Balantium* as distinct from *Dicksonia*, had placed *C. straminea* in *Dennstaedtia*. *C. dubia* remained doubtfully in its original genus *Davallia*, and *C. javanica* doubtfully in *Dennstaedtia*, in CHRISTENSEN'S Index Filicum (1905).

The genus *Culcita* differs strikingly from *Dicksonia* in the shape of the frond, which always has a long stipe and is more finely divided, with all major parts triangular in outline and asymmetric at the base. It differs also from *Dicksonia* in the grooves of the upper surface of all axes, including midribs of leaflets, being open to receive grooves of minor axes. In both these characters, *Culcita* agrees with *Thyrsopteris*. The difference in rachis-characters between *Dicksonia* and *Culcita* is exactly that between *Ctenitis* and *Dryopteris*.

Culcita differs from *Dennstaedtia* in its more massive rhizome which is sometimes erect and when creeping has a radially symmetrical vascular system (dorsiventral in *Dennstaedtia*) with overlapping leaf-gaps; also in the inner indusium not being appreciably joined to the outer along its sides (the two are partly or almost wholly united in *Dennstaedtia*, forming a cup or funnel) but joined to the receptacle of the sorus on its basiscopic side as in *Dicksonia* (the receptacle is free or columnar in *Dennstaedtia*). As regards rachis-characters, species like both *Dicksonia* and *Culcita* are at present placed in *Dennstaedtia* (see TRYON, Contr. Gray Herb. n. 187, 1960, who makes this distinction the main division in his key to American species of *Dennstaedtia*).

Subg. Calochlaena, to which Malaysian species belong, might possibly rank as a separate genus, but it appears to be much more nearly related to *subg. Culcita* than to any other ferns. Apart from size of sorus, *subg. Culcita* differs from *subg. Calochlaena* in the shape and size of pneumathodes, and in the shape of the vascular strands as seen in transverse section near the base of the stipe; in the latter character *subg. Calochlaena* conforms closely to the general scheme of *Dicksonia* and *Cyathea*, whereas in *subg. Culcita* the vascular strands on the adaxial side diverge instead of converging and curving inwards.

Cytol. MANTON reported $n = 66-68$ for *C. macrocarpa* (J. Linn. Soc. Bot. 56, 1958, 84), and has found $n =$ approx. 55 for *C. dubia* in cultivation at Kew (unpublished).

KEY TO THE SPECIES

1. Inner indusium smaller than outer; midribs of quaternary leaflets rather closely hairy on lower surface. Mountain plants.
2. Largest quinary lobes commonly with only one sorus. 1. *C. javanica*
2. Largest quinary lobes commonly with 3 or 2 sori 2. *C. villosa*
1. Inner indusium at maturity larger than outer, pouch-shaped and not reflexed; midribs of quaternary leaflets sparsely hairy. Lowland plants 3. *C. straminea*

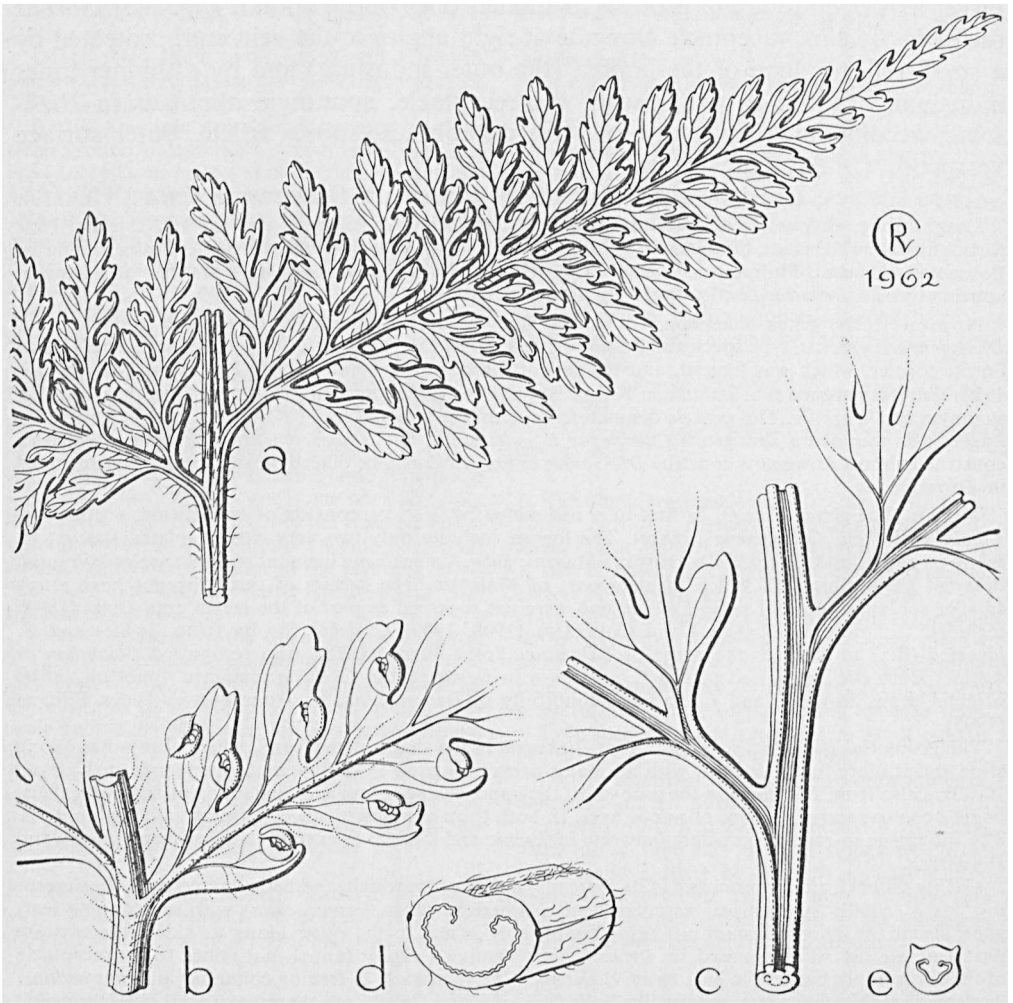


Fig. 34. *Culcita javanica* (BL.) MAXON. *a.* Part of pinna-rachis and complete pinnule, upper surface, $\times 2$, *b.* lower surface of leaflet showing sori, *c.* upper surface of part of pinnule, showing shape of rachis-branches, $\times 6$.—*C. dubia* (R. BR.) MAXON. *d.* Section of stipe, $\times 2$, *e.* section of pinna-rachis, $\times 4$ (*a-c* MATTHEW 617, *d-e* cult. R. B. G. Kew).

1. *Culcita javanica* (BL.) MAXON, J. Wash. Ac. Sc. 12 (1922) 456; BACKER & POSTH. Varenfl. Java (1939) 22.—*Dicksonia javanica* BL. En. Pl. Jav. (1828) 240; HOOK. Sp. Fil. 1 (1844) 79; C. CHR. Ind. Fil. (1905) 222.—*Dennstaedtia javanica* CHRIST, Bull. Herb. Boiss. II, 4 (1904) 617; v. A. v. R. Handb. (1908) 143.—*Dicksonia copelandii* CHRIST, Philip. J. Sc. 2 (1907) Bot. 183.—*Balantium copelandii* CHRIST in Copel. Philip. J. Sc. 3 (1908) Bot. 301; *ibid.* 4 (1909) 62, t. 19; COPEL. in Elmer, Leaf. Philip. Bot. 2 (1908) 395; v. A. v. R. Handb. Suppl. (1917) 76.—*Balantium javanicum* COPEL. Philip. J. Sc. 4 (1909) Bot. 62; v. A. v. R. Handb. Suppl. (1917) 75.—*Balantium pilosum* COPEL. J. Str. Br. R. As. Soc. n. 63 (1912)

71; Sarawak Mus. J. 2 (1917) 335; v. A. v. R. Handb. Suppl. (1917) 76.—*Dennstaedtia paraphysata* v. A. v. R. Bull. Jard. Bot. Btzig II, n. 16 (1914) 7; Handb. Suppl. (1917) 128.—*Dennstaedtia multifida* v. A. v. R. Bull. Jard. Bot. Btzig II, n. 20 (1915) 10; Handb. Suppl. (1917) 129.—*C. copelandii* MAXON, J. Wash. Ac. Sc. 12 (1922) 457; C. CHR. Ind. Fil. Suppl. 3 (1934) 57; Gard. Bull. S.S. 7 (1934) 224; COPEL. Fern Fl. Philip. 1 (1958) 86.—*C. pilosa* C. CHR. Ind. Fil. Suppl. 3 (1934) 57.—Fig. 34a-c.

Caudex ascending or erect (to 60 cm high, *fide* COPELAND), apex covered with rather stiff dark brown hairs to 10 mm long. *Stipes* to 100 cm or more, dark and densely hairy like the rhizome

at the base, pale and more sparsely hairy above the base; main rachis covered beneath with lax pale hairs 2 mm long and scattered dark thicker ones 3–4 mm long, upper surface with dense pale hairs in the groove. *Lamina* c. 150 cm long, basal pinnae to at least 50 cm; largest pinnules about 180 by 100 mm; tertiary leaflets to 50–60 by 30 mm; several free quaternary leaflets on larger pinnules, largest to about 12 by 4 mm, deeply lobed; quinary lobes up to 5 or 6; veins in largest quinary lobes pinnate, in smaller ones forked or simple. *Sori* usually one to each quinary lobe, at the end of the basal acroscopic vein if the vein in the lobe is branched; sori little over $\frac{1}{2}$ mm ϕ , when young quite enclosed by the two indusia which appear almost equal, the inner more or less reflexed at maturity and then seen to have a thinner edge. *Hairs* c. 1 mm, pale and spreading, rather numerous on lower surface of pinnule-rachis and axes of tertiary leaflets, more sparse on quaternary leaflets and veins; hairs of the same kind more sparse on upper surface of axes.

Type specimen: BLUME, Java (L).

Distr. *Malaysia*: Java, Lesser Sunda Is (Lombok, Flores), Sarawak and North Borneo, Philippines (Luzon, Negros).

Ecol. In Java at 1500–2300 m, in wet shady forest (BACKER & POSTHUMUS; but some specimens so named by POSTHUMUS are *Microlepia*); in the Philippines common at 1500–2000 m in Benguet Prov., N. Luzon and found at 1200 m in Negros; in Sarawak and North Borneo found at 1250–1600 m, on a landslide and on a ridge-top. Probably plants establish themselves in open places in forest and on landslides and persist when shadier conditions develop, as in the case of *Cibotium*. In exposed places, plants with small fronds may be fertile; one such was apparently the type of *Balanium pilosum*.

2. *Culcita villosa* C. CHR. Brittonia 2 (1937) 283; COPEL. Philip. J. Sc. 78 (1949) 7.

Caudex "short, woody" (BRASS). *Stipes* to 80 cm, dark at base and covered with shining brown

hairs 10 mm long with thick bases, pale and glabrescent above base. *Pinnae* to at least 50 cm long; pinnules to 150 by 70 mm; tertiary leaflets to 50 mm long; quaternary leaflets or segments to 12 pairs, largest 13 mm long, mostly about 10 by 3 mm with 5 pairs on quinary lobes; basal acroscopic quinary lobe bearing 3 sori, quite filling the lobe, 2 sori on next lobe, one on each remaining acroscopic and on all basiscopical lobes; inner indusium very delicate, fringed on the edge, pushed back and hidden by ripe sporangia. *Hairs* on lower surface of all axes and veins very copious.

Type specimen: BRASS 4791, Vanapa Valley, 1900 m, Papua (BM).

Distr. *Malaysia*: New Guinea, west to east; N. Celebes (G. Tampusu, coll: HUTTON).

Ecol. Secondary growth (on old garden land) and in grassland, at 1600–2230 m.

3. *Culcita straminea* (LABILL.) MAXON, J. Wash. Ac. Sc. 12 (1922) 457; COPEL. Fern Fl. Philip. 1 (1958) 86.—*Dicksonia straminea* LABILL. Sert. Austr. Cal. (1824) 7, t. 10.—*Sitobium stramineum* BRACK. in Wilkes, U.S. Expl. Exped. 16 (1854) 273.—*Dicksonia torreyana* BRACK. l.c. 278, t. 58, f. 2.—*Dennstaedtia straminea* J. SM. Hist. Fil. (1875) 265.

Caudex erect, up to 3 m (BRACKENRIDGE). *Fronde*s including stipes to 300 cm long, stipes to 120 cm; lamina similar in size and dissection to that of *C. javanica* but less hairy; inner indusia large, at maturity broader than outer, always evident and not deflexed at maturity.

Type specimen: LABILLARDIÈRE, New Caledonia (P; not seen).

Distr. Polynesia (Samoa, Fiji), Melanesia (New Caledonia, New Hebrides, Solomon Is), and *E. Malaysia*: Louisiades, Admiralty Is, and Philippines (Mindanao).

Ecol. In lowland country, up to 900 m (most specimens below 250 m), growing with *Gleichenia* on deforested slopes, in secondary forest and on river banks.

INDEX TO CYATHEACEAE

All suprageneric and infrageneric epithets have been entered under the name to which they belong preceded by the indication of their rank.

New epithets and new combinations have been printed in bold type, synonyms in *italics*.

An asterisk behind a page number marks the presence of a figure of the concerned taxon.

Page numbers in bold type denote main treatment.

Agryratae 71

Alsophila sensu C. Chr. 115

Alsophila R. Br. 73, 76

acrostichoides v. A. v. R. 123

acuta Pr. 135

aeneifolia v. A. v. R. 133

var. *subglauca* v. A. v. R. 133

allocota v. A. v. R. 152

alpina v. A. v. R. 91, 92

alternans Hook. 145

amaiambitensis v. A. v. R. 117, 118

amboinensis v. A. v. R. 114

(*Alsophila*) *angiensis* Gepp 135

annae v. A. v. R. 116

apiculata Rosenst. 93

arfakensis Gepp 113

atropurpurea C. Chr. 118

australis R. Br. 77

bakeri Zeill. 121

bartlettii (Copel.) C. Chr. 152

batjanensis Christ 88

benculensis v. A. v. R. 89

biformis Rosenst. 118

brevifoliolata v. A. v. R. 111

- (Alsophila) brunnea* Brause 120
brunoniana Hook. 137
burbidgei Bak. 151
burbidgei (non Bak.) Christ 117
buruensis Rosenst. 131
calocoma Christ 137
caudata J. Sm. ex Hook. 110
celebica (Bl.) Mett. 140
christii v. A. v. R., non Sod. 131
clementis Copel. 135
commutata Mett. 118
comosa Wall. ex Hook. 152, 153
comosa (non Wall. ex Hook.) Christ 131
concinna Bak. 130, 131
contaminans Wall. ex Hook. 135, 137
 var. *brunoniana* Scott 137
 var. *celebica* Christ 135
 var. *densa* Hassk. 135
 var. *longepaleata* Christ 134
 var. *microloba* Hassk. 135
 var. *robusta* Hassk. 135
 var. *setulosa* Hassk. 135
 var. *squamulata* Hassk. 135
crenulata (Mett.) Hook. 111
crinita (non Hook.) v. A. v. R. 132
curranii (Copel.) C. Chr. 133
cyclodonta Christ 127
debilis De Vr. 110
dielsii Brause 157
dimorpha Christ 121
dimorphotricha (Copel.) v. A. v. R. 131
dissitifolia Bak. 120
dryopteroidea Brause 158
dubia Bedd. 120
elmeri Copel. 131
extensa [non (Forst.) R. Br.] Bl. 110
fenicis (Copel.) C. Chr. 110
fenicis [non (Copel.) C. Chr.] Posth. 131, 132
fujiana Nakai 110
fuliginosa Christ 108
gazellae Kuhn 158
gigantea Wall. ex Hook. 124
glabra (Bl.) Hook 120
glabra (non Bl.) Bedd. 124
glabrescens v. A. v. R. 152
glauca (Bl.) Hook. 134
glauca (Bl.) J. Sm. 68, 135
 var. *celebica* v. A. v. R. 135
 var. *densa* v. A. v. R. 135
 var. *longepaleata* v. A. v. R. 134
 var. *microloba* v. A. v. R. 135
 var. *setulosa* v. A. v. R. 135
 var. *squamulata* v. A. v. R. 135
 var. *squamulosa* v. A. v. R. 135
 var. *trichocarpa* Rosenst. 135
gregaria Brause 102
haenkei Pr.
 var. *angustata* Hassk. 134
hallieri Rosenst. 157
hallieri v. A. v. R. 117
helferiana Pr. 124
heteromorpha v. A. v. R. 118
 var. *decomposita* v. A. v. R. 118
heterophylla v. A. v. R. 121
hewittii (Copel.) v. A. v. R. 118
- (Alsophila) hieronymi* Brause 88
hornei Bak. 120
hunsteiniana Brause 93
incisoserrata C. Chr. 113
indrapuræ v. A. v. R. 93
janseniana v. A. v. R. 145
junghuhniana Kze 110
kemberangana (Copel.) C. Chr. 151
kenepaiana v. A. v. R. 117
kingii Clarke 121
laeta Kze 152
lanuginosa (Jungh.) Pr. 132
lastreoides v. A. v. R. 115
latebrosa Wall. ex Hook. 115
 var. *batjanensis* Christ 114
 var. *denudata* Bedd. 110
 var. *ornata* Ridl. 113
latebrosa (non Wall.)
 var. *major* Christ 131
ledermannii Brause 120
lepidoclada Christ 82
lepifera J. Sm. ex Hook. 137
 var. *congesta* Christ 137
leucocarpa (Copel.) C. Chr. 115
longipinna (Copel.) C. Chr. 115
lunulata (Forst.) R. Br. 131
lunulata [non (Forst.) R. Br.] Bl. 110
lurida (Bl.) Hook. 121
macgillivrayi Bak. 123
margarethæ Schroet. ex Christ 150
marginata Brause 155
matthewii Christ 157
melanocaulos v. A. v. R. 120, 121
melanopus Hassk. 110
melanorachis Copel. 121, 122
mindanensis Christ 108
modesta Bak. 102
naumannii Kuhn 131
obliqua (Copel.) C. Chr. 146
obscura Scott. 152
okiana v. A. v. R. 131
oligosora Miq. 152
olivacea Brause 120
ornata (non Scott) Bedd. 113
 var. *sikkimensis* (non Clarke & Bak.) Bedd.
 113
palembanica v. A. v. R. 89
papuana Ridl. 155
paraphysata v. A. v. R. 152
parvifolia Holtt. 145
persquamulata v. A. v. R. 124
persquamulifera v. A. v. R. 134
philippinense Hort. Veitch. 157
poiensis (Copel.) v. A. v. R. 151
polycampta Kze 124
polyphlebia Bak. (1876) 130, 131
pulchra (Copel.) C. Chr. 152
punctulata v. A. v. R. 112
pustulosa Christ 137
ramispina Hook. 117
ramosii (Copel.) C. Chr. 151
rebeccaæ F. v. M. 120
recurvata Brause 101
reducta v. A. v. R. 120
ridleyi Bak. 152, 153

- (Alpsophila) robusta* De Vr. 110
rosenstockii Brause 101
rubiginosa Brause 93
rumphiana v. A. v. R. 131
salvinii Hook. 115
sangirensis Christ 130
saparuensis v. A. v. R. 88
sarawakensis C. Chr. 152
scaberula Christ 130
scaberulipes v. A. v. R. 131
scabriseta (Copel.) v. A. v. R. 131
scandens Brause 119
schlechteri Brause 123
smithiana Pr. 135
speciosa [non (Meyen) Pr.] Goldm. 157
spinifera v. A. v. R. 114
squamulata (Bl.) Hook. 152
squamulata (non Bl.) Hook. 118
straminea Gepp 88
subcomosa C. Chr. 131
subdimorpha (Copel.) v. A. v. R. 121
subdubia v. A. v. R. 124
subobscura v. A. v. R. 152
subulata v. A. v. R. 118
tenggerensis Rosenst. 134
tenuis Brause 90
tomentosa (Bl.) Hook. 132
 var. *novoguineensis* Rosenst. 132
trichodesma Scort. 150
trichophora (Copel.) v. A. v. R. 151
tristis (Bl.) Bl. ex Moore 158
truncata Brack. 157
 var. *nivea* Christ 140
 var. *sagittata* Christ 140
umbrosa Wall. ex Ridl. 124
vexans Ces. 120
vitiensis Carr 131
wallacei Mett. 151
warburgii Christ 158
warhoni (Copel.) C. Chr. 108
wengiense Brause 88
woodlarkensis (Copel.) C. Chr. 158
xanthina (Domin) C. Chr. 152
xantholepia v. A. v. R. 152
xantholepis Christ ex Diels 158
Amphicosmia Gardn. 73
 alternans Moore 145
 javanica (Pr.) Moore 111
 manilensis (Pr.) Moore 110
Aspidistes Harris 65, 67
Aspidium barometz Willd. 165
 triste Bl. 158
Athyrium 69
Balantium Kaulf. 71, 158, 166, 167
 auricomum 167
 blumei Kze 159
 chrysotrichum Hassk. 159
 copelandii Christ 168
 culcita 167
 glaucescens Link 165
 javanicum Copel. 168
 pilosum Copel. 168, 169
Cathetogyratea 71
Chnoophora Kaulf. 73
 glauca Bl. 135
 (Chnoophora) lanuginosa Jungh. 132
 lurida Bl. 121
 tomentosa Bl. 132
Cibotium Kaulf. 65, 67, 69, 70, 71, 72, 159, 164-166, 169
 arachnoideum (C. Chr.) Holtt. 164, 166
 assamicum Hook. 165
 barometz (L.) J. Sm. 164, 165*
 var. *cumingii* v. A. v. R. 166
 var. *sumatranum* Christ 165
 chamissoi Kaulf. 164
 crassinerva Rosenst. 166
 cumingii Kze 164, 166
 var. *arachnoideum* C. Chr. 166
 djambianum Hassk. 165
 glaucescens Kze 165
 glaucum [non (Sm.) Hook. & Arn.] Bedd. 165
 glaucum [non (Sm.) Hook. & Arn.] J. Sm. 166
 regale Linden 165*
Cnemidaria 65, 69, 70, 72
 horrida 69, 70
Coniopteris 65, 67
 hymenophylloides (Brongn.) Seward 65
 murrayana Brongn. 65
Ctenitis 167
Culcita Pr. 65, 67, 69, 70, 72, 159, 166-169
 coniifolia (Hook.) Maxon 167
 copelandii Maxon 168
 dubia (R. Br.) Maxon 70, 167, 168*
 formosae (Christ) Maxon 167
 javanica (Bl.) Maxon 167, 168*
 macrocarpa Pr. 70, 167
 pilosa Christ 168
 straminea (Labill.) Maxon 167, 169
 subg. *Calochlaena* 65, 166, 167
 subg. *Culcita* 65, 166, 167
 villosa C. Chr. 167, 169
Cyathea Smith 65, 67, 69, 70, 71, 72-158, 159
 acanthophora Holtt. 79, 81, 93
 acanthopoda v. A. v. R. 93
 aciculosa Copel. 138, 140
 acrostichoides (v. A. v. R.) Domin 116, 123
 acuminata Copel. 79, 98
 adenochlamys Christ 157
 aeneifolia (v. A. v. R.) Domin 126, 133
 var. *macrophylla* Holtt. 134
 var. *melanacantha* (Copel.) Holtt. 134
 agatheti Holtt. 142, 152
 albidosquamata Rosenst. 78, 88
 albidula Domin 93
 alderwereltii Copel. 81, 114
 alleniae Holtt. 81, 109
 allocota (v. A. v. R.) Domin 152
 alpicola Domin 91
 alpina v. A. v. R. 91
 alsophiliformis (v. A. v. R.) Domin 111
 alternans (Wall. ex Hook.) Pr. 76, 141, 145, 150
 var. *lobbiana* (Hook.) Domin 145
 var. *sarawakensis* (Hook.) Domin 145
 var. *serrata* Ridl. 145
 amaiambitensis (v. A. v. R.) Domin 117
 amboinensis (v. A. v. R.) Merr. 81, 114, 157
 amphicosmioides v. A. v. R. 89
 ampla Copel. 150
 ampla (non Copel.) Holtt. 151

- (*Cyathea*) *aneitensis* Hook. 157
angiensis (Gepp) Domin 126, 135, 136
angustipinna Holtt. 141, 143
annae (v. A. v. R.) Domin 116, 117*
apiculata (Rosenst.) Domin 79, 93, 94
apoensis Copel. 78, 86
arachnoidea Hook. 140
arachnoidea (non Hook.) Grether & Wagner 140
arachnoidea (non Hook.) Back. & Posth. 140
arborea (L.) Sm. 74
arborea [non (L.) Sm.]
 var. *pallida* Hassk. 86
arborescens Copel. 110
archboldii C. Chr. 79, 98
 var. *horrida* Holtt. 99
arfakensis Gepp 77, 82
arguta Copel. 146
argyrolepis Copel. 131
arthropoda Copel. 141, 143
arthropterygia v. A. v. R. 89
aruensis Domin 131
ascendens Domin 80, 101
aspidioides (Bl.) Zoll. & Mor. 158
assimilis Hook. 142, 150
assimilis (non Hook.) Christ 101
atrispora Domin 158
atropurpurea Copel. 116, 118
atropinosa Holtt. 126, 137
atrox C. Chr. 66*, 107*, 126, 128
 var. *atrox* 128
 var. *inermis* Holtt. 126, 128, 129*, 130*
auriculifera Copel. 138, 139
australis (R. Br.) Domin 69
austrosinica Christ 106
barisanica (v. A. v. R.) Domin 89
bartlettii Copel. 152
batjanensis (Christ) Copel. 75*, 78, 88
beccariana Ces. 150
benculensis (v. A. v. R.) v. A. v. R. 89
bicolana Copel. 149
bicolor Copel. 108
bidentata Copel. 98
biformis (Rosenst.) Copel. 68, 116, 118, 119*, 120
biliranensis Copel. 108
binuangensis v. A. v. R. 141, 145
bipinnatifida Copel. 151
bontocensis Copel. 149
borbonica Desv. 141
borneensis Copel. 81, 110
brackenridgei Mett. 157
brassii Copel. 131
brauseana Domin 88
brevifoliolata (v. A. v. R.) v. A. v. R. 111
breviloba Copel. 146
brevipes Copel. 110
brooksii Copel. (non Maxon) 152
brownii Domin 70*
brunei Christ 124
brunnea (Brause) Domin 120
brunoniana (Hook.) Clarke & Bak. 137
brunonis (J. Sm.) Wall. ex Hook. 143
bulusanensis Copel. 146
bunnemeijerii v. A. v. R. 78, 79, 94
burbridgei (Bak.) Copel. 151
- (*Cyathea*) *burbridgei* [non (Bak.) Copel.] Holtt. 150
buruensis (Rosenst.) Domin 131
callosa Christ 80, 106
calocoma (Christ) Copel. 137
camaguinensis Copel. 106
campbellii Copel. 104
capensis (L. f.) Sm. 70*
capitata Copel. 65, 141, 142, 144*
carrii Holtt. 138, 139*
catillifera Holtt. 78, 90
caudata (J. Sm. ex Hook.) Copel. 81, 108, 110, 114
caudiculata (Rosenst.) Domin 108
caudipinnula (v. A. v. R.) Domin 89
celebica Bl. 138, 140, 157
celebica v. A. v. R. (non Bl.) 139
cheilanthoides Copel. 95
christii Copel. 79, 95
cincinnata Brause 77, 86
cinerea Copel. 80, 104
clementis (Copel.) Copel. 135
coactilis Holtt. 78, 87
confluens (v. A. v. R.) Domin 102
contaminans (Wall. ex Hook.) Copel. 67, 68*, 70*, 71, 125*, 126, 135, 136*, 138
 var. *persquamulifera* v. A. v. R. 134
costalisora Copel. 78, 87
costulisora Domin 81, 109
crassipes Sod. 124
crenulata Bl. 76, 78, 89, 92*, 93, 95, 104
 f. *latissima* v. A. v. R. 103
 f. *squamulosa* v. A. v. R. 103
 f. *subspinulosa* v. A. v. R. 93
crinita (Hook.) Copel. 132
cucullifera Holtt. 80, 103
curranii Copel. 126, 133
curvipinnula C. Chr. 133
cyclodonta (Christ) v. A. v. R. 127
deminuens Holtt. 141, 145
densisora v. A. v. R. 140
deuterobrooksii Copel. 152
dicksonioides Holtt. 80, 83*, 106, 107*
dielsii (Brause) Domin 157
dimorpha (Christ) Copel. 116, 121
dimorphophylla Domin 120
dimorphotricha Copel. 131
discophora Holtt. 76, 142, 148
distans Rosenst. 92
dissitifolia Domin 120
doctersii v. A. v. R. 80, 102
dubia Bedd. 120
dulitensis Bak. 150
dupaxensis Copel. 110
dura Copel. 108
edanoi Copel. 80, 108
elliptica Copel. 141, 142, 146, 151
elmeri (Copel.) Copel. 126, 131, 132
eminens Domin 131
eriophora Holtt. 80, 102
everta Copel. 77, 85
excavata Holtt. 79, 94*
excelsa sensu Kze (non Sw.) 92
faberiana Domin 103
fallax (v. A. v. R.) Domin 111
fenicis (C. Chr.) Copel. 81, 110

- (*Cyathea*) *ferruginea* Christ 79, 100
ferrugineoides Copel. 100
foersteri Rosenst. 79, 99, 100
foxworthyi Copel. 106
frondosa Rosenst. 157
fructuosa Copel. 104
fugax v. A. v. R. 126, 137
fuliginosa (Christ) Copel. 81, 108
fusca Bak. 153, 154, 156
fuscopaleata Copel. 143
gazellae (Kuhn) Domin 158
geluensis Rosenst. 79, 95
 var. *tomentosa* Rosenst. 95
geppiana Domin 88
gibbsiae Copel. 118
gigantea (Wall. ex Hook.) Holtt. 116, 120, 124
glaberrima Holtt. 81, 111
glabra (Bl.) Copel. 67, 115, 116, 120
glabrescens (v. A. v. R.) Domin 152
glauca Bory 135
glaucophylla (v. A. v. R.) Domin 111
glaucum [non (Sm.) Hook. & Arn.] J. Sm. 166
gleichenioides C. Chr. 66*, 67*, 79, 96, 97*
globosora Copel. 85
gracillima Copel. 123
grata Domin 157
gregaria (Brause) Domin 80, 101, 102, 123
haenkei (Pr.) Merr. 132
halconensis Christ 79, 101
hallieri (Rosenst.) Domin 157
havilandii Bak. 79, 96
hemichlamydea Copel. 110
heterochlamydea Copel. 75*, 80, 108, 110, 157
heteroloba Copel. 149
heteromorpha (v. A. v. R.) Domin 118
heterophylla (v. A. v. R.) Domin 121
hewittii Copel. 118
holtiumii Copel. 146
hooglandii Holtt. 77, 83*, 84
hookeri Thw. 141
hornei (Bak.) Copel. 116, 120
horridipes (v. A. v. R.) Domin 114
horridula Copel. 78, 90
hunsteiniana Brause 77, 82
 var. *acuminata* Brause 82
hymenodes Mett. 76, 78, 89, 94
hypocrateriformis v. A. v. R. 146
imbricata v. A. v. R. 79, 97
inaequalis Holtt. 153, 155
incisoserrata Copel. 73*, 74*, 77, 81, 92, 112*, 113
indrapuræ (v. A. v. R.) v. A. v. R. 93, 94
indusiosa Copel. 104
inquinans Christ 79, 100
insignis Eaton 124
insulana Holtt. 79, 98
insularum Holtt. 153, 156
integra J. Sm. ex Hook. 142, 146, 147*, 156
 var. *petiolata* Hook. 146
integra (non J. Sm. ex Hook.) v. A. v. R. 147
janseniana (v. A. v. R.) Domin 145
javanica Bl. 75*, 76, 78, 89, 103
 var. *rigida* Bl. 89, 92
junghuhniana (Kze) Copel. 71, 81, 110, 111
kanehirae Holtt. 81, 113
- (*Cyathea*) *kemberangana* Copel. 151
kenepaiana (v. A. v. R.) Domin 117
keysseri Rosenst. 95
kinabaluensis Copel. 143
kingii (Clarke) Copel. 121
kingii Rosenst. 156
klossii Ridl. 78, 91
korthalsii Mett. 89
korthalsii (non Mett.) C. Chr. 104
lanaensis Christ 108
lastreoides (v. A. v. R.) Domin 115
latebrosa (Wall.) Copel. 67, 71, 77, 81, 92, 103, 111, 113, 115
 var. *indusiata* Holtt. 89
latipinnula Copel. 80, 105
ledermannii Brause 77, 83
 var. *dilatata* Brause 83
lepidigera Copel. 108
lepidoclada (Christ) Domin 77, 82
lepifera (J. Sm.) Copel. 126, 136, 137
leptolepia (v. A. v. R.) Domin 115
leucocarpa Copel. 115
leucophaea Hassk. 92
leucostegia Copel. 140
leucotricha Christ 125, 127, 128
leytensis Copel. 140
lobata Copel. 86
lobbiana Hook. 145
loerzingii Holtt. 80, 105
loheri Christ 76, 80, 104
 var. *tonglonensis* Christ 108
longipaleata Alston 103
longipes Copel. 79, 98
longipes v. A. v. R. 92
longipinna Copel. 115
lunulata (Forst.) Copel. 126, 131
lurida (Bl.) Copel. 116, 121, 122*
macgillivrayi (Bak.) Domin 80, 88, 115, 116, 123
macgregorii F. v. M. 67, 79, 83*, 95, 96*, 108
macrophylla Domin 138, 140
 var. *quadripinnata* Holtt. 141
macropoda Domin 78, 92
magna Copel. 126, 132
magnifolia v. A. v. R. 79, 92, 93
manilensis (Pr.) Domin 110
margarethae (Schroet. ex Christ) Copel. 150
marginata (Brause) Domin 153, 155
masapilidensis Copel. 80, 105
matthewii (Christ) Domin 157
mearnsii Copel. 101
media Wagner & Grether 81, 115
medullaris (Forst.) Sw. 124
megalosora Copel. 142, 148
melanacantha Copel. 134
melanoclada Domin 121
melanophlebia Copel. 101
melanopus (Hassk.) Copel. 111
melanorachis (Copel.) Copel. 121
merapiensis (v. A. v. R.) Domin 111
merrillii Copel. 108
mertensiana (Kze) Copel. 133
mesosora Holtt. 153, 155
microchlamys Holtt. 81, 114
microphyloides Rosenst. 77, 82, 84
mindanensis (Christ) Copel. 108

- (*Cyathea*) *mitrata* Copel. 104
modesta (Bak.) Copel. 80, 102
mollis Copel. 151
moluccana R. Br. 67, 141, 143, 144*, 145
montana Sm. 109
moseleyi Bak. 153, 157
muelleri Bak. 80, 98, 103, 104*
naumannii (Kuhn) Domin 131
negrosiana Christ 78, 90
nigrolineata Holtt. 79, 100
nigropaleata Holtt. 81, 113
nigrospinulosa v. A. v. R. 156
novae-caledoniae (Mett.) Copel. 138
novoguineensis Brause 95
obliqua Copel. 141, 146
obscura (Scort.) Copel. 142, 152
obtusata Rosenst. 110
oinops Hassk. 74*, 75*, 76, 80, 92, 103, 104
oinops (non Hassk.) Racib. 92
okiana (v. A. v. R.) v. A. v. R. 131
oligocarpia Jungh. 103
olivacea (Brause) Domin 121
oosora Holtt. 79, 101
ordinata Copel. 132
orientalis (Kze) Moore 73*, 75*, 78, 86, 95
pachyrrhachis Copel. 80, 105
paleacea Copel. 96
paleata Copel. 93
palembanica (v. A. v. R.) v. A. v. R. 89
pallidipaleata Holtt. 78, 87
papua (Ridl.) v. A. v. R. 153, 155
paraphysata Copel. 152
paraphysophora (v. A. v. R.) Domin 114
parva Copel. 78, 87
parvipinna Holtt. 153, 155
patellifera v. A. v. R. 78, 89
peranemiformis C. Chr. 82
percrassa C. Chr. 77, 84
perpelvigera v. A. v. R. 77, 82, 84
perpunctulata (v. A. v. R.) Domin 81, 114
persquamulata (v. A. v. R.) Domin 124
persquamulifera (v. A. v. R.) Domin 126, 134
philippinensis Bak. 142, 149, 150
 var. *nuda* Copel. 149
physolepidota Alston 81, 113
pilulifera Copel. 126, 133, 134
pinnata Roxb. 143
podophylla (Hook.) Copel. 120
potensis Copel. 151
polycarpa Jungh. 92
polypoda Bak. 142, 150, 151
princeps (Linden) Meyer 124
procera Brause 125, 127*
pruinosa Rosenst. 77, 84
pseudoalbizzia Copel. 149
pseudobrunonis Copel. 143
pseudomuelleri Holtt. 79, 98, 99*
pteridioides Copel. 137
pulcherrima Copel. 125, 126, 127, 153
pulchra Copel. 152
pumilio v. A. v. R. 88, 89
punctulata (v. A. v. R.) v. A. v. R. 81, 112
pustulosa (Christ) Copel. 137
pycnoneura Holtt. 77, 85
quadripinnatifida Copel. 140
- (*Cyathea*) *raciborskii* Copel. 81, 111
ramispina (Hook.) Copel. 116, 117, 118, 121
ramosiana v. A. v. R. 149
ramosii Copel. 151
rebecca (F. v. M.) Domin 116, 120
recommutata Copel. 117*, 118, 121, 122*
recurvata (Brause) Domin 80, 101
reducta (v. A. v. R.) Domin 120
ridleyi (Bak.) Copel. 145, 152
rigens Rosenst. 77, 85, 86
rigida Copel. 96
robinsonii Copel. 142, 149
rosenstockii Brause 153, 154*, 156
rubella Holtt. 116, 122
rubiginosa (Brause) Domin 79, 93
rudimentaris (v. A. v. R.) Domin 115
rufopannosa Christ 80, 106
rumphiana (v. A. v. R.) Merr. 131
rumphii Desv. 157
runensis v. A. v. R. 153, 156
saccata Christ 78, 93
salticola (v. A. v. R.) Domin 114
sangirensis (Christ) Copel. 74, 126, 130, 132
saparauensis (v. A. v. R.) v. A. v. R. 88
sarasinorum Holtt. 126, 134
sarawakensis Hook. 145
scaberula (Christ) Domin 131
scaberulipes (v. A. v. R.) Domin 131
scabriseta Copel. 131
scandens (Brause) Domin 116, 119
schizochlamys Bak. 91
schlechteri (Brause) Domin 116, 123
semiamplectens Holtt. 81, 109
senex v. A. v. R. 142, 149
sepikensis Brause 95
sessilipinnula Copel. 148
setifera Holtt. 153, 154
setulosa Copel. 80, 103
sibuyanensis Copel. 142, 149
singalanensis (v. A. v. R.) Domin 102
sinops (sphalma), cf. *oinops* 92, 104
sinuata Hook. 141
spinifera (v. A. v. R.) Domin 114
spinulosa Wall. ex Hook. 98, 106
 var. *muriculata* Hassk. 92
squamicosta Copel. 108
squamulata (Bl.) Copel. 67, 74*, 142, 145, 147*,
 148, 152
stipitipinnula Holtt. 142, 147
stipitulata Copel. 150
straminea (Gepp) v. A. v. R., non Karst. 88
strigosa Christ 125, 128
subbipinnata Copel. 146
subcomosa (C. Chr.) Domin 131
subconfluens (v. A. v. R.) Domin 102
subdimorpha Copel. 121
subdubia (v. A. v. R.) Domin 116, 120, 124
 subg. *Cyathea* 69, 73, 75*, 76, 77-124
 sect. *Cyathea* 76, 77-115, 123
 sect. *Gymnosphaera* (Bl.) Holtt. 76, 80,
 115-124, 141
 subg. *Gymnosphaera* Tindale 115
 subg. *Sphaeropteris* (Bernh.) Holtt. 69, 74, 76,
 124-158
 sect. *Schizocaena* (J. Sm.) Holtt. 76, 124, 141

(Cyathea)

- subsect. *Sarcopholis* Holtt. 76, 141, **153-158**
 subsect. *Schizocaena* 76, 112, **141-153**
 sect. *Sphaeropteris* 69, 76, **124-141**, 151
 subsect. *Fourniera* (Bommer) Holtt. 76,
 124, **138-141**
 subsect. *Sphaeropteris* 76, 124, **125-138**, 153
subobscura (v. A. v. R.) Domin 152
subspatulata Brause 95
subtripinnata Holtt. 77, **86**
subulata (v. A. v. R.) Domin 118
subuliformis v. A. v. R. 91
sulitii Copel. 108
suluensis Bak. 142, **148**
sumatrana Bak. 78, **91**, 149
taiwaniana Nakai 106
tengerensis (Rosenst.) Domin 126, **134**
tenuicaulis Domin 78, **90**
tenuis Brause 90
ternatea v. A. v. R. 78, **88**
teymannii Copel. 138, **139**
tomentosa (Bl.) Zoll. & Mor. 126, **132**, 133
tomentosissima Copel. 126, **128**
tonglonensis (v. A. v. R.) Domin 108
toppingii Copel. 118
trachypoda v. A. v. R. 78, **91**, 92
trichodesma (Scort.) Copel. 142, **150**, 151
trichophora Copel. 142, 146, **150**, **151**
tripinnata Copel. 138, 139, **140**
tripinnatifida Roxb. 147, 153, **156**, 157
truncata (Brack.) Copel. 140
tuberculata v. A. v. R. 91
umbrosa Copel. 137
urdanetensis Copel. 146, 147
vandusenii Holtt. 77, **84**
veitchiani Domin 157
verrucosa Holtt. 126, **135**
versteegii Christ 156
vexans C. Chr. 120
vitiensis (Carr.) Domin 131
wallacei (Mett.) Copel. 142, **151**
warihon Copel. 108
wangiensis (Brause) Domin 78, 81, **88**
wernerii Rosenst. 153, 154, **156**
womersleyi Holtt. 138, **139**
woodlarkensis Copel. 158
xanthina Domin 152
xantholepis (Christ ex Diels) Domin 158
zamboangana Copel. 142, **147**
zollingeriana Mett. 92
zollingeriana (non Mett.) v. A. v. R. 103
- Cyatheaceae 65-169**
 subfamily Cibotioideae 72
 subfamily Cyatheoideae 71
 tribe Cyatheae 71, 72
 tribe Dicksonieae 71, 72
 tribe Lophosoriaeae 72
 subfamily Metaxyoideae 72
 subfamily Thyrsopteridoideae 72
 tribe Culciteae 72
 tribe Thyrsopterideae 72
- Cystodium* J. Sm. 65, 69, 72, **162-164**
 sorbifolium (Sm.) J. Sm. 67, **163***
Davallia 167
Dennstaedtia 68, 69, 71, 159, 167

- (Dennstaedtia) ampla* (Bak.) Bedd. 161
cuneata (Hook.) Moore 161
erythrorachis (Christ) Diels 162
flaccida (Forst.) Bernh. 162
glabrata (Ces.) C. Chr. 162
gomphophylla (Bak.) C. Chr. 162
javanica Christ 168
moluccana (Bl.) Moore 162
multifida v. A. v. R. 168
paraphysata v. A. v. R. 168
remota (Christ) Diels 162
rhombifolia (Bak.) C. Chr. 162
scabra (Wall.) Moore 161, 162
scandens (Bl.) Moore 162
smithii (Hook.) Moore 162
straminea J. Sm. 169
Diacalpe aspidioides Bl. 158
Dichorexia Pr. 73, 76
 latebrosa Pr. 115
Dicksonia L'Hérit. 65, 67, 68, 69, 70, 71, 72, 74,
 108, **158-162**, 167
 ampla Bak. 161
 antarctica Labill. 69, 160*
 arborescens L'Hérit. 158, 159, 167
 archboldii Copel. 159, **160**
 assamicum Griff. 165
 baranetz Link 165
 blumei (Kze) Moore 69, **159**, 160*
 blumei [non (Kze) Moore] C. Chr. 159
 chrysotricha (Hassk.) Moore 159
 copelandii Christ 168
 culcita L'Hérit. 167
 cuneata Hook. 161
 deltoides Hook. 161
 erythrorachis Christ 162
 flaccida (Forst.) Sw. 162
 glabrata Ces. 162
 gomphophylla Bak. 162
 grandis Rosenst. 159, **161**
 hieronymi Brause 159, **161**
 japonica Sw. 162
 javanica Bl. 168
 kingii Bedd. 162
 lanigera Holtt. 159, **161**
 ledermannii Brause 161
 linearis Cav. 162
 mollis Holtt. 159, 160*
 moluccana Bl. 162
 moluccana Roxb., non Bl. 163
 neglecta Fée 162
 nephrolepioides Christ 162
 papua F. v. M. 163
 remota Christ 162
 rhombifolia Bak. 162
 scabra Wall. ex Hook. 162
 scandens Bl. 162
 schlechteri Brause 161
 sciurus C. Chr. 159, **160**, 161
 sect. *Eudicksonia* Hook. & Bak. 158, 166
 smithii Hook. 162
 sorbifolia Sm. 163
 straminea Labill. 169
 strigosa Thunb. 162
 subg. *Balantium* Hook. 158, 166
 torreyana Brack. 169

- (*Dicksonia*) *zippeliana* Kze 162
Dicksoniaceae 65, 71
Diplazium 157
Disphenia Pr. 73, 76
orientalis Kze 86
Dryopteris 65, 67, 69, 158, 167
atrispora C. Chr. 158
Eatonioopsis Bommer 73
Fourniera Bommer 73, 138
Gleichenia 70, 71, 169
Gleicheniaceae 71
series Marginales 71
series Superficiales 71
Gymnosphaera Bl. 73, 76, 115
atropurpurea (Copel.) Copel. 118
biformis (Rosenst.) Copel. 118
bipinnatifida Copel. 151
burbidgei (Bak.) Copel. 151
dinagatensis Copel. 151
glabra Bl. 120
glabra (non Bl.) Copel. 151
gracillima Copel. 123
hewittii Copel. 118
holttumii Copel. 146
hornei Copel. 121
kingii (Copel.) Copel. 121
melanoclada Copel. 121
melanorachis Copel. 121
mollis (Copel.) Copel. 151
obliqua (Copel.) Copel. 146
papuana (Ridl.) Copel. 155
pulchra Copel. 152
ramispina (Hook.) Copel. 117
recommutata Copel. 118
sarawakensis (C. Chr.) Copel. 152
schlechteri (Brause) Copel. 123
squamulata Bl. 152
squamulata (non Bl.) J. Sm. ex Hook. 118
subbipinnata Copel. 146
trichophora Copel. 151
vexans (Ces.) Copel. 120
Helicogyrateae 71
Hemitelia R. Br. 69, 71, 73, 77
alsophiliformis v. A. v. R. 111
alternans Hook. 145
arfakensis (Gepp) v. A. v. R. 82
barisanica v. A. v. R. 89
bicolor (Copel.) v. A. v. R. 108
capensis Hook. 111
caudata (J. Sm.) Mett. 110
caudiculata Rosenst. 106, 108
caudipinnula v. A. v. R. 89
confluens v. A. v. R. 102
crenulata Mett. 111
fallax v. A. v. R. 111
var. *major* v. A. v. R. 111
glaucophylla v. A. v. R. 111
hemichlamydea (Copel.) v. A. v. R. 110
heterochlamydea v. A. v. R. 108
horrida 73
horridipes v. A. v. R. 114
javanica Pr. 110
junghuhniana (Kze) Mett. 111
var. *dissoluta* Racib. 111
(*Hemitelia*) *latebrosa* (Wall.) Mett. 111, 115
var. *paraphysata* v. A. v. R. 115
latipinnula v. A. v. R. 105
ledermannii Brause 140
leptolepia v. A. v. R. 115
manilensis Pr. 110
merapiensis v. A. v. R. 111
montana v. A. v. R. 109
multiflora (Sm.) R. Br. 77
paraphysophora v. A. v. R. 114
perpunctulata v. A. v. R. 114
rudimentaris v. A. v. R. 115
salticola v. A. v. R. 114
singalanensis v. A. v. R. 102
subconfluens v. A. v. R. 102
sumatrana v. A. v. R. 114
tonglonensis v. A. v. R. 108
truncata (non Brack.) Christ 139
warihon (Copel.) v. A. v. R. 108
Kylikipteris 65
Lastrea dryopteroides Copel. 158
Lindsaea 71
Lophosoria 65, 70, 72
Loxsonia 70
Matonia 71
Metaxya 65, 72
Microlepia 168
strigosa (Thunb.) Pr. 162
Nephrolepis dicksonioides Christ 162
Orthiopteris kingii (Bedd.) Holtt. 162
Osmunda 71
Palmifilix alba Rumph. 131
Pleocnemia cumingiana Pr. 158
Polybotrya arfakensis Gepp 118, 119
Polypodiaceae 71
Polypodium
alternans Wall. 145
arborescens Lour. 157
barometz L. 165
contaminans Wall. 135
latebrosum Wall. 115
lunulatum Forst. 131
Pseudogyrateae 71
Pteridaceae 71
Saccoloma sorbifolia Christ 163
Schizocaena J. Sm. 73, 76, 141
alternans J. Sm. 145
arthropoda (Copel.) Copel. 143
brunonis J. Sm. ex Hook. 141, 143
capitata Copel. 142
gaudichaudii Fée 143
kinabaluensis (Copel.) Copel. 143
moluccana (R. Br.) Copel. 143
Sitobolium stramineum Brack. 169
Sphaeropteris Bernh. 124
Stenochlaena dubia v. A. v. R. 118
Stenolepia tristis (Bl.) v. A. v. R. 158
Tapeinidium pinnatum (Cav.) C. Chr. 162
Thelypteris 65, 66, 158
immersa (Bl.) Ching 158
Thyrsopteris 65, 69, 70, 72, 167
Thysanobotrya v. A. v. R. 73, 115
arfakensis (Gepp) v. A. v. R. 118
Trichopteris falcata Llanos 146