BRYODIVERSITY OF DISTRICT BUDGAM (JAMMU AND KASHMIR) DIPLOLIPDEA ACROCARPAE II

Amarpreet Kour & Anju Rao & Sunita Kapila
Department of Botany, Panjab University, Chandigarh-160014

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ABSTRACT *The present survey of the unexplored area till date has revealed the occurrence of 73 bryophyte species in various habitats. These species fall in 32 genera in 10 orders and 18 families. Among these, there are 44 diplololepidous acrocarpae specices. The present study provides a working base to an Ecologist, Cytologist, Chemist, Physiologist and Pharmacist to evaluate potential of these tiny plants in their relevant field of study.*

Keywords:

Funaria hygrometrica Hedw., Sp. Musc. : 172(1801). **Plate 24**
Mnium hyrometricum (Hedw.) With., Syst. Arr. Br. Pl. ed. 4, 3: 787 (1801).
*Funaria angustifolia*Brid., Sp. Musc., 3;:71(1817).
F.androgyna Brid., Bryol. Univ., 2 :58(1827).
F. ramificans Brid., *ibid.:* 738(1827).
*F. campylopus*Brid.,*ibid*.: 739(1827).
F. gracilescens Schimp. *ex* C. Muell., Bot. Zeit., 16: 154(1858).
*F. marginata*kindb., Bih. K. Svensk. Vet Ak. Handl., 7 : 79(1883).
F. megapoda C. Muell., Bull. Herb. Boiss., 5: 175(1897).
F. globicarpa C. Muell., Nuov. Giorn. Bot. Ital. n. ser., 5: 162 (1989).
F. lonchopelma C. Muell., Hedwigia , 38: 61 (1899).
as var. calvescens (Schwaegr.) Mont., Ann. Sc. Nat. Bot. Ser. 2, 12: 54(1839).
*Funaria calvescens*Schwaegr., Sp. Musc. Suppl. 1(2): 77 (1816).
*Funaria leptopoda*Griff., Cal. J. Nat. Hist., 2: 512 (1842).
Funaria nepalensis C. Muell., Bot. Zeit., 13: 748(1855).
F. connivens C. Muell., *ibid*: 747(1855).
Dioecious. Plants light green, brown-red when dry,small-medium, growing in lose tufts. Stem simple or branched, ±8 mm long, comal leaves twisted aroud stem. Leaves shrunken when dry, erect-spreading when moist, upper leaves ±4mm long and ±0.8mm broad, lower leaves ±2.5mm long and ±1mm wide, ovate to acuminate, concave, soft, slightly decurrent, margins entire, apex acute, apex awned; costa strong, excurrent, base red; upper laminal cells ±101 × 27µ, rhomboid-hexagonal, elongated red-brownish, prosenchymatous, marginal laminal cells ± 30×10µ, narrower, basal laminal cells long-rectangular, ±42× 20µ; perichaetial leaves ±4mm long and ±0.8mm broad. Seta apical, erect, red, ±3cm long; capsule horizontal to pendulous, ±3.5 mm long and ±1mm wide, clavate-pyriform, ovate, cylindrical, apophysis tapering, peristome teeth double, epicranoid, outer teeth brown, spirally arranged, inner teeth hyaline; operculum short conic and apiculate. Spores small, yellowish, finely papillose, ±14 µ in diameter.
In this species of cosmopolitan distribution of species, plants were found growing on moist soil near streams.

Specimen examined
Budgam: Chadoora; Collected from moist soil and sandy soil; Jun 2013, **PAN 6121.**
Distribution:*Funaria hygrometrica* Hedw. is cosmopolitan in distribution.
Chromosome number: n=14

KEY TO THE SPECIES OF GENUS *POHLIA*

1. Plants with abundant gemmae…… *Pohlia flexuosa* Plants without gemmae……2
2. Dioecious. Leaves closely arranged on stem. Capsule pendulous…… …….. *Pohlia rigescens* Monoecious. Leaves distantly

placed on stem. Capsule horizontal. …….. ……..…….. ……..*Pohlia himalayana*

Pohlia flexuosa Hook., Icon. Pl. Rar., 1:19(1836). **Plate 25**

*Bryum brachydontium*Hamp., C. Muell. Syn., 1:327(1848).
Webera flexuosa(Hook.)Mitt., Musci Ind. Or.:66(1859).
*W. delicatula*Mitt.,*ibid*.: 66 (1859).
Brachymenium leucostomum Bosch *et* Lac., Bryol. Jav., 1 : 142 (1860).
Webera hampeana Bosch et Lac., ibid., 1: 137(1860) nom. illeg.
Bryum scabridens Mitt., J. Proc. Linn. Soc., 8:151 (1864).
Webera scabridens (Mitt.) Jaeg., Ber. S. Gall., Naturw. Ges., 1873-74: 130 (1875).
Brachymenium papillosum Jaeg., ibid. :122 (1875).
B. scabridens (Mitt.) Broth. Hedwigia, 38: 218(1899).
Pohlia brachydontia (Hamp.) Broth., Monsunia, 1 : 45 (1899).
P. delicatula (Mitt.) Broth. Nat. Pfl., 1(3): 552 (1903).
P. hampeana Broth. ibid.: 547 (1903).
P. papillosa (Jaeg.) Broth., ibid.: 552 (1903).
P. leucostoma (Bosch *et* Lac.) Fleisch., Musci Fl. Buiteenz., 2: 514(1904).
Webera gracillima Card., Bull. Soc. Bot. Geneve ser. 2, 1: 125 (1909).
*Pohlia subflexuosa*Broth., Sitz. Ak. Wiss. Wien. Math. Nat. Kl. Abt. 1, 131 : 213 (1923).
Webera leucostomoides Broth., Bishop Mus. Bull. 40: 14 (1927).
Pohlia gracillima (Card.) His., Cat. Moss Jap.: 91(1929).
*Webera gracilescens*Bartr., Bishop Mus. Bull., 101: 109 (1933).
*W. speciosa*Sak., Bot. Mag. Tokyo, 53:288 (1939).
W. curiosa Dix. *et*Sak., Bot. Mag. Tokyo, 54: 6 (1940).
Pohlia gracilescens (Bartr.) Bartr., Bishop Mus. Occ. Pap. 20: 299 (1952).
P. leucostomoides(Broth.) Bartr., ibid. : 299 (1952).

Dioecious. Plants yellowish to green-brownish, growing in close tufts. Stem erect, ±1 cm long, brown, simple with subfloral innovation, gemmae present. Leaves dense, erectopatent, lanceolate, ±2.7 mm long and ± 0.6 mm broad, apex acuminate, margins flat but reflexed at base, entire below, dentate at tip; costa strong, percurrent, yellow; upper laminal cells linear, rhomboid, ±56×7µ, narrower and slightly curved towards margins, basal laminal cells rectangular, ± 45×11µ; perichaetial leaves longer than normal leaves, ±3.3mm long and ±0.5mm wide, linear-lanceolate. Seta erect, ±1.5 cm long, arcuate, flexouse when dry; capsule pendulous or nodding, ±3mm long and ±1.5 mm in diameter, elongated, oval pyriform; outer peristome teeth yellow with hyaline, papillose tips; inner teeth hyaline, papillose, basal membrane low, cilia rudimentary or lacking; operculum small, pointed conical, exothecial cells irregular. Spores brown, rounded, lightly papillose, ±10 µ in diameter.

Plants were medium sized, yellow to green, growing in tufts on moist soil under trees. Sterile plants possess gemma present in axil of uppermost leaves.

Specimen examined

Budgam: Budgam,Khansahib,Beerwah; Growing on moist soil, Mar 2015, **PAN 6145**.

Distribution: Western Himalaya, Western Ghats, Sri Lanka, Philippines, Taiwan, China, Korea, Japan Hawaii, Central America, North and South America. It is worldwide distributed species.

Chromosome number: n=11

Pohlia himalayana (Mitt.) Broth., Nat. Pfl., 1(3):548(1903). **Plate 26**

*Webera himalayana*Mitt., Musc. Ind. Or. :66 (1859).
Bryum himalayanum (Mitt.) C. Muell., Gen. Musc. Fr.: 218(1900).

Monoecious. Plants variable in size, growing in loose tufts. Stem slender, ± 2.7 cm long, reddish. Leaves erect to erectopatent when moist, crispate and closely appressed to stem when dry, small, ovate-lanceolate, upper ones longer, narrower lanceolate, ± 2mm long and ± 0.5 mm wide, basal leaves broad, decurrent, apex acute, margins entire at base, dentate at apex, reflexed throughout leaf; costa strong, excurrent; upper laminal cells hexagonal to rhomboidal, ±37×7µ, basal laminal cells narrow rectangular, ±22× 7µ. Seta apical, erect, ±1.5cm long, reddish in color; capsule brown when mature, oblong ±5mm long and ±2mm broad; club-shaped; outer peristome teeth yellow with hyaline, papillose tips; inner teeth hyaline, papillose, basal

membrane low, cilia rudimentary or lacking; tapering apophysis. Spores reddish-brown, papillose, ±12 µ in diameter.

Plants medium sized, green in color and were growing in tufts. They were growing on moist soil under trees. Earlier, this species was reported from Sikkim and now for the first time it is being reported from the study area.

Specimen examined

Budgam: Budgam, Khansahib, Beerwah; Growing on moist soil; Mar 2015, **PAN 6146.**

Distribution: North-Eastern India and North Western Himalayas.

Chromosome number: Not known so far.

Pohlia rigescens (Mitt.) Broth., Nat. Pfl., 1(3):548(1903). **Plate 27**

*Webera rigescens*Mitt., Musci Ind. Or.: 65(1859).

Dioecious. Plants loosely or densely tufted, green to yellow. Stem red, erect, ±2cm long, simple, brown, tomentose. Leaves patent to erectopatent when moist, shrunken when dry, ± 2mm long and ±0.5 mm wide, ovate-lanceolate; upper leaves form comal rufts, narrowly lanceolate with tapering acumen, flexuose, decurrent, margins denticulate at tip; costa strong, red, percurrent to shortly excurrent; upper laminal cells narrowly rectangular, ±21×7µ, basal laminal cells hexagonal to rhomboid, ±38×7µ. Seta apical, ±1.8 cm long, red; capsule pendulous, ±5mm long and ±2mm in diameter, oblong-ovate, wider and tapering; outer peristome teeth yellow with hyaline, papillose tips; inner teeth hyaline, papillose, basal membrane low, cilia rudimentary or lacking. Spores reddish-brown, papilose, ±11.5 µ in diameter.

Plants with densely clothed leaves and pendulous capsule help easy distinction of the species. Like the preceeding species, this taxon was also earlier reported from Sikkim. The present discovery of the species from the investigated area extends its range of distribution.

Specimen examined

Budgam: Budgam,Khansahib,Beerwah; Growing on moist soil; Mar 2015, **PAN 6147.**

Distribution: Endemic in the Himalayas.

Chromosome number: Not known so far.

KEY TO THE SPECIES OF GENUS *BRACHYMENIUM*

1. Plants tall (±1.3 cm), leaf margins recurved in lower half……
…… *Brachymenium microstomum*
Plants small (±5mm), Leaf margin flat ……2
2. Leaves aristate, upper laminal cells larger (±100×10µ)……
……*Brachymenium acuminatum*
Leaves acuminate, upper laminal cells smaller(±40×7µ)…….. *Brachymenium bryoides*

Brachymenium acuminatum Harv., Icon. Pl. Rar, 1:19(1836). **Plate 28**

Brachymenium cuspidatum Griff., Cal.J.Nat.Hist., 3:58(1943).

Bryum pungens Tayl.,Lond. J.Bot., 5:52(1846).

B.multicaule Tayl. *ibid*:53(1846).

B. harveyanum C.Muell., Syn., 1: 313(1848).

B.flaccidisetum C.Muell., Bot. Zeit., 11:23(1853).

Brychymenium mielicchoferioidies C.Muell., Giorn. Bot. Ital., 4: 16(1872).

B. flaccidisetum (C. Muell.) Jaeg., Ber. S. Gall. Naturw. Ges., 1873-74:111(1875).

Dioecious. Plants pale-yellow, reddish brown below, growing in tufts, branched by several innovations, matted together by tomenta below. Stem erect, reddish in color, ±5mm long. Leaves erect when moist, contorted when dry, crowded, ±1mm long and ±0.5 mm broad, imbricate, oblong-lanceolate, concave, acuminate, margins entire, flat; costa strong, excurrent, extending into arista; upper laminal cells, ±100×10µ, thin walled, rhomboid; basal laminal cells ±90×15µ, rectangular to irregularly rounded, cells narrower at margin. Seta apical, ±2.5 cm long, curved; capsule ±3mm long and ±1mm in diameter, clavate, light brown; operculum short, conical, apex blunt. Spores rounded, papillose, ±14 µ in diameter.

Plants small, reddish in color and were growing in tufts. They were growing near the bank of stream. The soil was moist. It is widespread species.

Earlier, this species was recorded from South India. The present finding is first record from the area.

Specimen examined

Budgam: Charari Sharie, Khansahib; Growing on moist soil; Oct 2013, **PAN6150.**

Distribution: Kashmir,Nepal, South India, Thailand, Penang, Philippines, Ethiopia, Australia and South America.

Chromosome no: n=10

Brachymenium bryoides Hook. *ex* Schwaegr., Musc. Suppl. 2(1): 134 (1824). **Plate 29**

*Brachymenium herpocaulon*Brid., Bryol. Univ., 1:603(1826).
B. weisia Harv. Hook., Icon. Pl. Rar., 1:19(1863).
Bryum weisia (Harv.) C. Muell., in Syn., 1:325(1843).

Dioecious. Plants green, gregarious. Stem short ±5mm long, main stem prostrate, reddish tomenta below. Leaves erect when moist, erectopatent when dry, dense, small, ±1mm long and ±0.2mm broad, ovate-lanceolate, margins flat, entire throughout; costa strong, excurrent; upper laminal cells ±40×7µ, thin walled, elongate, hexagonal to rhomboid at top, basal laminal cells quadrate to rectangular, ±38×7µ; perichaetial leaves like branch leaves. Seta apical, red, ±1.2cm long; capsule erect, ±0.8mm long and ±0.3 mm broad, brown, narrow-mouthed; exothecial cells thick walled, rounded hexagonal to quadrate, shorter near rim; peristome teeth linear-lancolate, wide at base, papillose at tip, inner transparent; operculum short, dark red, conical obtuse tip; annulus prominent, broad; . Spores rounded, papillose, ±12 µ in diameter.

Earlier, this species was recorded from Eastern Nepal, Simla, Almora, and Nilgri (South India). The present report is the first record from the area.

Specimen examined

Budgam: Charari Sharie, Khansahib; Growing near the bank of stream; Oct 2013, **PAN6149.**

Distribution: North-Western Himalaya (Shimla, Almora, Kashmir), South India (Nilgri), East Nepal.

Chromosome no: n=11

Brachymenium microstomum Harv. Hook., Pl. Rar., 1: 19 (1836). **Plate 30**

Dioecious. Plants small, glossy, green, reddish brown below, growing in loose tufts. Stem short, erect, branched, ±1.3cm long. Leaves erect when moist, erectopatent, curmpled when dry, ±0.8mm long and ±0.55 mm broad, oblong-lanceolate, broad, red at base, acuminate, denticulate apex, margins recurved in lower half, entire; costa strong, excurrent; upper laminal cells thin walled, ±60×6µ, narrow-elongated, rhomboid, middle cells ±110×8, linear, basal laminal cells ±80×14µ, sub rectangular; perichaetial leaves shorter, ±1mm long and ±0.3mm wide. Seta apical, ±3cm long, erect; capsule ±3mm long and ±1mm wide, erect, ovate-clavate, short apophysis; peristome teeth brown, lanceolate, exostome yellow, inner peristome segments transparent; operculum conical; exothecial cells irregular, annulus present. Spores rounded, papillose, ±17 µ in diameter.

This species was found growing near the bank of stream. The soil was moist and sandy. Earlier, this species was reported from Eastern Nepal and Orissia. It was considered endemic in these areas. For the first time, it has been reported from Kashmir which extends its range of distribution.

Specimen examined

Budgam: Charari Sharief,Chadoora; Growing near the bank of stream; Oct 2013, **PAN 6148.**

Distribution: Orissia, Kashmir and East Nepal.

Chromosome no:n=11

KEY TO THE SPECIES OF GENUS *BRYUM*

1.Plants silver white …….. *Bryum argenteum* Plants green to reddish……2

2. Leaf borderd…….. *Bryum pseudotriquetrum* Leaf unborderd……3

3. Leaf margins recurved…….. *Bryum recurvulum* Leaf margins non –recurved……4

4. Arista denticulate……5 Arista entire……6

5. Leaves ovate to oblong…….. *Bryum pseudotriquetrum* Leaves acuminate…….. *Bryum coronatum*

6. Leaf oblong, arista long, leaf margin entire…….. *Bryum alpinum* Leaf ovate-acuminate to oblong, arista short, leaf denticulate at apex……..*Bryum capillare*

Bryum alpinum Huds. *ex*With., Syst. Arr. Birt. Pl. ed. 4, 3: 824(1801). **Plate 31**
Mnium alpinum (With.) P. Beauv., Prodr.: 73(1805).

*Bryum subalpinum*Warnst., Bot Centralbl., 72: 394(1897).
B. afro-alpinium Rehm. *ex* C. Muell., Hedwigia, 38: 73(1899).
B. wilmsii C. Muell., *ibid.,* : 74(1899).
B. velonovskyi Podp. *Rozpravy*Cesk .Ak. Ved. Tr. 2, 10(2): 42(1901).
B. laurentianum Card. &Ther., Proc. wash. Ac. Sc., 4: 320(1902).
B. gemmiparum var. sublapiunum (Warnst.) Roth., Eur. Laubm, 2: 146(1904).
B. spindleri Podp. &Stoll. Spindl., Hedwigia, 52: 51(1912).
B. rivulare ssp. velenovskyi (Podp.) Amann., Fl. Mouss. Suiss, 2: 238(1919).
B. gemmiparum var. flaccidum Dism., Bull. Soc. Bot. France, 67:45(1920).
*B. madagassanum*Ther., Podp. Act. Ac. Sc. Nat. Morav ., 25 :110(1953).
*B. gemmiparum var. cuspidatum*Roth., Podp in Consp., : 358(1954).

Dioecious. Plants deep brown, sturdy, robust, reddish brown below. Stem erect, reddish brown, ±1cm long. Leaves stiff with subfloral innovations, erect when moist, erectopatent when dry, oblong, ±2.5 mm long and 0.5mm broad, decurrent, concave, margins reflexed, entire; costa thick, brown, ending in a arista; laminal cells thick walled, upper laminal cells rhomboid, ±68×8µ, marginal laminal cells narrow forming distinct border, basal laminal cells rectangular ±53×12µ. Seta apical, ±1.5cm long, erect, arucate tip; capsule pendulous, ±3.5mm long and ±1.5mm in diameter, deep red, elongate pyriform; outer teeth hyaline at apex and yellow below, inner peristome yellow; operculum glossy mamillate. Spores yellow, finely papillose, ±11 µ in diameter.
Plants medium sized, green and were growing in tufts. They were growing on moist soil present near water springs. It is a cosmopolitan species.

Specimen examined

Budgam: Budgam, Khansahib; Growing on moist soil near water spring; Mar 2015, **PAN 6152** .

Distribution: Western Himalaya, South India, West Tibet, Asia, Europe, Africa and North America.A cosmopolitan species

Chromosome no: n=10, 20

Bryum argenteum Hedw., Musc. : 181 (1801). **Plate 32**
VAR. *lanatum* (P. Beauv.) Hamp., Linnaea, 13: 44(1839) et B.S. G. in Bryol. Eur., 4: 148(1839).
Mnium lanatum P. Beauv., Prodr.: 75(1805).
Bryum lanatum (P. Beauv.) Brid., Sp. Musc., 3: 20(1817).
Bryum argenteum var. costa-ricense Ren. et Card. in Bull., Soc. R. Bot. Belg., 31(1):167(1893).
B. argenteum var. percurrens Podp., Beih. Bot. Centralbl., 15: 492(1903).

Dioecious. Plants glossy, silver-white, growing in dense turfs. Stem erect, silver white, about ±2cm long. Leaves small, ±2mm long and ±0.5mm broad, erectopatent, imbricate, ovate, concave, apex obtuse, margins plane, unbordered; costa percurrent or ending into hyaline arista; upper laminal cells hyaline, middle laminal cells rhomboidal, ±60×15µ, often thick-walled; basal laminal cells chlorophyllose, quadrate to short-rectangular, ±45×11µ; costa weak, ending into hyaline arista; apex acute; perigonial and perichaetial leaves differentiated, perichaetial leaves triangular, ending into hyaline arista, ±2.7 mm long and ±0.9mm broad. Seta apical, red, erect, ±2cm long; capsules ±2mm long and ±1mm broad, pendulous, ovate; apophysis tapering; peristome with double teeth, exostome dark yellow, papillose, tips hyaline, lanceolate, endostome well developed, hyaline; operculum conical, apiculate. Spores finely papillose, 8 µ in diameter.
The silver white plants help instantaneous recognition of this species in the field. Gemma multicellular and bud-like are found on sterile branches which offer an additional feature in identification. The species exists in three cytological forms which hardly differ in their morphological characters.

Specimen examined

Budgam: Charari Sharief**,** Khansahib; Growing on moist soil; Sep 2013, **PAN6116a**.

Distribution: India, Australia, New Zealand and Antarctica. It is a cosmopolitan species.

Chromosome no: n=10, 11, 20

Bryum capillare Hedw., Musc.; 182 (1801). **Plate 33**
Bryum squalidum Brid., Musc. Rec., 2(3): 52(1803).
B. ferchelii Funck ex Brid., Bryol. Univ., 1: 847(1827)
B. torquescens De Not., Syll. n. 163 (1838).
B. domingense C. Muell., Linn., 17: 594(1843).

B. philippianum C. Muell., Linn., 18: 701(1845).
B. capillare var. capense C. Muell.,Syn., 1 :281(1848).
B. cuspidatum Wils., Kew J. Bot. 9:364 (1857).
B. thomsonii Mitt., Musc., Ind. or: 364 (1857).
B. oreganum Sull. U. S Expl. Exp. Wilkes Musc.: 10 (1859).
B. baueri Hamp., Linn., 30:457(1860).
B. teneriffae Hamp., C. Muell. Bot. Zeit., 20: 12(1862).
B. triste De Not., Cronac. Briol. Ital., 1: 26 (1866).
B. chilense Reichd Oest. Freg. Novara Bot., 1: 75(1870).
Rhodobryum albo-limbatum Hamp. & C. Muell. Linn., 36:517(1870).
Bryum pohliaeforme Schimp. in Besch., Mem. Soc. Sc. Nat. Cherbourg, 16: 198 (1872).
B. rufonitens Hamp.,Vid. Medd. Naturh.For. Kjobenh. ser. 3, 9-10: 261(1878).
B. nanocoma C. Muell.,Linn., 43: 365(1882).
B. sawyeri Ren. & Card., Rev. Bryol., 15: 71(1888).
B. pusillum Broth., Oefv. Finsk. Vet. Soc. Foerh., 33: 99(1890).
B. whiteleggei Broth., Proc. Linn. Soc. N. S. Wales, 7: 277(1892).
B. capillare ssp. heteroneuron C. Muell. & Kindb, Macoun: Cat. Canad. Pl., 6: 130(1892).
B. immarginatum Broth., Oefv. Finsk. Vet. Soc. Foerh., 35: 50 (1893).
B. heteroneuron (C. Muell. & Kindb.) Ren. & Card., Rev. Bryol., 20: 3(1893).
B. floridanum Ren. & Card., *ibid.*, : 4(1893).
B. Sanguilentum Ren. & Card. *ibid.*, : 31 (1893).
B. syntrichiaefolium C. Muell., Broth., Bot. Jahrb., 20: 88 (1894).
B. speirophyllum Kindb., Bull. Soc. Bot. Ital. 1895:17(1895).
B. squarrosum Kindb., Roell. Hedw., 35:66(1896).
*B.bernouilli C.*Muell., Herb. Boiss., 5: 183(!897).
B. vulcanicola C. Muell., *ibid.*:184(1897).
B. donianum var. floridanum (Ren. &Card.) Kindb., Eur. N. Am. Bryin., 2: 359(1897).
B. gemmascens Kindb., *ibdi.,*: 360(1897).
B. streptophyllum Kindb., *ibid., :* 359(1897).
B.tomentosum Kindb., *ibid.,*: 361(1897).
B. trichophorum Kindb., *ibid.,*: 359(1897).
B. plebejum C. Muell., Hedw., 37: 94(1898).
B. synoicum C. Muell., *ibid.*, : 96(1898).
B. erythropyxix C. Muell., *ibid.,*: 101(1898).
B. nagasakense Broth., Hedw., 38: 219(1899).
B. lonchopyxix Broth., *ibid.*,:72(1899).
B. microsporum Broth.,Oefv. Finsk. Vet. Foerh., 42:100(1899).
B. flaccidifolium C. Muell., Gen. Musc. Fr.: 238(1900).
B. obconicum var. *aristatum* Roth., Eur. Laubm., 2: 152(1904).
B. pycnoloma C. Muell., Par. Ind. Bryol., ed. 2, 1; 250(1904).
B. tomentosulum Par., *ibid.,*: 264(1904).
B.subrepandocarpum Card. & Ther., Bot. Gaz., 37:374(1904).
B. baileyi Holz., *Bryologist,* 8: 54(1905).
B. fosteri Holz., *ibid.*:80(1905).
B. moravivcum Podp.,Vestn. Klub. Prirod. Prost., 8: 41(1906).
B. courtoisii Broth. & Par., Rev. Bryol., 35: 41(1908).
B. tosanum Card., Bull. Soc. Bot. Geneve ser. 2, 1: 128(1909).
B. rubrolimbatum Broth.,Philipp. J. Sci., 5C: 147(1910).
B. validicostatum Card. & Dix., J. Bot., 49: 4(1911).
B. leptothecioides Besch. et Watts., Proc. Linn. Soc. N. S. Wales, 40: 374(1915).
B. yuennanense Broth., Sitz. Ak. Wiss. Wien. Math. Nat. KI., 133: 570(1924).
B. rhomboidale Ther., Rev. Bryol. n. ser., 3:37(1930).
B. vino-viride Bartr., in Bis. Mus. Bull., 101:116(1933).
B.spininervium Dix., Not. R. Bot. Gard. Edin., 19: 291(1938).
B. capense (C.Muell.) Podp., in Act. Ac. Sc. Nat. Morav., 22:439(1950).
B. littorale Hamp. Podp. in nom. nid. in *synon.*, *ibid.* : 389(1950).
B. capillare var. spininervium (Dix) Podp. ibid.,: 389(1950).

B. donianum var. squarrosum Podp., ibid., 23:26(1951).

Dioecious. Plants small to medium-sized, growning in compact tufts. Stem brown, ±3cm long, green to reddish, branched with many subforal innovations. Leaves shrunken, spirally twisted when dry, erect-spreading when moist, comal leaves uniformaly twisted aroud stem, ovate-acuminate to oblong, ±3mm long and ±2mm wide, concave, soft, slightly decurrent, apex acuminate, margins entire, tip of leaf denticulate; costa stout, excurrent ending into arista, reddish base; upper laminal cells rhomboid-hexagonal, ±45×15µ, red-brownish, prosenchymatous, 1-3 line of cells near margin are longer, narrower, usually with hyaline walls, ±115×10µ, basal laminal cells long-rectangular, ±75×25µ; perichaetial leaves shorter, narrower, ±2.5 mm long and ±1.8 mm wide. Seta apical, red, arcuate, ±2.9 cm; capsule horizontal, ±4mm long and ±1mm wide, pyriform-ovate, cylindrical, apophysis tapering; peristome teeth double, exostome red, endostome hyaline; operculum short conic and apiculate. Spores light green, smooth to finely papillose, ±10 µ in diameter.

The species is highly polymorphic. The variations in several morphological characters result from the diversity in cytological constitution.

Specimen examined

Budgam: Budgam, Khansahib; Growing on moist soil, attached to rocks; Sep 2013, **PAN6117a.**

Distribution: Southern India (Tamil Nadu, Kerala) Western Himalaya and Kashmir; China, Thailand, Vietnam, Taiwan, Korea, Japan, Siberia, Central Asia, Europe, North & Central Africa, North & South America, Australia and New Zealand. It is a cosmopolitan species.

Chromosome number: n= 9, 10, 10+2-3 acc., 10+2 m, 20, 20 +m

Bryum coronatum Schwaegr., Sp. Musc. Frond., Suppl. 1(2):103 (1816). **Plate 34**

Bryum angustifolium Brid., Sp. Musc., 3: 31(1817).
B. caespiticium var. angustifolium (Brid.) Hamp., Linnaea, 13:44(1839).
*B. doliolum*Dub., Moritzi Syst. Verz. Zoll. Pfl.: 133(1846).
*B. brevicacule*Hamp., Linnaea, 36: 518(1870).
B. subatropurpureum C. Muell., Linnaeae, 37: 147 (1871).
B. macropelma C. Muell., Linn., 37: 149(1872).
B. rufinerve C. Muell., Linn., 38: 549(1874).
B. barbulaceum C. Muell., Linn., 39: 389(1875).
B. convolutaceum C. Muell., *ibid*.:388 (1875).
B. gracilifolium C. Muell., *ibid*.: 390(1875).
B. hogbergii C. Muell., *ibid*.: 391(1875).
B. schweinfurthii C. Muell., *ibid.:* 386(1975).
*B. mariei*Besch., Ann. Sc. Nat. Bot. ser. 6, 10: 235(1880).
B. zygodontoidies C. Muell., Bot. Jahrb., 5: 83(1883).
B. afro-litorale C. Muell., *ibid.,* : 88(1883).
B. erythrostegium C. Muell., Flora, 69: 279(1886).
B. rhyparicaulon C. Muell., *ibid* .: 507(1886).
*B. balanocarpum*Besch., Bull. Soc. Bot. France 41:82(1894).
B. curtum Par., Ind. Bryol.: 176(1894).

Dioecious. Plants dull green, densely growing, tomentose at base. Stem erect, ±2cm long. Leaves ovate, erect when moist, erecto-patent when dry, ±4mm long and ±1mm broad, acuminate, margins entire; costa strong, red, excurrent, ending into denticulate arista; upper laminal cells narrow, ±57×8µ rhomboid - rectangular, basal laminal cells rectangular, ±39×9µ, thin-waled, unbordered; perichaetial leaves shorter than normal leaves, triangular, ±3.2 mm long and ±1mm broad. Seta apical, erect, 1±.5cm long; capsule pendulous, ±2.5mm long, ±1.5 mm in diameter, apophysis thick and spongy; peristome double, exostome hyaline, lanceolate, papilose tips, endostome yellow, finely papillose; operculum conical. Spores double, yellow, smooth, ±12.5 µ in diameter.

The plants were growing on moist soil present near water sources like streams, springs, under water tanks, water seeping through walls, kitchens and water pipes.

Male plant slender 3cm long, antheridal bud becomes pseudoalters by innovations, antheridia large, long, numerous with many paraphyses. It is a cosmopolitan species.

Specimen examined

Budgam: Khansahib,Beerwah; Growing on moist soil; Oct 2013,**PAN6151**.

Distribution: India: Eastern Himalaya, Western Himalaya, Kashmir and Rajasthan, Bolivia, Borneo, Brazil, China, Japan, Thailand,Taiwan and Java, Mexico, Peru, Philippines.

Chromosome number: n=10

Bryum pseudotriquetrum Hedw., Sp. Musci Suppl., 1 (2): 110(1816). **Plate 35**

*Mnium pseudotriquetrum*Hedw., Sp. Musc.,: 190(1801).
Bryum cubitale Dicks. *ex*with., Syst. Arr. Brit. Pl. ed. 4, 3: (1801).
B. ventricosum Reth., Fl. Cantrabr. ed. 2: 427(1802).
*Mnium bimum*Schreb., Bot. Zeit. Regensburg, 1:79(1802).
Bryum bimum (Schreb) Turn. Musc. Hib.: 127(1804).
B. straminifolium Tayl. *ex*.Schwaegr., Sp. Pl. ed. 4, 5(2): 54(1832).
*B. subobliquum*Lindgr., Bot. Not. 1842:18(1842).
B. tasmanicum Hamp., Linn., 25:714(1853).
B. rubiginosum Hook. f. et Wils., Fl. Tasman., 2 : 90(1859).
*B. ellipticum*Lac., Ned. Kruidk. Arch., 5:294(1861).
B. physcomtrioides C. Muell., Jaeg. Ber. S. Gall. Naturw. Ges. 1877-78:446(1880).
B. turgens Hag. K. Norsk. Vid. Selsk. Skrift. 1897(2):20(1897).
B. maudii R. Br. ter. Trans. NewZ. Inst., 31: 460(1899).
B. austropolare Card., Rev. Bryol., 27: 45(1900).
Webera gerlachei Card., *ibid.,*: 44(1900).
Bryum amoenum var. cavifolium Podp., Beih. Bot. Centralbl., 15: 483(1903).
B. quarnboense Bomanss., Rev. Bryol., 39: 99(1903).
B. gracilens Card., Bull. Soc. Bot. Geneva, Ser. 2, 1: 128(1909).
*B. pallens var filamentosum*Mik., Bryoth. Balt.: 105(1910).
B.intortulum Stirt., Trans. Bot. Soc. N. S. Wales, 42: 586(1916).
*B. austro-affine*Broth., ibid.: 487(1916).
*B. baurii*Amann., Fl. Mousse Suiss, 1: 128(1919).
B. yendangaianum Card. in Card. &Broth ., K. Svensk. Vet. Ak. Handl., 63(10):43(1923).
*B. suzukii*Broth., Sas. Trans. Nat. Hist. Soc. Formosa, 18:90(1928*).*
B. samuelssonii Ther., Rev. Bryol. Lichen., 14:17(1944).

Dioecious. Plants robust, green, reddish below, growing in close tufts. Stems erect, ±4cm tall, reddish tomentose below, subfloral innovations. Leaves erect when dry, erectopatent to erect spreading when moist, 5mm long, ±1.5mm wide, oblong-lanceolate, apex acute, base broad, comal leaves erectopatent; margins entire, except denticulated apex, margins bordered; costa stout, excurrent, denticulated arista; apical laminal cells thin walled, hexagonal-rhomboid, ±49×19µ, middle cells longer than apical cells, ±69×25µ, basal laminal cells rectangular, ±64×19µ. Seta reddish brown, erect, ±5cm long; capsule pendulous, ±5mm long and ±2mm in diameter, ovate-clavate, apophysis tapering; peristome teeth double, exostome teeth yellow-brown, finely papillose below, endostome segments fenestrate; operculum conical. Spores smooth, light yellow, 9 µ in diameter.

Plants medium sized, green in color and were growing in tufts. They were growing on moist soil present near water along the bank of water along stream. It is a cosmopolitan species.

Specimen examined

Budgam: Khansahib; Growing on moist sandy Soil; Sep 2013; **PAN 6118a.**

Distribution: India (Kumaon Himalaya, Sikkim, Kashmir); Nepal, Korea, Columbia, Ecuador, Siberia, Venezuela; Europe, Australia, Africa, Antarctica and.

Chromosome number: n=5,10,11

Bryum recurvulum Mitt., Musci Ind. Or. : 77 (1859). **Plate 36**

Bryum leptoflagellans C. Muell., Nouv. Giorn. Bot. Ital. n. ser., 3: 96(1896).
*B. chrysobasilare*Broth., Sitzungber. Ak. Wiss. Wien Math. Nat. KI., 133: 569(1924).
*B. recurvatum*Broth., Symb. Sin., 4:59(1929).
*B. mussuriense*Broth., Bruehl Bot. Surv. Ind., 13(1): 122 (1931).
B. noguchii Ochi J. Jap. Bot., 31: 364(1956).

Dioecious. Plants yellow-green, slender, growing in tufts. Stem erect, ±2cm long, tomentose below present, subforal innovations present. Leaves uniformly arranged, comal leaves curled when dry, ovate-oblong, ±2.5 mm long and ±1mm broad, acuminate, margins entire; costa strong, excurrent, arista long; upper leaf cells rhomboid-hexagonal, ±38×15µ, basal leaf cells rectangular, ±38×19µ, reddish brown, marginal cells longer, narrower, ±76× 9µ; perichaetial leaves not differentiated. Seta apical, ±2.5 cm long, reddish brown,

suberect, arcuate; capsule brown, ±4mm long and ±2mm in diameter; apophysis tapering; peristome teeth double; operculum conical, apiculate. Spores smooth, light yellow, 10 µ in diameter.
The plants were found growing on moist soil present near bank of the stream.

Specimen examined

Budgam: Budgam,Khansahib; Growing on moist soil; Sep 2013, **PAN 6119a.**
Distribution: Eastern andWestern Himalayas, China, Japan.
Chromosome number: n=10, 10+m

Bryum uliginosum (Brid.) B.S.G., Bryol. Eur., 4:88 (1839). **Plate 37**
*Cladodium uliginosum*Brid., Bryol. Univ., 1: 841(1827).
*Cynontodium cernuum*Hedw., Sp. Musc., 1: 156(1806).
Bryum Turbinatum var pallens Drumm., Musc. Bor. Am. n. 267(1828).
B. cernuum (Hedw.) B.S.G., Bryol. Eur., 4: 84(1839).
*B. viridans*Wils., Mitt. Musc. Ind. Or. : 71(1859).
*B. elbingense*Warnst., Schrift. Naturf. Ges. Danzing Ser. 2, 9: 170(1896).
B. conditum Williams, Bull. N.Y. Bot. Gard., 2: 125(1901).
B. camptocarpum Card. *et* Ther., Bot. Gaz., 37: 374(1904).
B.inclinatum var. stolleanum Podp. Riehm. Sitzungsb. Abjh. Naturw. Ges. Isis Dresden 1926: 24(1927).

Autoecious. Plants small to medium size, growing in loose tufts, green to dark brown, interwoven below with tomenta, subfloral innovations present. Stem erect, ±3cm long. Leaves soft, comal leaves clustered around stem, erectopatent, ovate to oblong, apex acuminate, margins entire, denticulate at apex; costa brown, excurrent, arista short hyaline. Upper laminal cells longer, rhomboid, ±69×8µ, basal laminal cells large, thin walled, rectangular to rhomboid, ±57×8µ. Seta apical, slender, erect, ±2.5 cm long; capsule, pendulous, cylindrical-elongate, ±4mm long and ±2mm in diameter, brown, oval-pyriform; peristome teeth double, exostome linear, yellowish, endostome hyaline and shorter than exostome; operculum conical. Spores rounded, yellow, minutely papillose, ±12 µ in diameter.
The plants were growing on moist soil, present near water along the bank of water stream. The lax thin walled cells, the long setae and long cylindrical capsule characterise the small- sized species.

Specimen examined

Budgam: Khansahib; Growing on wet sand; Sep 2013, **PAN 6120a.**
Distribution: India, California, America and Europe.
Chromosome number:n=10, 11

KEY TO THE SPECIES OF GENUS *MNIUM*

1. Leaf margins entire ……2 Leaf margins dentate……3
2. Leaf ovate-elliptical…… *Mnium confertidens* Leaf ovate-oblong to rounded obtuse……4
3. Leaf large ±6 mm long and ±3mm wide, laminal cells strongly collenchymatous, whitish tinge, mildly denticulate. Spores ±15 µ in diameter……*Mnium succulentum* Leaf small ±3.5 mm long and ±2.5 mm wide, laminal cells non collenchymatous, whitish tinge absent, strongly denticulate in upper half. Spores ±30 µ in diameter…… ……*Mnium confertidens*
4. Leaf oblong,costa percurrent…… *Mnium integrum* Leaf ovate, costa sub percurrent…… *Mnium rostratum*

Mnium confertidens (Lindb. Arn.) Kindb., Bryin. Exot. :107 (1891). **Plate 38**
*Astrophyllum confertidens*Lindb. *et*Arn. K.Svensk. Vet. Ak. Handl., 23(10)17(1890).
Mnium arbusculum C. Muell. Nuov. Giorn. Bot. Ital. n. ser. 5:161(1898).
M. densirete Hamp. C. Muell. Gen. Musc. Fr.:134(1900).
M. undulatum var. densirete Broth. Symb. Sin., 4:61(1949).
Monoecious. Plants yellow-green above, reddish-brown at base, growing in loose tufts. Stem erect, branched, dendroid, stolons not prominent, ±4cm long. Leaves crispate when dry, spreading when moist, ±6mm long and ±2mm wide, ovate-elliptical to narrowed at top and base, median leaves rounded, decurrent at base, mucronate at apex; more or less transversely undulate, margins dentate; costa yellow brown, excurrent; laminal cells thick walled, irregularly rounded quadrate at top, ±22µ, median laminal cells rounded-hexagonal, ±20µ, basal laminal cells near costa elongated, rectangular, ±83×7µ.

Sporophyte not observed.
Plants medium sized, green and were growing in loose tufts. They were growing near bank of stream and on the ground, where water was seeping.

Specimen examined

Budgam: Khansahib, Beerwah;Growing on moist soil and wet logs; Oct 2013,
PAN 6111a. Itis first time record for the area.
Distribution: India, Mongolia, Turkey, Asia and Europe.
Chromosome number:n=6

Mnium cuspidatum Hedw., Musc. :192(1801). **Plate 39**
Bryum cuspidatum (Hedw.) Crom., Samml. Deutsch. Laubm.: 46(1803).
Pollo cuspidata (Hedw.) Brid., Bryol. Univ., 2:827(1827).
*Mnium trichomanes*Mitt., Kew. J. Bot., 8: 231(1856).
M.silvaticum Lindb., Not. Saellsk. F. Fl. Fenn. Foerh., 9:59(1868).
*M. acutum*Lindb., Act. Soc. Sc. Fenn., 10:227(1872).
Astrophyllum silvaticum Lindb Musc. Scand.:14(1879).
*Mnium japonicum*Schimp., Besch. Ann. Sc. Nat. Ser. 17, 7: 343(1893).
Mnium incrassatum C. Muell., Nouv. Giorn. Bot. Ital. n. ser., 3: 91(1896).
*M. kashmirense*Broth., Act. Soc. Sc. Fenn., 24(2): 28(1898).
M. subacutum Broth. in C. Muell., Gen. Musc. Fr.:135(1900).
M. decursivifolium C. Muell., *ibid*: 135(1900).
M. dubitatum Card., Bull. Soc. Bot. Geneve ser. 2, 1: 129(1909).
*M. amurense*Brorth., Trav. Bot. Mus. Ac. Sc. Petrograd, 16:30(1961).
M. microblastum Broth., Oefv. Finsk. Vet. Soc. Foerh., 62A(9) : 20(1921).
*M. sirajevii*Podp., Publ. Fac. Sc. Univ. Masaryk Brno, 116:15(1929)
M. cuspidatum Dix., Rev. Bryol. Lich., 7:109(1934).
M. rosulaceum C. Muell., Kab in Hedw., 76: 34(1936).
Plagiomnium trichomanes (Mitt.) Kop., Ann. Bot. Fenn., 5: 146(1968).

Dioecious. Plants green, robust, growing in close tufts. Stem erect, green, shoots sub erect, about ±4cm long. Leaves spreading when moist, crumpled-crispate when dry, lower leaves smaller, upper leaves crowded forming comal tufts ovate, acuminate, base narrowed, decurrent, ±3.5 mm long and ±2.5 mm wide, margins dentate only in the upper half; costa strong, reddish; laminal cells thick walled, irregularly rounded quadrate, ± 22µ, marginal laminal cells bordered by 2 to 5 rows, elongated, hyaline, ±88×8µ; perichchaetial leaves longer, narrower, pointed ends, ±4.3 mm long and ±2 mm wide. Seta erect, arcuate at tip, ±2cm long; capsule pendulous, ovate-oblong, ±2.5mm long and ±1.5 mm wide;peristome normal; operculum conical obtuse. Spores light brown, papillose, round, ±30 µ in diameter.
Plants robust, dark green and were growing in tufts. They were growing on moist soil present near the bank of stream and also in forests, where water was seeping from the sandy ground.

Specimen examined

Budgam: Budgam,Khansahib; Growing on moist sand; Oct 2013, PAN**6112a.**
Distribution: North Western Himalayas, Europe, North America, Tropical and Southern Africa.
Chromosome number:n=12

Mnium integrum Bosch & Sande Lac., Bryol. Jav. 1:153(1861). **Plate 40**
*Mnium vesicatum*Besch., Ann. Sc. Nat. Bot. Ser. 7, 17: 345(1893).
M. pseudocrispum C. Muell., Gen. Musc. Fr.: 134(1900).
*M. spathulifolium*Dix., J. Siam . Soc. Nat. Hist. Suppl. 9:23(1932).
*M. osadae*Sak., Bot. Mag. Tokyo, 49: 765(1935).
*M. doii*Sak.,*ibid*.: 770(1935).
M. latedecurrens Dix. Kab., Hedw., 76: 49 (1936).
Plagiomnium integrum (Bosch. & Lac.) Kop. Hikobisa, 6: 57(1971).

Dioecious. Plants green, robust, lax. Stem erect, ± 9cm long, tomentose at base. Leaves large, erect when moist, crumpled when dry, branched, ±8mm long and ±4mm wide, ovate-oblong, narrowed at base, apex obtuse, vegetative shoots sub-erect, margins entire, revolute at base; costa percurrent in older leaves; laminal cells usually thin walled, quadrate-hexagonal, ±45µ, marginal laminal cells (3-5 rows) forming borders; perichaetial leaves longer, narrower,±10mm long and ±3mm wide. Seta erect, ±1.5cm long, arcuate

at tip. Capsule ±2.4 mm long, ±1.3mm wide, pendulous, ovate-oblong; peristome double; operculum conical obtuse, Spores light brown, papillose, round, ±21 µ in diameter.

Plants robust, dark green and grow in tufts. This species occurs in two cytological races. The lack of distinction in morphological characters suggest that polyploidy is not able to effect morphological characters.

Specimen examined

Budgam: Budgam,Chadoora, Khansahib; Growing on sandy soil, near the bank of stream and in forests; Oct 2013, PAN6113a.

Distribution: North Western Himalayas, Asia ,Europe. A European and Asiatic species.

Chromosome number: n=6, 12

Mnium rostratum schrad., Regensburg, 1:79 (1802). **Plate 41**

*Mnium longirostre*Brid., Musc. Rec., 2(3):106 (1803).
Hypnum rostratum (Schrad.) Web. & Mohr., Ind. Mus. Pl. Crypt:(1803).
Bryum rostratum (Schrad.) Sm., Fl. Brit., 3: 1369(1804).
Mnium cylindricum Hoffm. *ex*Brid., Bryol. Univ., 1: 70(1826).
M. rhynchophorum Hook., Icon. Pl. Rar., 1:20(1836).
*Bryum coriaceum*Griff., Cal. J. Nat. Hist., 3:60(1843).
Mnium ecklonii C. Muell., Bot. Zeit., 13:749(1855).
M. coriaceum (Griff.) Mitt., Musc. Ind. Or. :143(1859).
M. nietneri C. Muell., Linn, 36:32(1869).
*M. maximovickzii*Lindb., Act. Soc. Sc. Fenn., 10:224(1872).
Astrophyllum rostratum (Scrad.) Lindb., Musc. Scand.: 13 (1879).
Mnium novae-zeelandiae Col.,Trans. NewZealand Inst., 18: 225(1886).
M. xanthocarpum Col., ibid. , 20: 238(1888).
M. madagascariense Kiaier in Wright in J. Bot., 26: 265(1888).
M. hilderbrandti C. Muell., Wright in ibid.: 265(1888**).**
M. prorepens C. Muell., Flors, 82: 437(1896).
*M. micro-ovale*C.Muell., Nuov. Giorn. Bot. Ital. n. ser. 4: 246(1897).
M. orbifolium C. Muell., Bull. Herb. Boiss., 5: 176(1897).
M. spathulatum Mitt.,Trans. Linn. Soc. Lond. Bot. ser. 2, 3 :166(1899).
M. pseudorhynchophorum Broth. Fleisch., Musc. Fl. Buitenz., 2: 580(1904).
M. ligulifolium Card., Bull. Soc. Bot. Geneve ser. 2, 1: 129(1909).
*M. yunnanense*Ther., Bull Ac. Geogr. Bot., 21: 270(1911).
*M. undulatifolium*Warnst., Hedw., 57: 107(1915).
*M. kiyoshii*Okam., J. Coll. Sc. Imp. Univ. Tokyo, 38(4): 19(1916).
*M. reidii*Sim., Dix. Trans. R. Soc. S. Africa, 8: 204(1920).
*M. spathulatulum*Sak., Bot. Mag. Tokyo, 49: 769(1935).
M. ligulaceum C. Muell., Sak., ibid., 49: 685(1935).
M. subundulatum Dix in Kab. Hedw., 76:58(1936).
Plagiomnium maximovickzii(Lindb.) Kop., Ann. Bot. Fenn., 5: 147(1968).
P. rostratum (Hook.) Kop.,*ibid*., (1968).
P. rhynchophorum (Hook.) Kop., Hikobia, 6: 57(1971).

Dioecious. Plants yellow-green to dark-green, growing in loose-compact creeping mats. Main stem erect, lateral sterile branches arise from the comal regions, fertile shoots erect, crowded at apex, ±4cm long. Leaves undulated, complanate, erect when moist, crumpled when dry, simple-branched, ovate, ±8mm long and ±3mm broad, apex obtuse, notched at tip, margins denticulate, bordered; costa red, strong, *sub* percurrent; upper and middle laminal cells thick walled, irregularly quadrate, hexagonal, ±25µ, basal laminal cells rectangular or sub-rectangular, ±61×26µ, a row of narrower longer rectangular cells present at margin, ±132×7µ; costa red, percurrent, guide cells present; perichaetial leaves longer, ±10mm long and ±4 mm wide. Seta red, erect, ±3cm long; capsule horizontal to pendulous, ±4mm long and ±2mm in diameter, yellow-light brown; beak red; peristome normal; operculum long rostrate, straight or curved . Spores brown, papillose, round, 12 µ in diameter.

Plants robust, dark green and were growing in tufts, present on moist and sandy ground in forests. Lateral sterile branches arise from the comal regions, fertile shoots erect and crowded at apex.

Specimen examined

Budgam: Budgam, Charari Sharief,Khansahib; Growing on moist soil; Oct 2013, PAN 6114a.

Distribution: Nepal and India (Dharmshala, Western Himalayas); New Zealand, Pennsylvania, Europe,

Chromosome number: n=12

Mnium succulentum Mitt., Musci Ind. Or. :143 (1859). Plate 42

M. voxense Besch., Bull. Soc. Bot. France, 41: 82(1894).

M. formosicum Card., Beih. Bot. Centralbl.,19(2): 112(1905).

M. nazeense Card. &Ther., Monde Pl. ser. 2, 9(45): 22(1907).

M.yakusimense Card. &Ther.,*ibid.*, : 22 (1907).

M. subvesicatum Broth. & Par., Rev. Bryol., 35: 44(1908).

M. esquirolli Card. & Ther., Bull. Ac. Geogr. Bot., 19:19(1909).

*M. nakanishikii*Broth., Oefv. Finsk. Vet. Soc. Foerh., 62A(9): 21(1921).

M. yazeense Card. & Ther. *ex* Broth., Nat. Pfl., 2(10): 415(1924).

M. magnifolium Hor., J. Jap. Bot., 11:503(1935). *M. laxe-limbatum* Broth., Kab. Hedwigia, 76: 52(1936).

*M. mackinnoi*Broth., Kab. ibid. : 52(1936).

M. zierii (Hedw.) P. Beauv. var. grandifolium Dix. & Ther. Kab. ibid.: 52(1936).

Plagiomnium succulentum (Mitt.) Kop., Ann. Bot. Fenn., 5:147(1968).

Dioecious. Plants roboust, branched, lax, growing in close tufts. Stem ±5cm long, stout, green, brown tomenta below, creeping, branched. Leaves placed in two rows, obovate-oblong, ±6 mm long and ±3mm wide, whitish tinge present, erect when moist, flexuose when dry, rounded-obtuse, apiculate, base narrower, wide at middle, margins entire; costa percurrent, inconspicuous, ending just below the apiculus; laminal cells collenchymatous, rounded to hexagonal, ±20µ in diameter, border cells in two rows, rectangular, ± 38×22µ; pericheatial leaves longer than normal leaves, 8mm long and 3mm broad. Seta ±2cm long. Capsules ±3.5 mm long and ±2.4mm broad, cernuous, oblong; exostome teeth yellowish-brown; cilia endostome 2-3; operculum rostrate; calyptrae cucullate, with a long beak. Spores brown, papillose, round, ±15 µ in diameter. Plants robust, dark green and were growing in tufts. They were growing on moist soil near the bank of stream.

Specimen examined

Budgam : Budgam; Growing on moist soil, on the banks of stream; Oct 2013,PAN6115a.

Distribution:Western Himalayas, Tiwan, China, Britian.

Chromosome number: n=6, 6+m

Philonotis falcata (Hook.) Mitt., Musci Ind. Or. : 62(1859). **Plate 43**

*Bartramia falcata*Hook., Trans. Linn. Soc. Lond., 9: 317(1808).

Philonotis fontana var. *falcata*(Hook.) Brid., Bryol. Univ., 2:21(1827).

*Bartramia subulosa*Griff., Calcutta J. Nat. Hist., 2:512(1842).

B. fontana var. *falcata* (Hook.) B. S. G., Bryol. Eur., 4: 49(1842).

B. macrocarpa C. Muell., Bot. Zeit., 11: 57(1853).

B. pseudofontana C. Muell., Bot. Zeit., 10:418(1856).

*B. goniocladа*Wils., Kew J. Bot., 9: 369(1857).

*Philonotis subulosa*Musc., Ind. Or., 61(1859).

P. macrocarpa (C. Muell.) Mitt.,*ibid*.,: 62(1859).

P. pseudofontana (C. Muell) Mitt., ibid. :62(1859).

*P. carinata*Mitt., Trans. Linn. Soc. Bot. Lond. ser. 2, 3: 164(1891).

P. ruficuspis Besch., Rev. Bryol., 18:(1891).

*Philonotula japonica*Schimp., Besch. Ann. Sc. Nat. Bot, ser. 7, 17: 348(1893).

Philonotis angularis C. Muell., Nuov. Giorn. Bot. Ital. n. ser. 3:105(1896).

P. giraldii C. Muell., *ibid*.: 104(1896).

P. japonica (Schimp.) Par., Index Bryol.: 923(1897).

Bartramia tsanii C. Muell., Nuov. Giorn. Bot. Ital. n. ser. 4: 251(1897).

B. tomentosula C. Muell., *ibid*. n. ser. 5:172(1898).

Philonotis hymenodontoidea Par., Ind. Bryol. Suppl. 266(1900).

P. orthostichaceae C. Muell., Par. ibid.: Suppl. 267(1900).

P. tomentosula (C. Muell.) Par., *ibid*.: Suppl. 268(1900).

P. tsanii (C. Muell) Par., *ibid*.: 268(1900).

P. bodonierii Card. & Ther., Bull. Ac. Int. Geogr. Bot., 13:82(1904).

*P. baldwinii*Broth., Bull. Soc. Bot. Ital., 1904:21(1904).

P. laxiretis Card., Bull. Soc. Bot. Geneve. ser. 2, 1: 122(1909).
*P. caespitosa var. fallax*Dism., Mem. Soc. Bot. France, 17:30(1910).
P. fallax (Dism.) Dism.,*ibid*., 17:35(1910).
*P. bonatii*Copp., Bull. Soc. Sc. Nancy ser. 3, 12(4):9(1911).
P. mutica C. Muell., Dism., Bull. Soc. Bot. France, 59: 485(1912).
P. anisoclada Card. & Vard., Rev. Bryol., 50: 23(1923).
P. fragilicupis Dix Ann. Bryol., 3: 62(1930).
P. dickinosoniana C. Muell., Kab. Hedwigia, 77: 108(1937).
P. pallescens C. Muell., Kab., ibid.: 110(1937).

Dioecious. Plants robust, yellow-green, growing in dense mats. Stem ±2cm long, whorl of sub-floral branches, interwoven tomenta below. Leaves ±6 mm long and ±3mm wide, erectopatent, triangular, tips falcate, acuminate, carinate, margins flat, sharply denticulate; costa, prominent, strong, yellow, excurrent; upper laminal cells mamillose, narrow, elongate-hexagonal, ±34×7µ, basal laminal cells rectangular, ±30×15µ; perichaetial leaves triangular, ±7 mm long and ±3mm wide. Seta apical, erect, red-brown, ±5cm long. Capsule pendulous, ±5mm long and ± 2mm broad, ovoid, furrowed when dry; exostome lancolate, brown, papillose, hyaline at tip, endostome shorter, hyaine, papillose; operculum planoconvex. Spores round, brownish, ±20 µ in diameter.

Specimen examined

Budgam: Budgam.Khansahib, Beerwah; Growing on sandy bank of stream and in fish culture tank; Oct 2012, **PAN 6110a**.

Distribution: Asia, Europe and Africa.

Chromosome number: n=6

Discussion

the acrocarpic mosses outnumber the pleurocarpic taxa.

Among the acrocarpic mosses, the families Bryaceae (represented by 13 species) and Pottiaceae (represented by 19 species) are more commonly distributed in this area (Figure 6, 7).

The members of the former family are restricted to moist and shady situations, while the members of the latter family are adapted to exposed situations. This difference in the distribution pattern under contrasting situations seems to be linked with their distinctive morphological and structural organization of stem and leaves. The short and thickened leaf cells increase the surface area for water absorption and increased photosynthetic activity, the dense papillae in the cells check loss of water and provide protection from high insulation, the densely clothed stems, hair pointed leaves helpin water conservation. All these features, singly or in combination found in the Pottiaceae and Grimmaceae, confer adaptive advantage to those families for colonization in exposed habitats. On the other hand, the larger leaves, sparsely clothed stems, the larger leaf cells, smooth areolations, the thin walled epidermis and cortex in the stem, the features that are found in the members of the family Bryaceae, favour/ restrict colonization in shady, moist and damp habitats.

The family Bryaceae, a diplolepideous taxon, appears to have lagged behind in evolving different adaptive features that are necessary for colonizing in diverse habitats, and hence are restricted to bryologically hygrophytic and, at best, bryologically mesophytic situations.

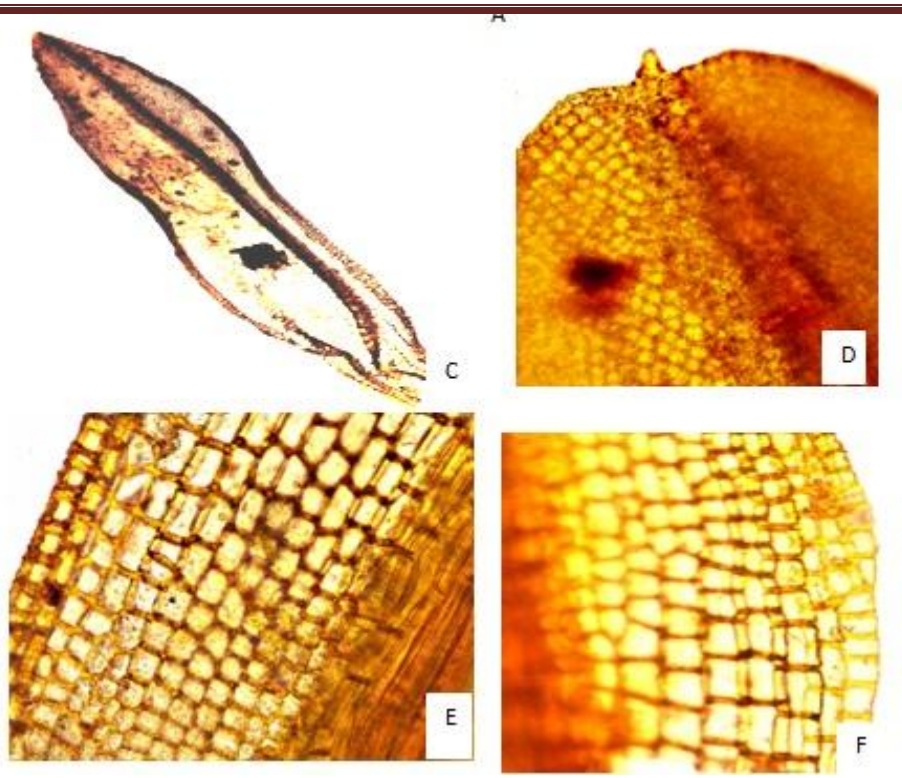

Plate 24: *Funaria hygrometrica* (Hedw.) Sp. Musc. : 172(1801); A. Dry plant (3X), B. Wet plant (3X), C. Leaf (75X), D. Apical laminal cells (290X), E. Middle laminal cells (290X), F. Basal laminal cells (290X).

Plate 25:*Pohlia flexuosa* Hook., Icon. Pl. Rar., 1:19(1836); A. Dry plant (2X), B. Wet plant (3X), C. Leaf (75X), D. Apical laminal cells (290X), E. Middle laminal cells (290X), F. Basal laminal cells (290X).

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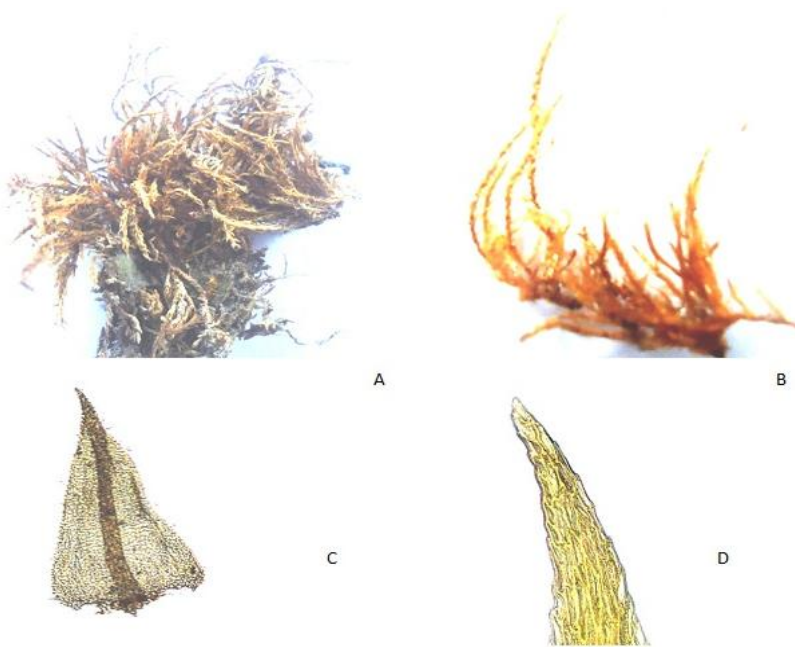
Plate 26:*Pohlia himalayana* (Mitt.)Broth., Nat. Pfl., 1(3):548(1903);A. Dry plant (2X), B. Wet plant (3X), C. Leaf (75X), D. Apical laminal cells (290X), E. Middle laminal cells (290X), F. Basal laminal cells (290X).



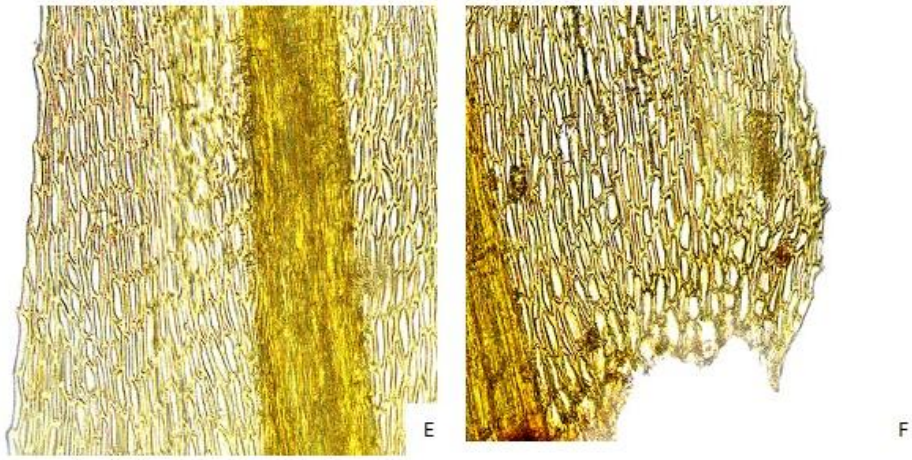


Plate 27*: Pohlia rigescens* (Mitt.)Broth., Nat. Pfl., 1(3):548(1903); A. Dry plant (2X), B. Wet plant (3X), C. Leaf (75X), D. Apical laminal cells (290X), E. Middle laminal cells (290X), F. Basal laminal cells (290X).

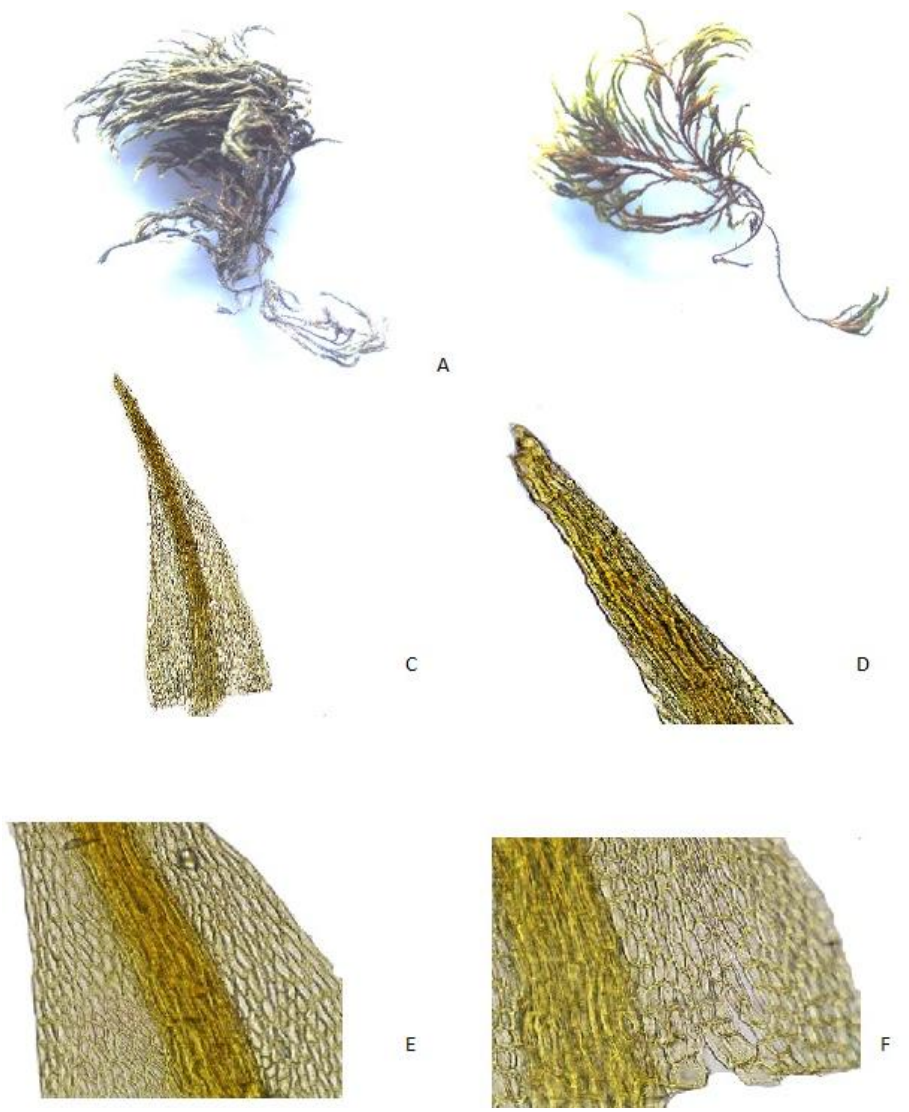


Plate 28:*Brachymenium acuminatum*Harv., Icon. Pl. Rar, 1:19(1836); A. Dry plant (3X), B. Wet plant (3X), C. Leaf (75X), D. Apical laminal cells (290X), E. Middle laminal cells (290X), F. Basal laminal cells (290X).

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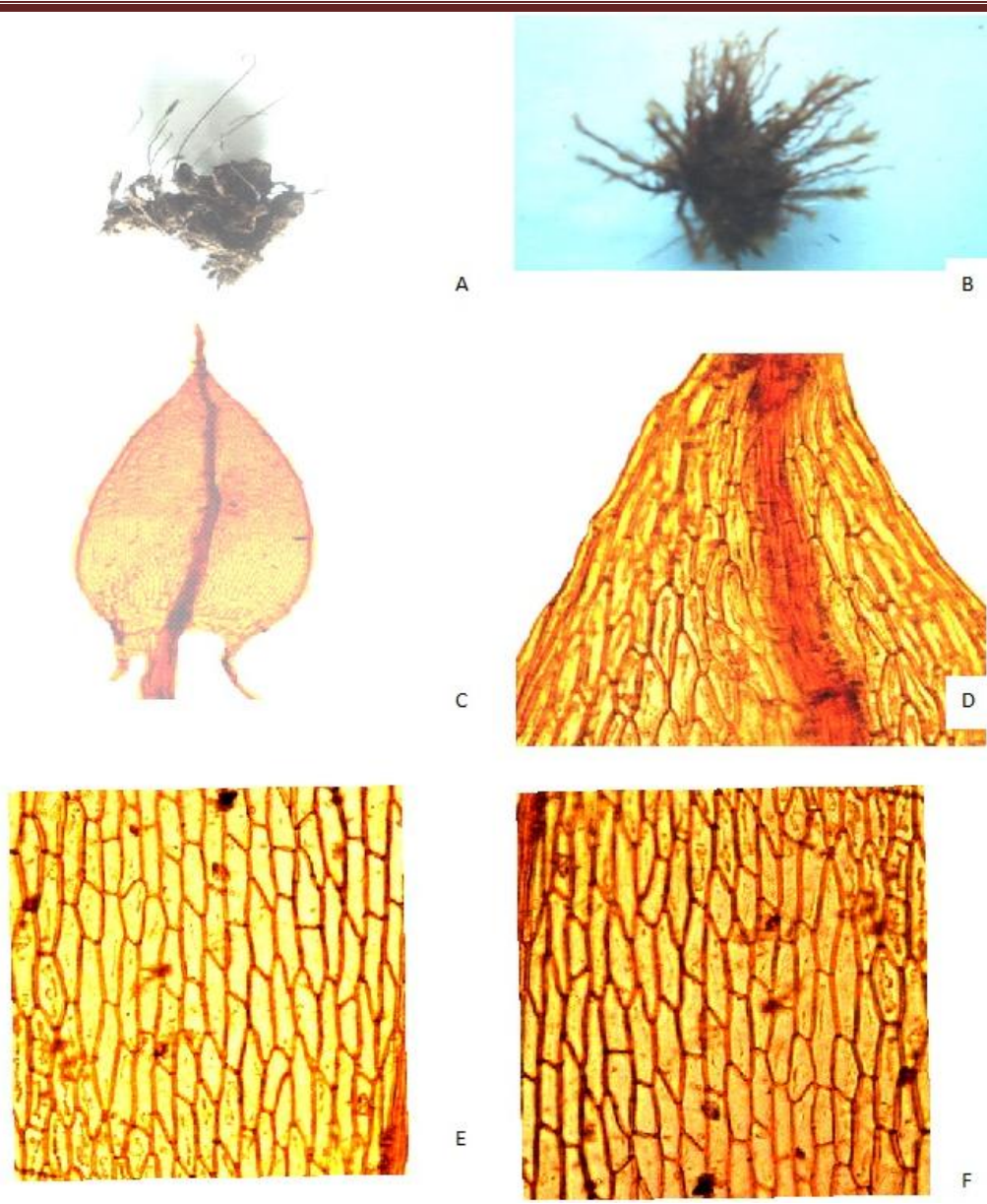
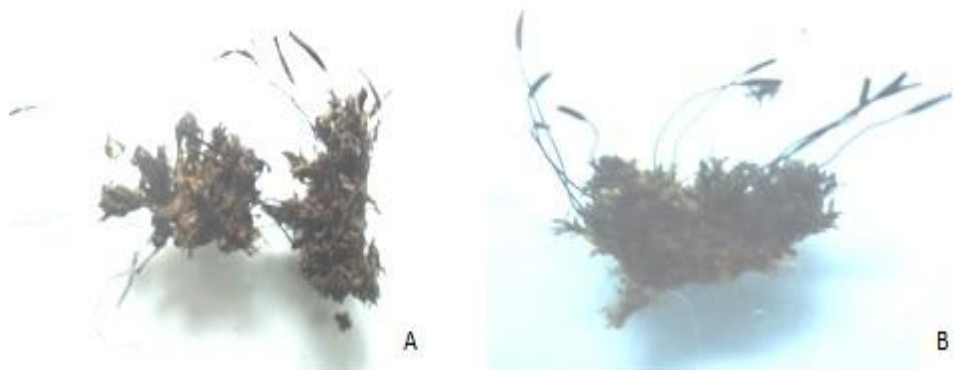


Plate 29:*Brachymenium bryoides* Hook. *ex*Schwaegr. Musc. Suppl. 2(1): 134 (1824); A. Dry plant (1X), B. Wet plant (3X), C. Leaf (75X), D. Apical laminal cells (290X), E. Middle laminal cells (290X), F. Basal laminal cells (290X).



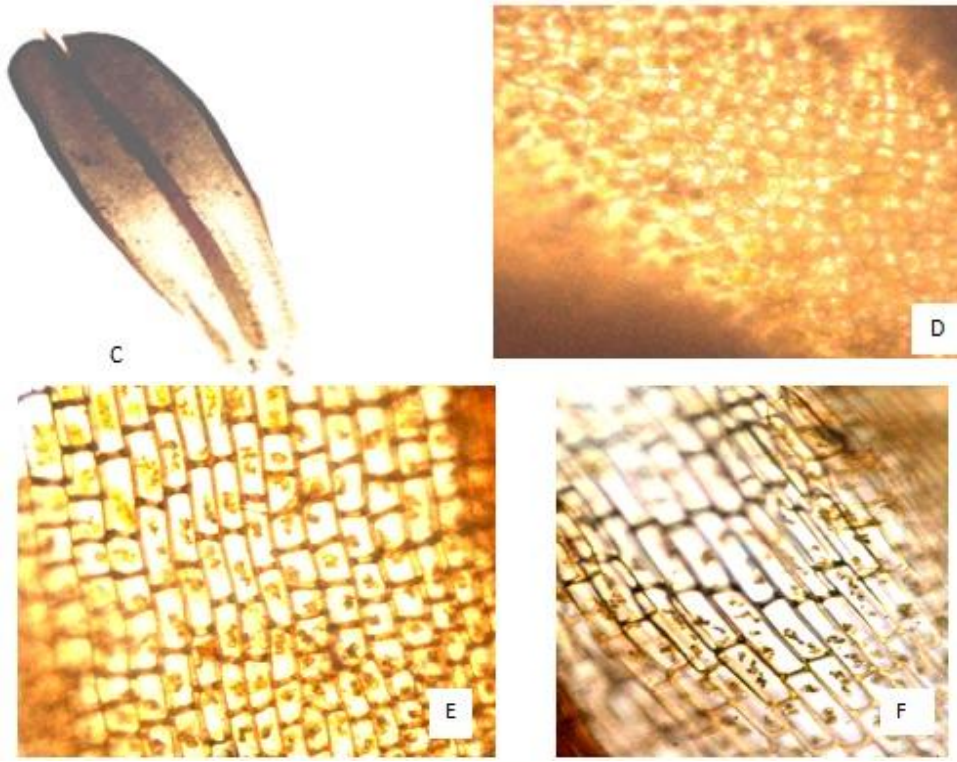


Plate 30:*Brachymenium microstomum* Harv.Hook. Pl. Rar., 1: 19 (1836);A. Dry plant (2X), B. Wet plant (3X), C. Leaf (75X), D. Apical laminal cells (290X), E. Middle laminal cells (290X), F. Basal laminal cells (290X).

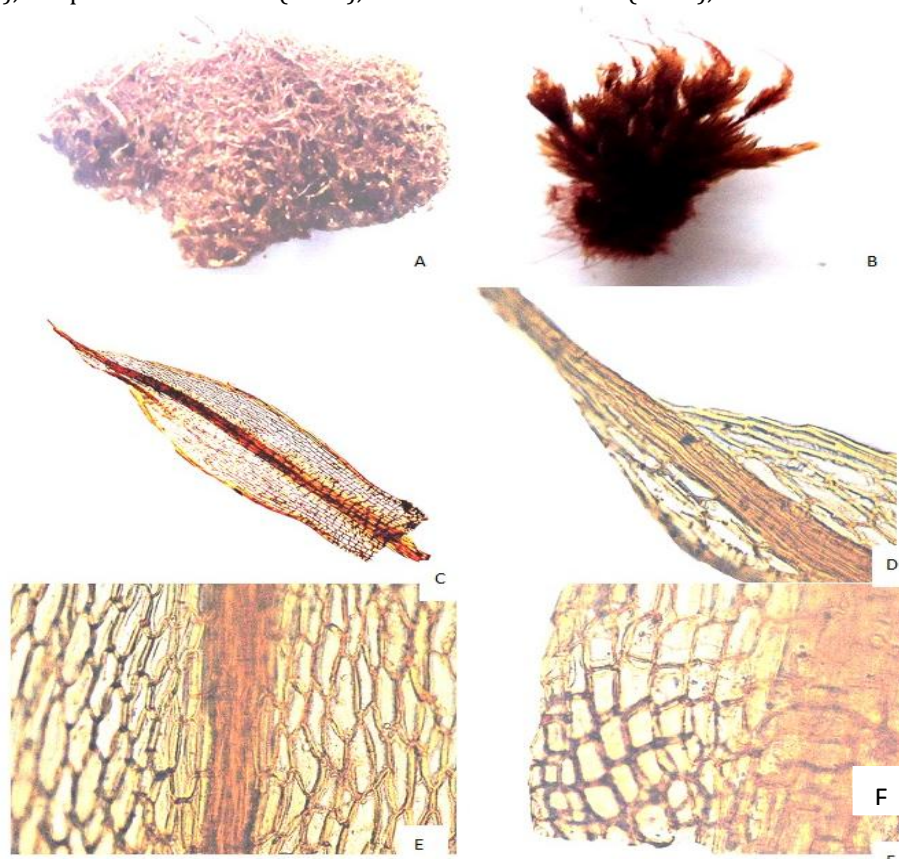


Plate 31:*Bryum alpinum* Huds.*ex*With., Syst. Arr. Birt. Pl. ed. 4, 3: 824(1801); A. Dry plant (1X), B. Wet plant (3X), C. Leaf (75X), D. Apical laminal cells (290X), E. Middle laminal cells (290X), F. Basal laminal cells (290X).

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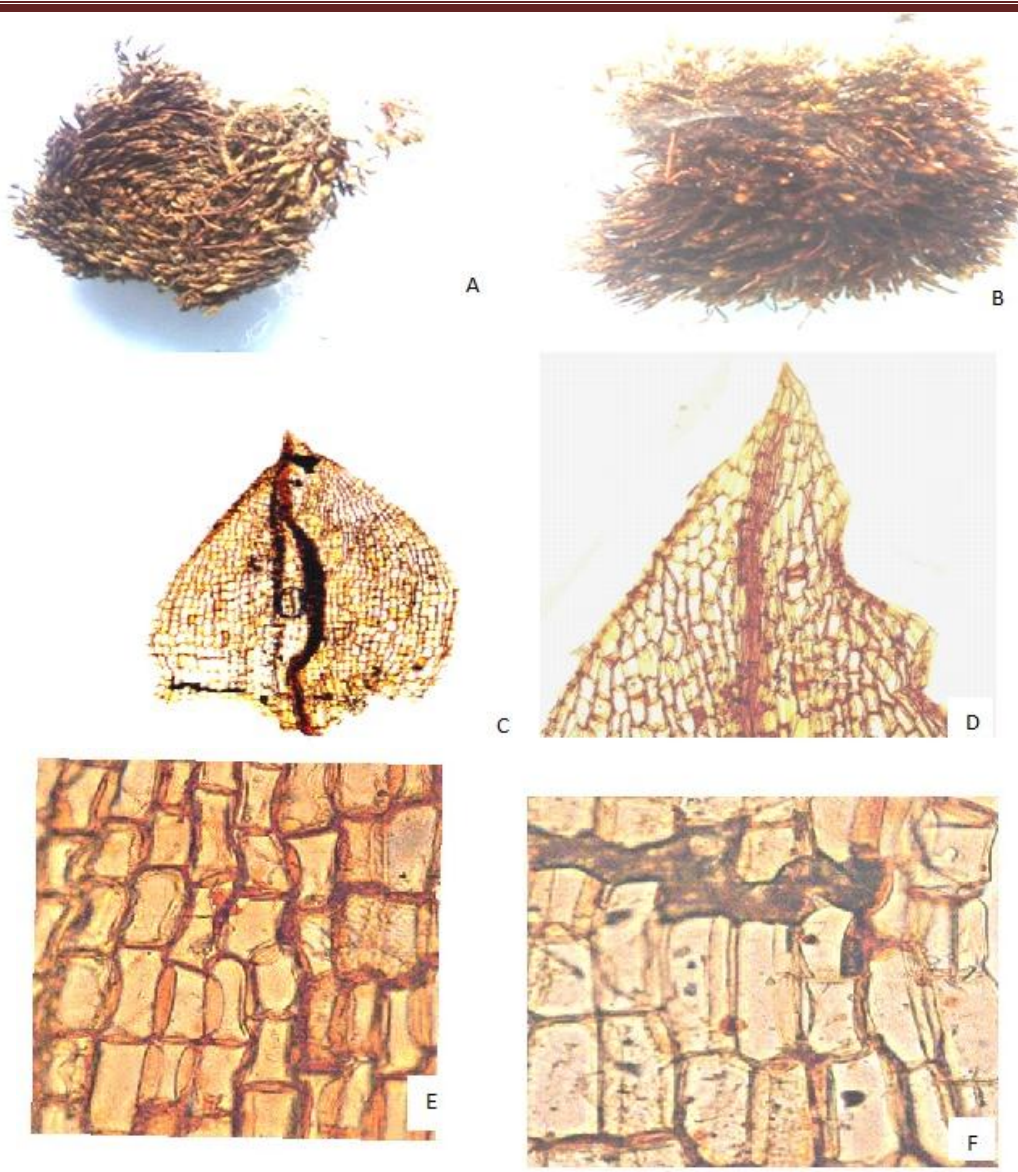
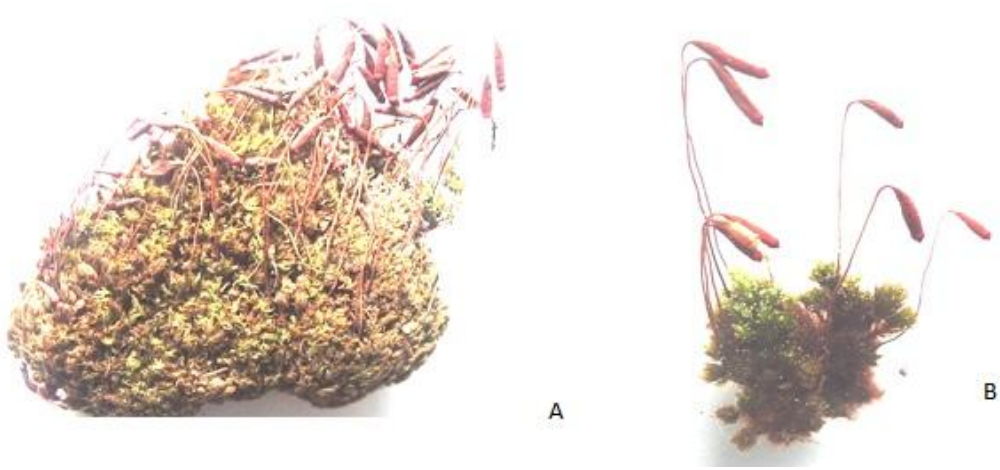


Plate 32:*Bryum argenteum* Hedw.,Musc. : 181 (1801); A. Dry plant (2X), B. Wet plant (2X), C. Leaf (75X), D. Apical laminal cells (290X), E. Middle laminal cells (290X), F. Basal laminal cells (290X).



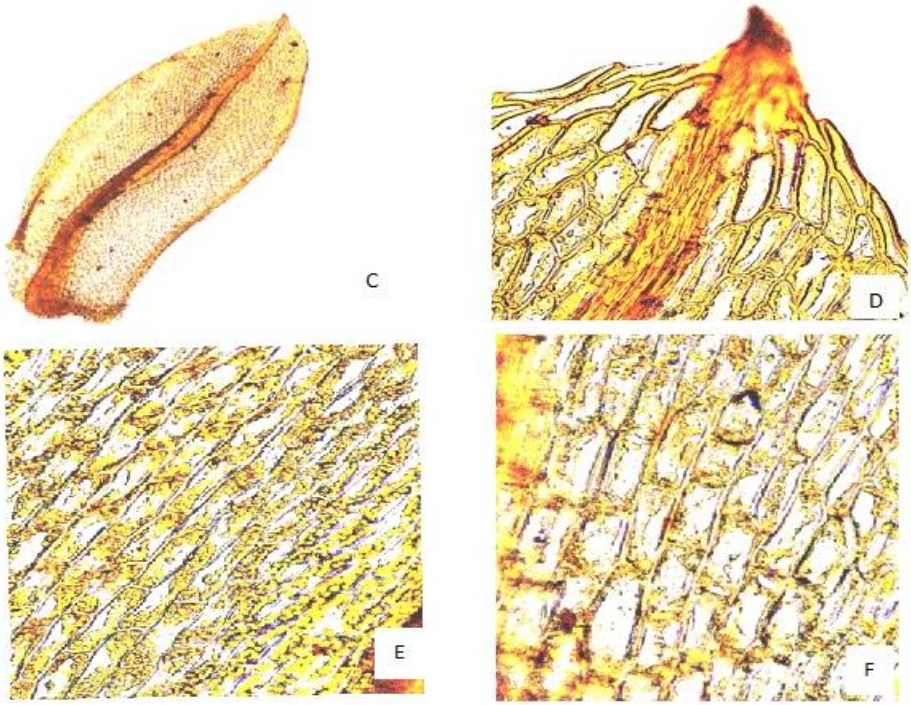


Plate 33:*Bryum capillare* Hedw.,Musc.; 182 (1801); A. Dry plant (1X), B. Wet plant (3X), C. Leaf (75X), D. Apical laminal cells (290X), E. Middle laminal cells (290X), F. Basal laminal cells (290X).

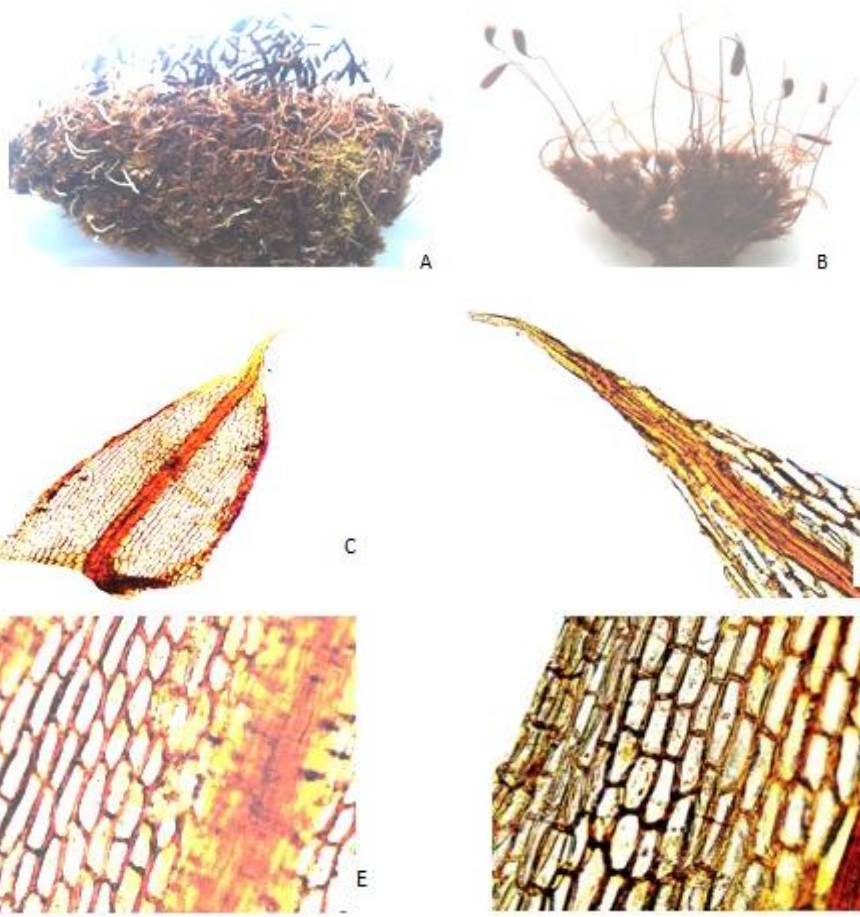


Plate 34:*Bryum coronatum* Schwaegr.,Sp. Musc. Frond.,Suppl. 1(2):103 (1816); A. Dry plant (1X), B. Wet plant (3X), C. Leaf (75X), D. Apical laminal cells (290X), E. Middle laminal cells (290X), F. Basal laminal cells (290X).

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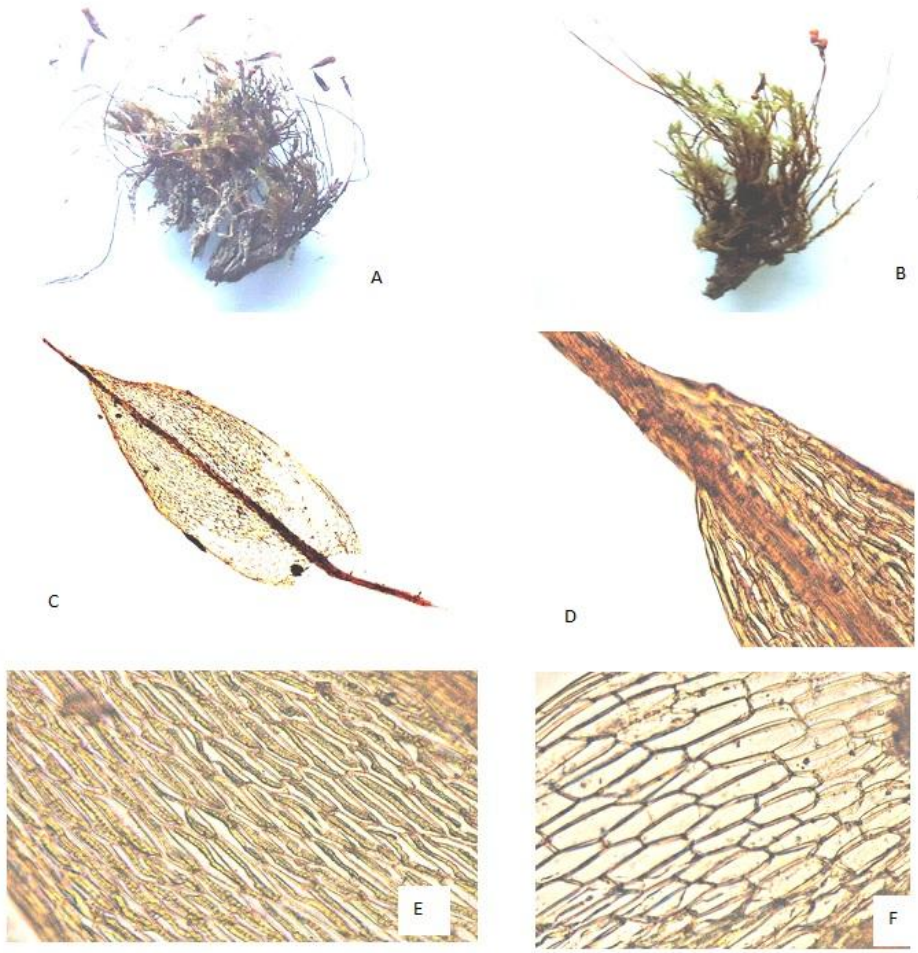
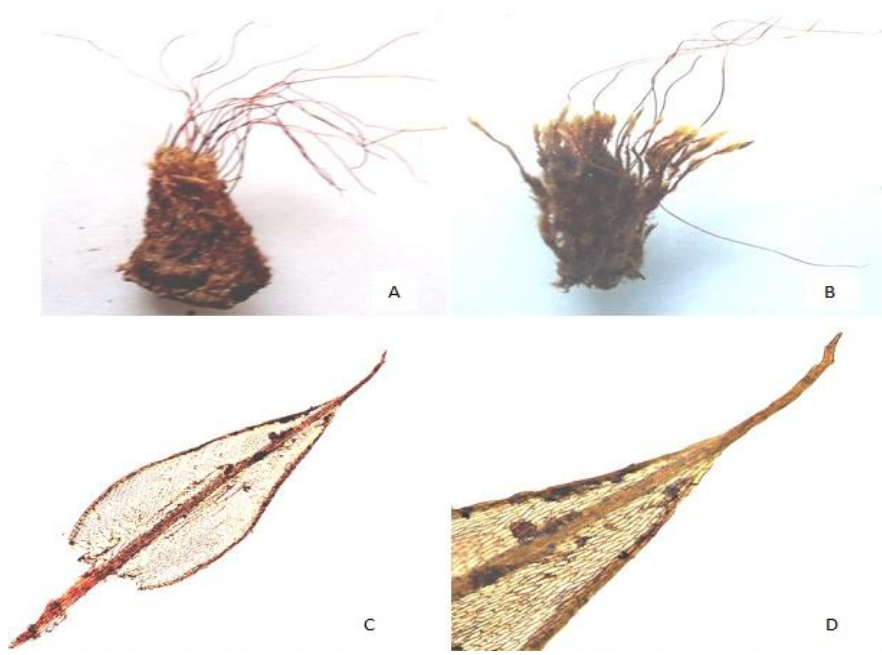


Plate 35:*Bryum pseudotriquetrum*Hedw., Sp.Musci Suppl., 1 (2): 110(1816); A. Dry plant (3X), B. Wet plant (3X), C. Leaf (75X), D. Apical laminal cells (290X), E. Middle laminal cells (290X), F. Basal laminal cells (290X).



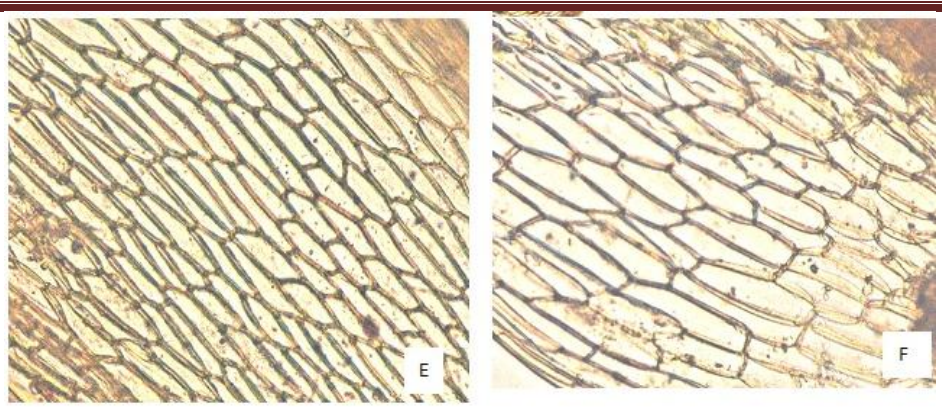


Plate 36:*Bryum recurvulum* Mitt.,Musci Ind. Or. : 77 (1859); A. Dry plant (3X), B. Wet plant (3X), C. Leaf (75X), D. Apical laminal cells (290X), E. Middle laminal cells (290X), F. Basal laminal cells (290X).

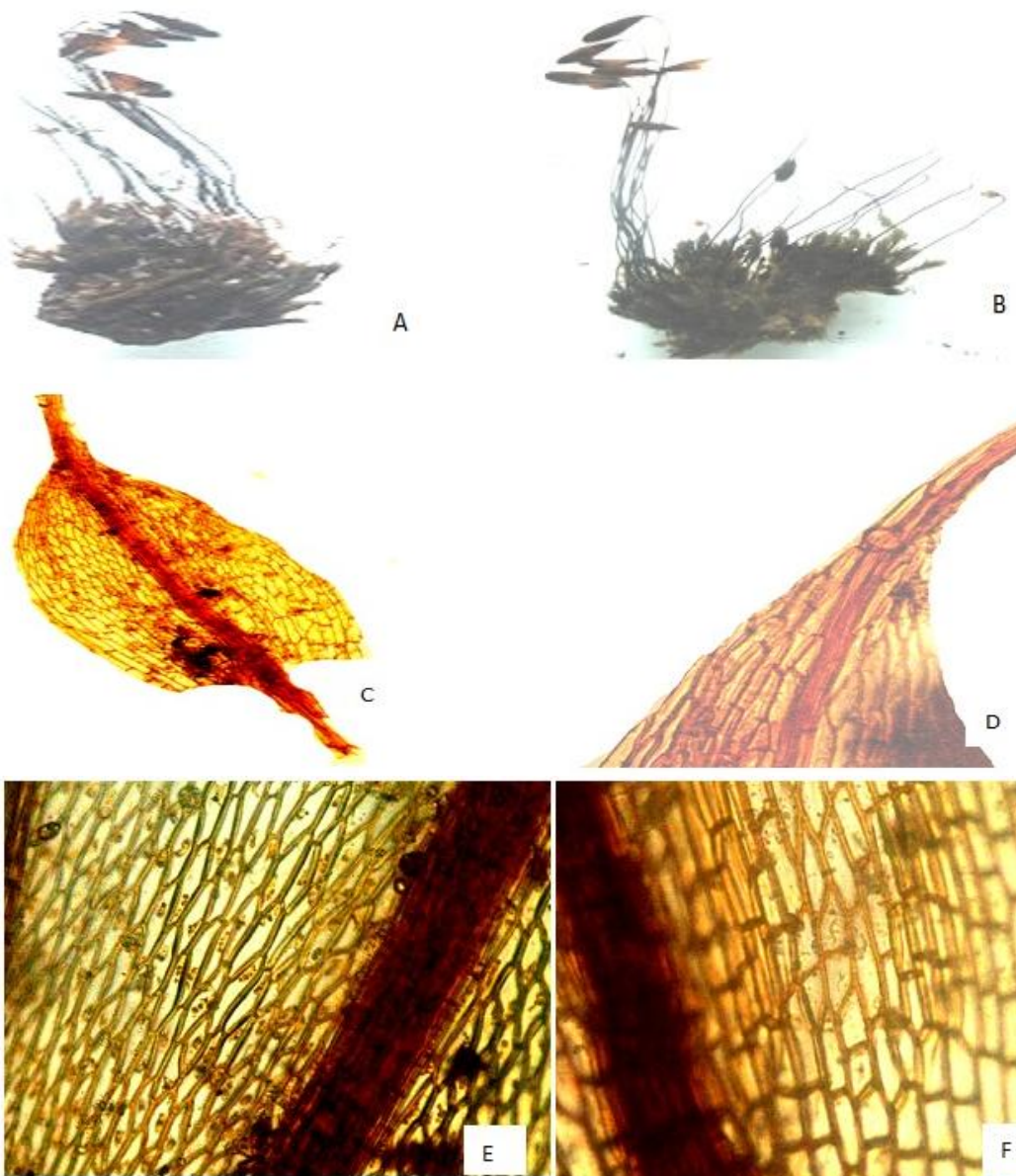


Plate 37:*Bryum uliginosum* (Brid.) B.S.G., Bryol. Eur., 4:88 (1839); A. Dry plant (3X), B. Wet plant (3X), C. Leaf (75X), D. Apical laminal cells (290X), E. Middle laminal cells (290X), F. Basal laminal cells (290X).

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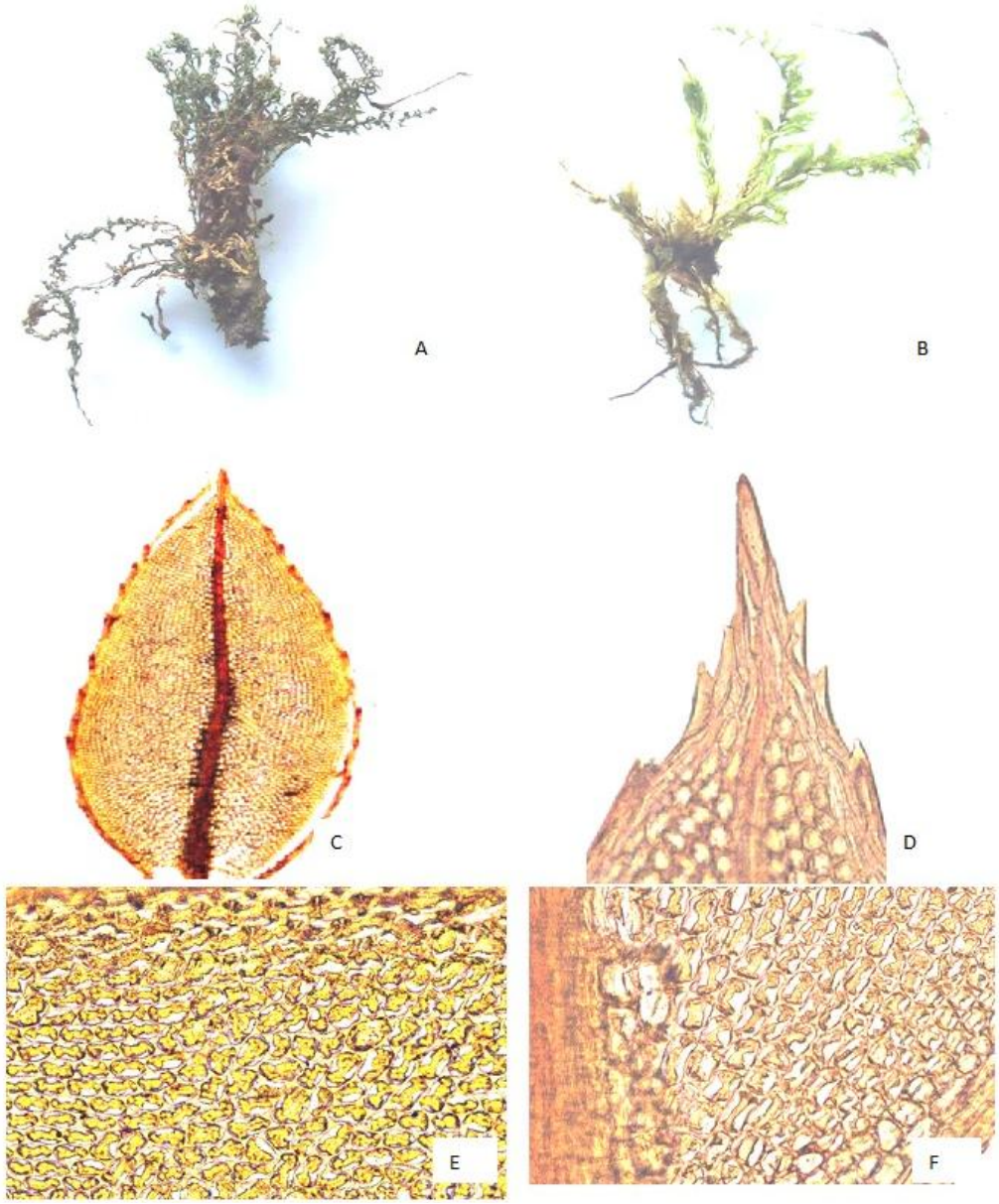
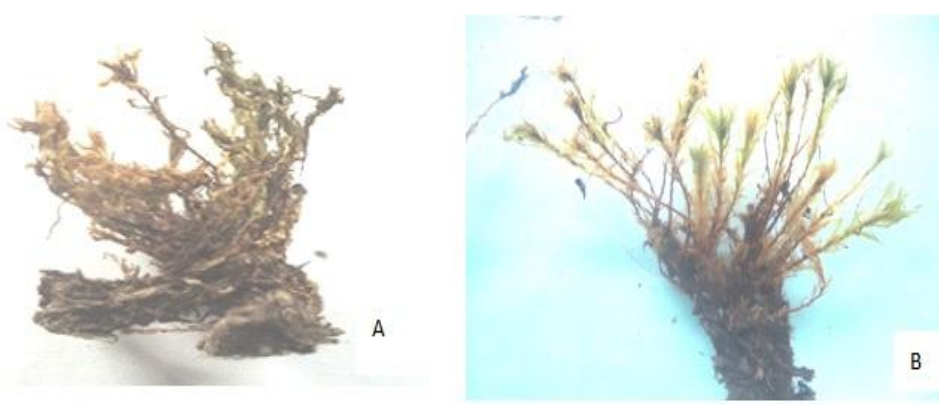


Plate 38:*Mnium confertidens* (Lindb.Arn.)Kindb.Bryin.Exot.:107 (1891); A. Dry plant (3X), B. Wet plant (3X), C. Leaf (75X), D. Apical laminal cells (290X), E. Middle laminal cells (290X), F. Basal laminal cells (290X).



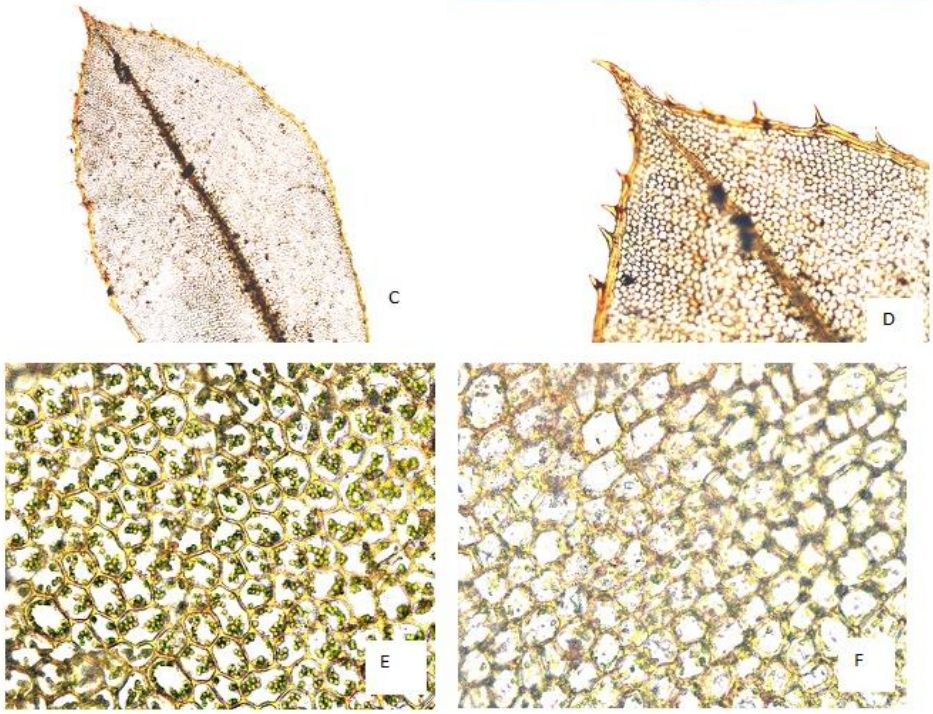


Plate 39:*Mnium cuspidatum*Hedw.Musc.:192(1801); A. Dry plant (3X), B. Wet plant (3X), C. Leaf (75X), D. Apical laminal cells (290X), E. Middle laminal cells (290X), F. Basal laminal cells (290X).

Plate 40:*Mnium integrum* Bosch &Sande Lac.Bryol. Jav. 1:153(1861); A. Dry plant (3X), B. Wet plant (3X), C. Leaf (75X), D. Apical laminal cells (290X), E. Middle laminal cells (290X), F. Basal laminal cells (290X).

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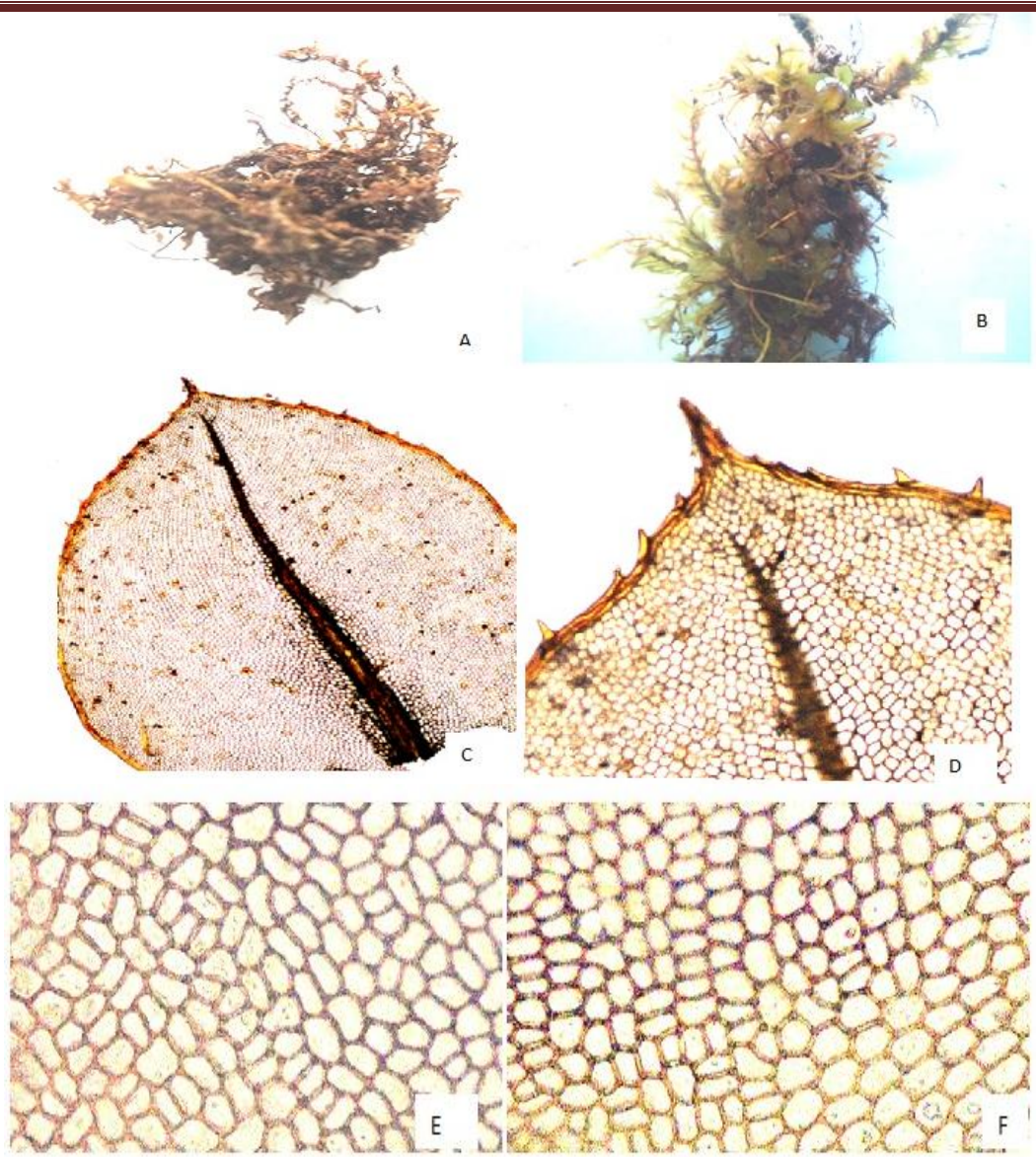
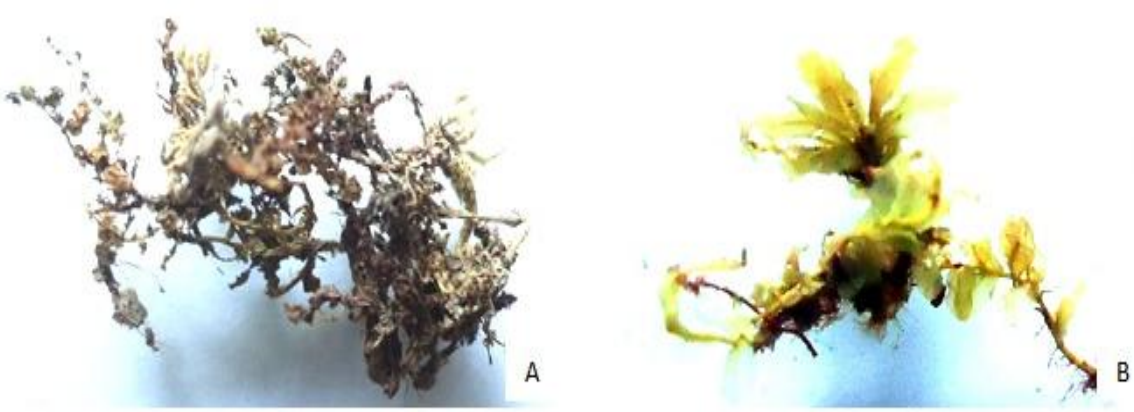


Plate 41:*Mnium rostratum* schrad. Regensburg, 1:79 (1802); A. Dry plant (2X), B. Wet plant (3X), C. Leaf (75X), D. Apical laminal cells (290X), E. Middle laminal cells (290X), F. Basal laminal cells (290X).



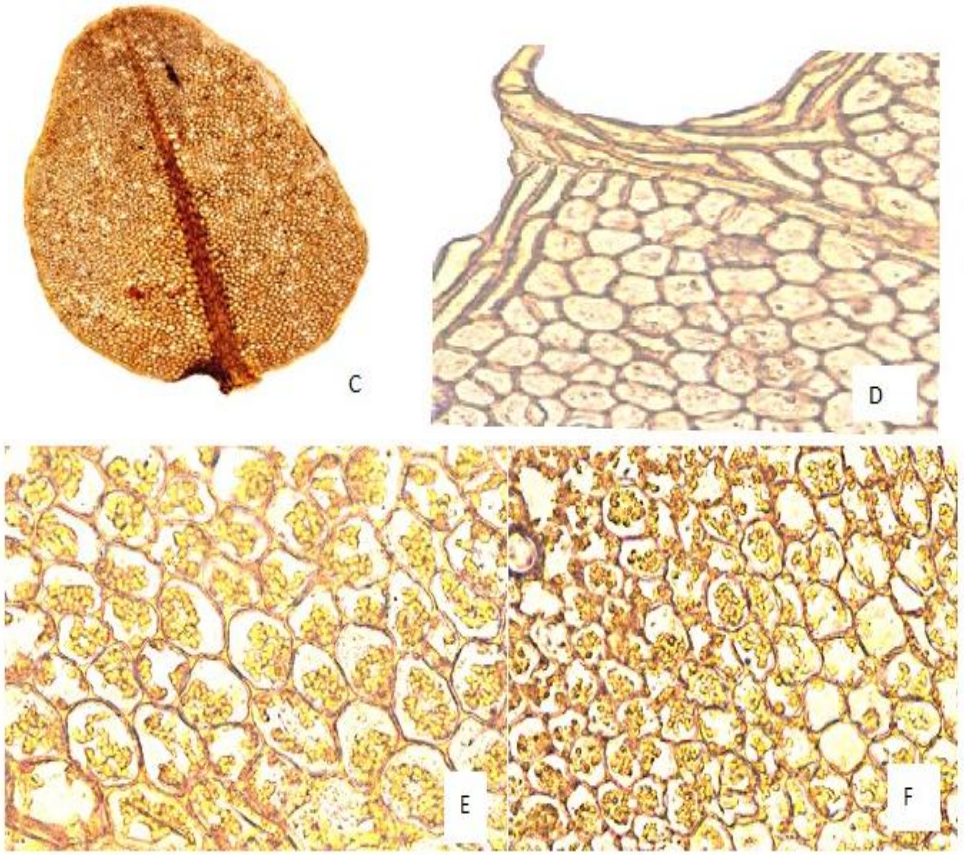


Plate 42:*Mnium succulentum* Mitt.Musci Ind. Or. :143 (1859); A. Dry plant (2X), B. Wet plant (3X), C. Leaf (75X), D. Apical laminal cells (290X), E. Middle laminal cells (290X), F. Basal laminal cells (290X).

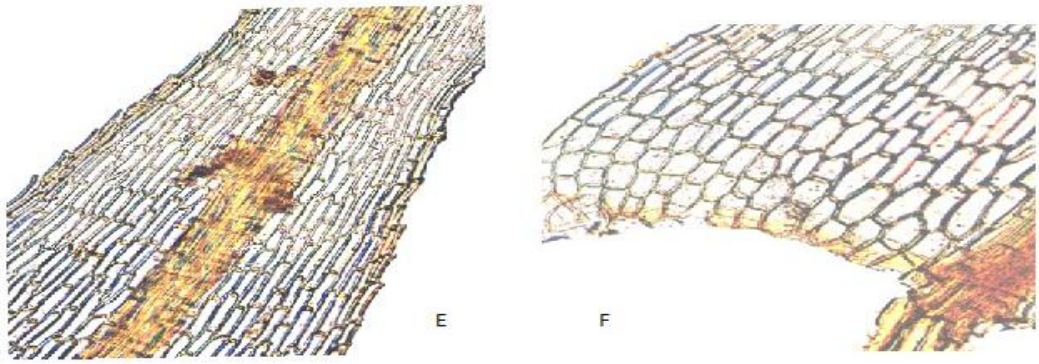


Plate 43:*Philonotis falcata* (Hook.) Mitt., Musci Ind. Or. : 62(1859);A. Dry plant (3X), B. Wet plant (3X), C. Leaf (75X), D. Apical laminal cells (290X), E. Middle laminal cells (290X), F. Basal laminal cells (290X).