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Seventeen spp. new records for the Moss flora of Iraq

Contribución a la flora de musgos en Irak con 17 registros nuevos de subespecies

Farhad H. Aziz

Abstract. Samples and specimens of mosses were collected in different parts of Erbil, Sulaimani, Duhok and Even Kirkuk provinces in Iraq Kurdistan Region, since 1998 to April 2010. This collection could be taken as the representative species of mosses on the soil surface, rocks and tree barks of either terrestrial and aquatic habitats of foothills, mountains and plains. A total of 67 species distributed in 32 genera, 16 families and 9 orders were found. Among them there were 17 species in 10 genera, the 2 families Schistogaceae and Ephemeraceae and the single order Schistostegales. The rarest species recorded in this study were *Schistostega pennata* with fern-like leaves within a Shanadar cave, *Pottia wilsoni* var. *crinata*, at the entrance of Ba-stoon cave, and *Ephemerum cristatum* within Gali Ali-beg area. Description and photographs of records are included. The key of identification was done based on the study of (1) gametophytic and saprophytic vegetative characters, (2) habitat, and (3) growth forms.

Keywords: Mosses; New records; Photos; Illustrations; Mountains; Kurdistan; Iraq.

Resumen. El muestreo de los musgos recolectados se efectuó in diferentes partes de las Provincias de Erbil, Sulaimani, Duhok y Even Kirkuk, Región Kurdistan de Irak desde 1998 hasta Abril 2010. Esta colección podría corresponder a especies representativas de musgos al pie de montañas, montañas y planicies de hábitats terrestres y acuáticos sobre la superficie del suelo, roca y corteza de árboles. Un total de 67 especies en 32 géneros, 16 familias y 9 órdenes. Entre ellos, 17 especies en 10 géneros, 2 familias Schistogaceae y Ephemeraceae, y un único orden Schistotegales. Las especies más raras registradas en este estudio fueron *Schistostega pennata* con hojas semejantes a los helechos, en la cueva Shanadar, *Pottia wilsoni* var. *crinata* en la entrada de la cueva Ba-stoon, y *Ephemerum cistatum* dentro del área Ali-beg. Se acompañan descripciones y fotografías de los registros. La clave de identificación está basada en los caracteres vegetativos saprofitico y gametofitico en paralelo con el hábitat y las formas de crecimiento.

Palabras clave: Musgos; Nuevos registros; Fotos; Ilustraciones; Montañas; Kurdistán; Irak.

Biology Department, College of Education, University of Salahaddin, Iraq.
Address Correspondence to: Assist. Prof. Dr. Farhad H. Aziz, *e-mail*: aziz.farhad@yahoo.com
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INTRODUCTION

Works on the Iraqi bryophytes have been concerned mainly with the moss species collected during excursions of foreign workers in different parts of Iraq (Agnew & Tow, 1970; Agnew & Vondracek, 1975). Agnew & Vondracek (1975) recorded 54 genera and 149 moss species; they referred in detail to old works on mosses collected from Mesopotamia, Iraq, Syria and other Middle East countries (e.g. Lebanon, Phalstine, Persia and Afghanistan). Maulood & Resheed (1994) have given a literature survey related to the moss flora of Iraq. They recorded 27 genera and 48 species in the North part of Iraq Nineveh, Erbil and Dohok, where 4 genera and 9 species were considered as new records for the Iraqi flora. Al-Ni'ma (2003) constitutes an excellent reference for the bryophytes of Iraq. He collected more than 450 specimens, covering 5 genus and 8 species as new records to the Iraqi Flora. However, there are only a few references for the Iraqi mosses in the literature leading with bryophytes (Schiffner, 1913; Frochlich, 1959; Al-Ni'ma, 2003) The present study constitutes an additional contribution to the moss flora of Iraq. It includes clear pictures, photographs and illustrations of new recorded mosses, reporting their habitats and distribution.

MATERIALS AND METHODS

The identification and classification was based on the available references (Micelle, 1951; Conrad, 1963; Jaques, 1963; Nicholson & Brightman, 1974; Scott et al., 1976; Smith, 1978; Watson, 1980; Phillips, 1994). Hand drawing was made for all identified new records. It was done by wing Lucida camera. Drawings were then redrawn, having support from reference books. Photographs were taken in the field and laboratory using a digital camera. A digital camera joined to a dissecting Olympus microscope was also used. Measurements were done in microns or millimeters after microscope calibration.

Study sites. The study area was located in the Iraqi Kurdistan Region, Iraq. It extended within 43°15' - 45°14' E, 37°24' - 36°34' N. The total study land was 65000 km^2. It covered mountain foothills and hills with plateau areas at an altitude of 400-3785 m.a.s.l. Physiographically speaking, there are two main regions: High Folded Zone and Nappe zone Low Folded Zone (Anon, 1975). The rocks of hills and mountains, of a calcareous type, are covered by alluvium; they were formed by stream and river flows forming alluvial plains. Climate is cold from October to April with winter rains and snow falls (from less than 250 to more than 1200 mm/year). The study growing season was during the spring and dry, hot summer (June to September) (Guest, 1966; Agnew & Vondarcek, 1975).

RESULTS

From more than 300 collected samples, I found 67 species of mosses distributed in 32 genus, 16 families and 9 orders. Mostly the new records were found in the (1) Shanadar and Bastoon cave (in April and August, 2010), (2) Barzewa spring out flow at the base of Hindrain mountain behind Barzewa village, and (3) same places of Halgurd mountain, in very cold water coming from snow out flows above Nawanda village (in July). New records found in the Balayian valley were found within Gali-Ali Beg village during February, April 2010, and also in Ikoban and Kawlokan villages, Rawanduz town, Erbil province, and Denarta in Duhok province.

List (1): Mosses flora recorded in the study area. New records are indicated by an asterisk (*).

Direcanales
Ditrichaceae
Ditrichoideae
Ditrichum pusillum (Hedw.) Hampe.
Dicranaceae
Dicranelloideae
Dicranella varia (Hedw.) Schimp
Dicranowissia cirrata* (Hedw) Mild.
Campylopus schimperi* (Mild) Husn
Leycobryceae
Leyucobryum glaucum (Hedw.) Angstr.
Fissidentales
Fissidentaceae
Fissidens viridulus (SW.) Wahlenb.
Pottiales
Pottioideae
Aloina ambigua (B.S.G.) Limpr.
Tortula ruralis (Hedw.) Gaetn.
T. intermedia (Brid.) Denot.
T. sabulata var. ***sabulata*** Hedw.
T. laevipila (Brid.) Shwaer
T. muralis var. ***muralis*** Hedw.
T. muralis var. ***aestiva*** Brid. Hedw.
T. muralis var. ***aestiva f. brefolia*** (shiffin) Hedw.
T. marginata Schimp.
Syntrichia inermis Mont.
S. princes (Denot.) Mitt.
Pottia lancelate
****P. truncata*** (Hedw) Furnr.
****P. wilsoni*** var. ***crinata*** (Br. Eur.) Warnts.

Trichostomodeae
Barbula convulata var. ***convulata*** Hedw.
B. faliax Hedw.
****B. unguiculata*** var. ***caspidata*** (Schultz) Brid.
B. viniales Brid.
Gymnostomum recurvirostrum* Hedw.
Eucladium verticillatum* (With) B.S. and G = ***Weissia verticillata***
Grimmiales
Grimmiaceae

Schistidium aporcapum Hedw. var. ***atrofuscum***
Grimmia maritime
G. patens (Hedw.) Br. Eur.
G. pulvinata (Hedw.) Sm.
****G. donniana*** (Hedw.) var. ***doniana*** Bals and Denot.
Racomitrium affine (Wib Hedw. and Mohr.) Lindb.

Funariales
Funariaceae
Funaria hygomatrica
Ephermeraceae
****Ephemerum cristatum*** (Hook) F. Wils.

Schistostegales
Schistostegaceae
****Schistostega pennata*** (Hedw) Web and Mohr.

Eubryales
Bratramiaceae
Bryceae
Bryum biocolour Dicks
B. capillare Hedw.
B. caespiticium Hedw.
B. kunekii Hedw.
B. pseodotriquetrum Hedw. Schwaeq.
****B. rubens*** Mitt.
Mniaceae
Mnium menziesil Hedw.
****Plagiomnium rostratum*** (Schard.) kop.
Philonotis Fontana

Orthotrichales
Orthotrichaceae
Amphidium mingotti (Br.Eur.) Schimp.
Orthotrichum affine Bride.
O. diaphanum Brid.
O. schemperri Mon. Hammar.
Hedwigiaceae
Hedwigia ciliata (Hedw.) P. Beauv.

Hypnobryales
Amblystegiaceae
Cratoneuron commutatum var. ***commutatum*** (Hedw.) G. Roth.
C. filfciaum (Hedw.) Spruce.
Amblystegium serpens (Hedw.)Br. Eur.
Drepanocladus aduncus (Hedw.) Warnst.
D. flutans (Hedw.) Warnst.
****D. revolvens*** (Hedw.) Warnst.
Hygrohypnum ochraceum (Wils.) Loesk.
Brachytheceae
Brachythecum capillare (Hedw.) Br. Eur.
B. plumosum (Hedw.) Br. Eur.
B. rivulare Br. Eur.
B. rulabulum (Hedw.) B.S.G.
B. velatinum (Hedw.) B.S.G.
****Eurhynchium paraelongum*** var. ***paraelongum*** (Hedw.) Br. Eur.
Homalothecium ceviceum (H edw.) Br. Eur.
H. philipeanum (Hedw.) Br. Eur.
Plagiotheciaceae
****Plagiothecium denticulatum*** (Hedw.) Br. Eur.
Isoptergiopsis taxiphyllum (Schimp.) Wats.
Hypnaceae
Hypnoideae
****Rhytidiadelphus loreus*** Warnst.
****Isopterygium elegans*** (Brid.) Mitt. and Lindb.

DESCRIPTION OF NEW RECORDS

1- ***Dicranowisia cirrata*** (Hedw.) Lindb.

Plants up to 2.0 cm long, with green tuft leaves. These leaves become crisped and curved when dry, and branched when moist, lanceolate, upper narrowly linear lanceolate, tapering to acute apex. Cells rectangular at the base; cells above are rounded quadrate, 10-18μm wide. It grows on rocks and trees. In Gali-Beg (Smith, 1978: p. 147-148, Fig. 62.5-8).

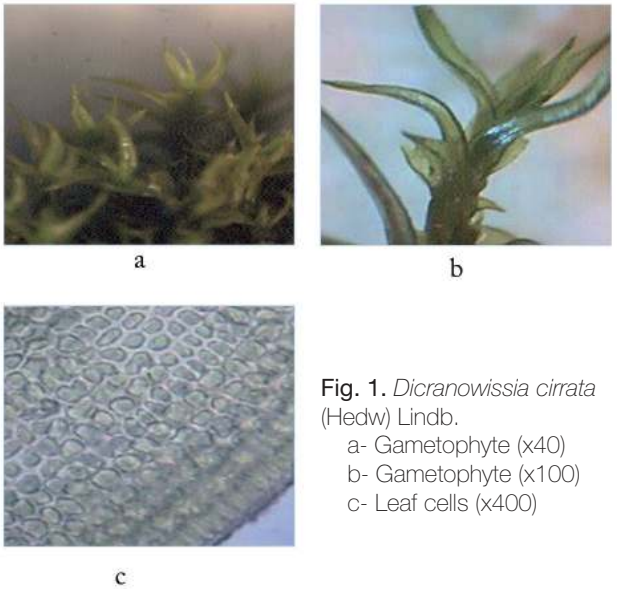


Fig. 1. *Dicranowissia cirrata* (Hedw) Lindb.
a- Gametophyte (x40)
b- Gametophyte (x100)
c- Leaf cells (x400)

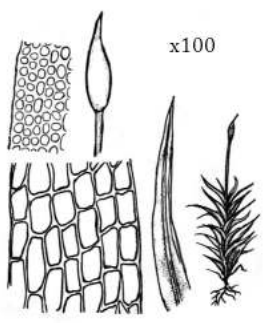


Fig.1. *Dicranowissia cirrata* (Hedw). Lindp. (Smith, 1978)

2- *Campylopus schimperi* (Mild) Husn.

Plants up to 8 cm long with reddish tomentum in their lower part. Leaves 2.5-7.5 mm long, erect. Suppressed when dry, tapering toward apex, minutely denticulate with 1-3 teeth, lamina call with 1-3 (-8) rows. Base cells either hyaline or slightly contain (green) chlorophylls. Cells fragile, angular, hyaline-brownish, trapeze shape, 3-10μm wide. Widely distributed in moist areas, forming yellowish, green color tufts on stones and smooth soil. Found in Denarta, Akri, Duhok, at an altitude of nearly 700 m above sea level. (Smith, 1978: p. 170-171, Fig.73).

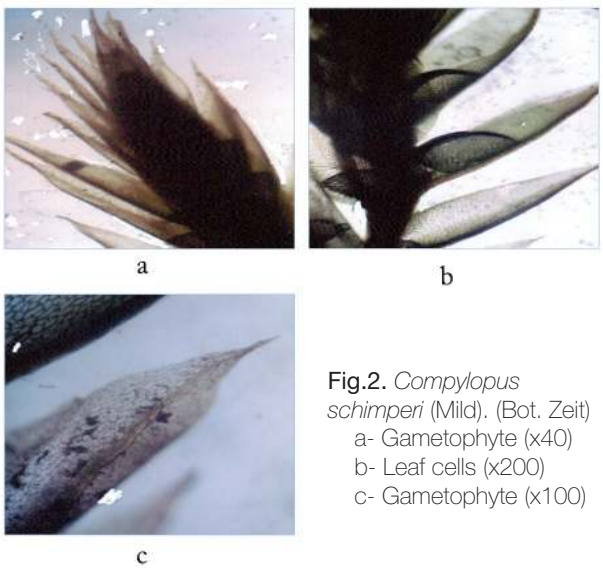


Fig.2. *Compylopus schimperi* (Mild). (Bot. Zeit)
a- Gametophyte (x40)
b- Leaf cells (x200)
c- Gametophyte (x100)

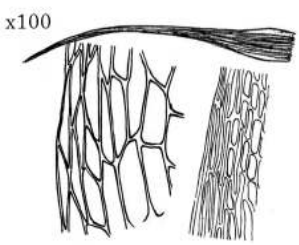


Fig. 2. *Campylopus schimperi* (Bot. Zeit). (Smith, 1978).

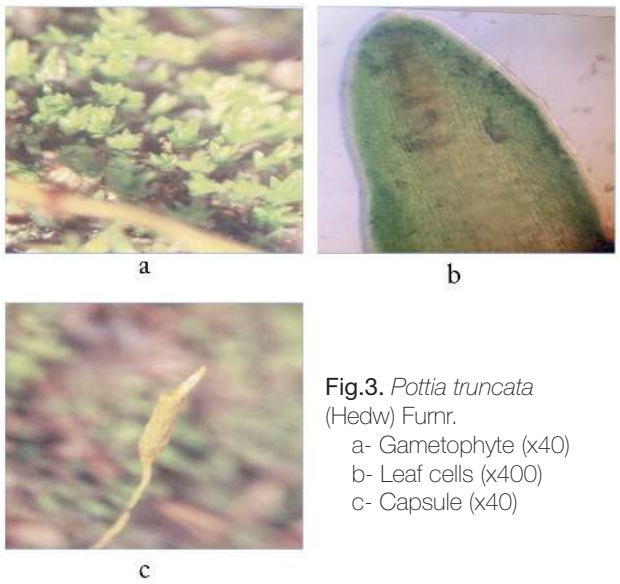


Fig.3. *Pottia truncata* (Hedw) Furnr.
a- Gametophyte (x40)
b- Leaf cells (x400)
c- Capsule (x40)



Fig.3. *Pottia truncata* (Hedw). Furnr. (Smith, 1978).

3- *Pottia truncata* (Hedw.) Furnr. = ***P. truncatula*** (With) Bus.

Plants are small without seta, 2-4 mm long. Leaves oblong-lanceolated, 3-4 times as long as wide, margin plane, upper cells quadrate to hexagonal, 17-24μm wide at mid-leaf, smooth, thin walled. Seta 2-6 mm long. Capsule turbinate 1.0×0.8 mm, widest at the mouth. Plants grow in rock fissures and at the mouth of Baston cave. Bradost mountain, Soran town / Erbil Gali Ali-Beg on rocks and clay muds (Smith, 1978, p.240, Fig. 109, 1-4 and Watson, 1980, p.195, Fig. 56)

4- *Pottia Wilsoni* var. ***crinata*** (Br.Eur.) Warns

P. viridifolia Mitt. = ***P. crinata*** var. ***viridifolia*** (Mitt). Kind.

Plants are red in colour when leaves are dry. Dry leaves spathulate-oblong; apex rounded 2.0-4.0 long and wide; margin recurved. Upper cells are quadrate 17-24 μm wide, papillae, thin walled. Capsule is red, ovoid 0.8 × 1.0 mm, widest at mouth, with 2-4 rows. Growing on rocks in Balayian area, near stream edge (Smith, 1978: p. 238 Pl. 108, Figs. 5-8).

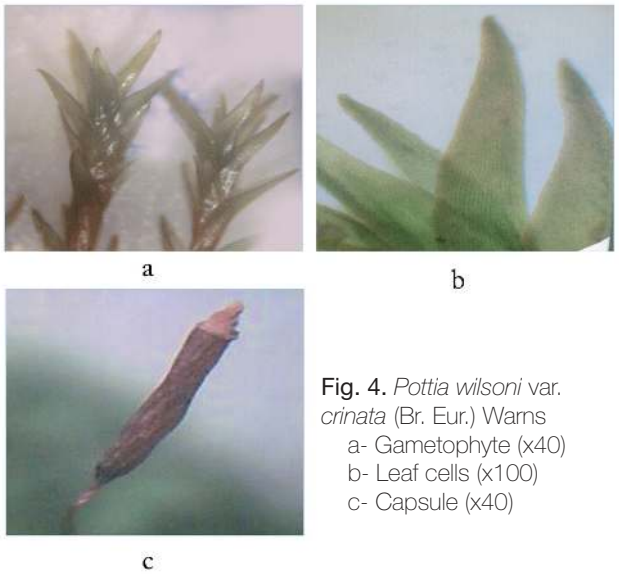


Fig. 4. *Pottia wilsoni* var. *crinata* (Br. Eur.) Warns
a- Gametophyte (x40)
b- Leaf cells (x100)
c- Capsule (x40)

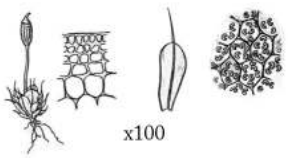


Fig. 4. *Pottia wilsoni* var. *crinata* (Br. Eur.) Warnst. (Smith, 1978).

5- *Barbula unguiculata* var. ***caspidata*** Schultz Brid.

Plants are strong when dry, corkscrew, spirals into which leaves are contorted. Seta erect, 1-3 cm tall, plant forming yellowish-green tufts, shining by white spots. Leaves are 1.5-2.0 mm long. The Narre is slightly extended at the leaf apex. The leaf margin is recurved, obscure, papillose upper areola (Mizelle, 1951, plate XVI, and Smith, 1978, p.252, Fig. 115).

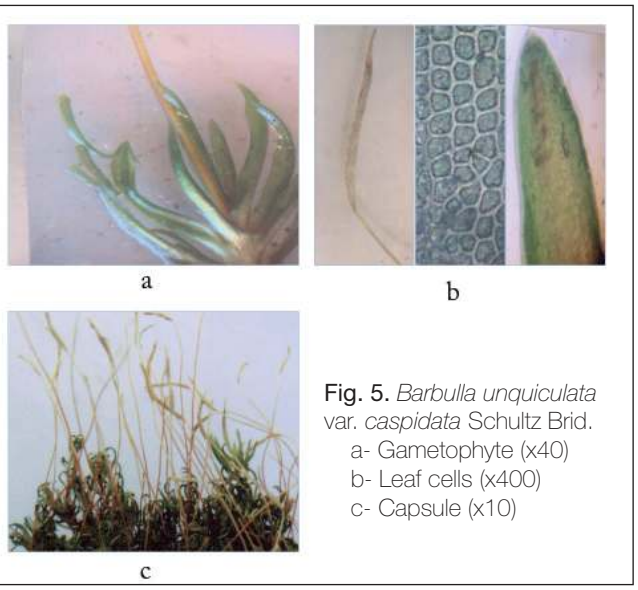


Fig. 5. *Barbulla unquiculata* var. *caspidata* Schultz Brid.
a- Gametophyte (x40)
b- Leaf cells (x400)
c- Capsule (x10)

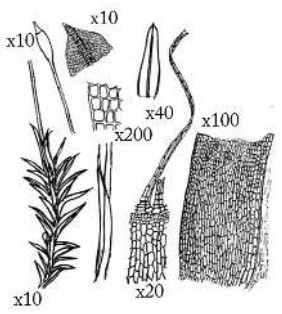


Fig. 5. *Barbula unguiculata* var. *caspidata* (Schultz) Brid

6- *Gymnostomum recurvirostrum* Hedw. = ***Wesissia curriros-tris*** (Ehen) C.M.

Plants 0.5-10 cm, brownish-red tufts, abundant on rocks in mountainous areas. Leaves tapering to final points, leaf margin recurved below, seta is about 8-10 mm long.

Capsule small, rounded-oblong, with narrow yellowish-orange lid twists when dry, erect patent when moist, cells rectangular, papilose above, growing in calcareous rocks in Balayian valley, Joman town areas. (Smith, 1978: p.270, Fig. 126.9-12; Watson, 1980: p.209).

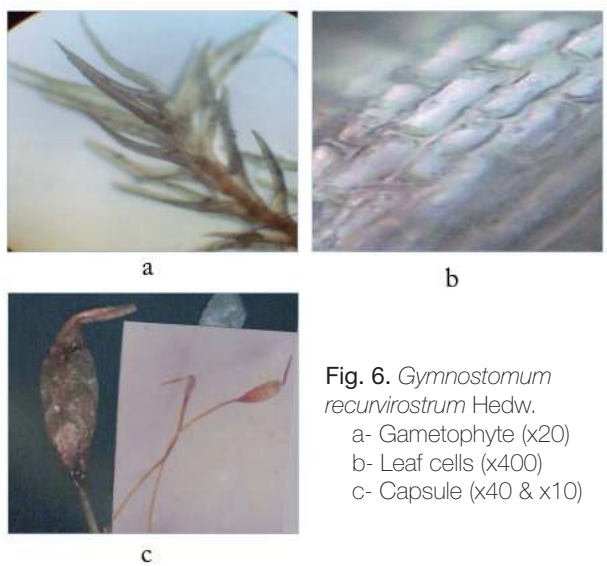


Fig. 6. *Gymnostomum recurvirostrum* Hedw.
a- Gametophyte (x20)
b- Leaf cells (x400)
c- Capsule (x40 & x10)

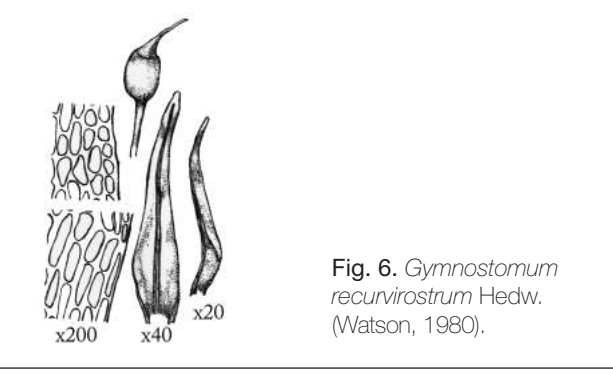


Fig. 6. *Gymnostomum recurvirostrum* Hedw. (Watson, 1980).

7- *Eucladium verticillatum* (With.) B.S and G. = ***Wissia Vermiculata*** With

Plants pale green when moist, yellowish-brown when dry, leaves very narrow. Leaf margin with a row of blunt leath. Leaf cell papillose, found on calcareous rocks in Kawlocan and Gali-Ali-Beg (Waston, 1980: p. 210, Fig.66).

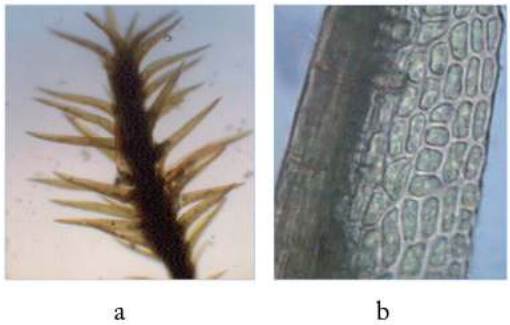


Fig. 7. *Eucladium verticillatum* (With.) B.S and G. = *Wissia Vermiculata* With
a- Gametophyte (x40) b- Leaf cells (x400)

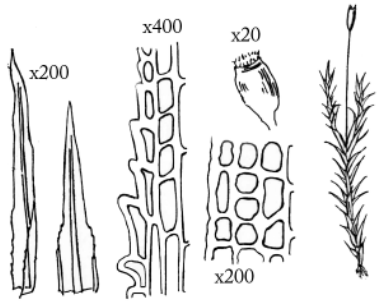


Fig. 7. *Eucladium verticillatum* (With.) B.S and G. = *Wissia Vermiculata* With. (Watson, 1980)

8- *Grimmia doniana* var. ***doniana*** Sm.

Confined to mountain areas. Forming rounded tufts, 1.0 cm long, olive-green or black to brownish in colour. Leaves lanceolate to hair point, variable in length. White ovoid capsule on erect, short (2mm) seta. Our sample without capsule. Grown in moist areas, near stream edge Ikoban-Faqian village (Smith, 1978: p. 316, Fig 149, 1-4; Watson, 1980: p. 220, Fig. 74).

9- *Ephemerum cristatum* Hook, F. and Wilson

Plant very small, dichotomously branched, the stem about 0.5 mm high. Few leaves, loosely arranged, spreading, hyaline, leaves spathulate, not narrowly lanceolate. Leaves deeply serrated-ciliated. With teeth. The cells are rectangular to irregularly rhomboidal, 10-20 µm wide, thick walled. The seta very short. Tiny capsule, rounded, red brown. Grown on rocks in Gali Ali-Beg (Scott et al., 1976: p. 263, Fig. 49, p. 264).

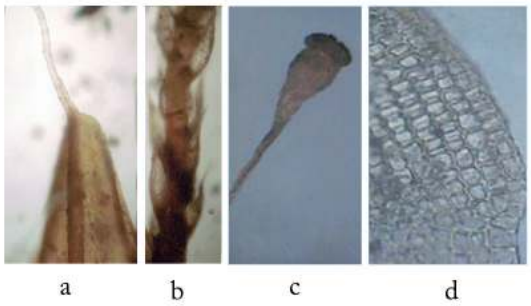


Fig. 8. *Grimmia doniana* var. *doniana* Sm.
a- Leaf (x400) b- Gametophyte (x40)
c- Capsule (x40) d- Leaf cells (X400).

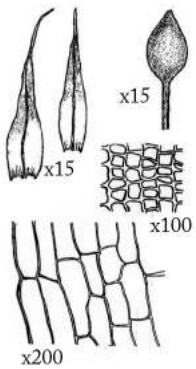


Fig. 8. *Grimmia doniana* var. *doniana* Sm.

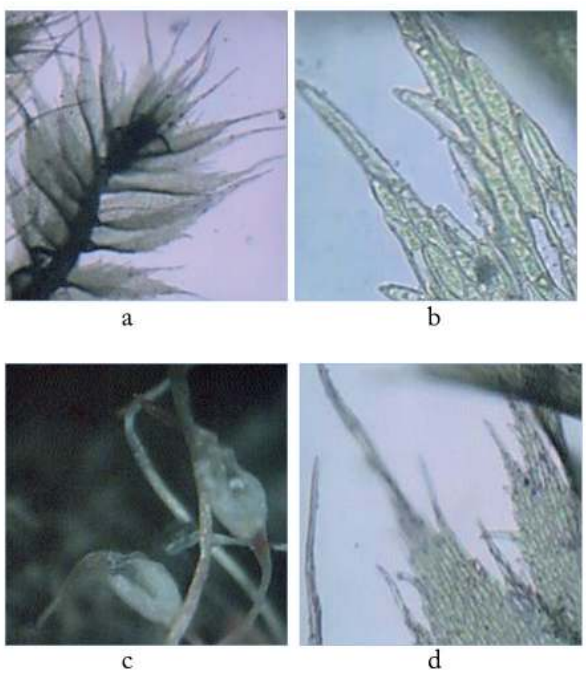


Fig. 9. *Ephemerum cristatum* Hook, F. and Wills.
a- Gametophyte (x100) b- Leaf cells (x400).
c- Capsule (x40) d- Leaf cells (x100).

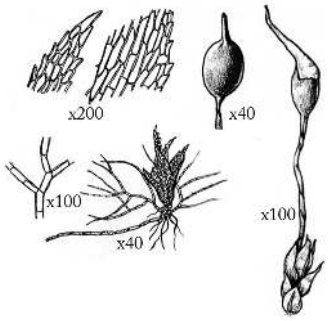


Fig. 9. *Ephemerum cristatum* Hook, F. and Wills. (Scott et al., 1976)

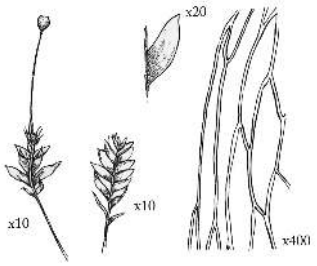


Fig. 10. *Schistostega pennata* (Hedw). Web. And Mohr. (Smith, 1978)

10- *Schistostega pennata* (Hedw) Web. and Mohr. = ***S. Osmundacea Mohr.***

It is a typical and rare plant, named the luminous moss, male and female plants are separate, but at the same protonema stage. It grows based on reflected light. The species name refers to its fern-like leaves. Protonema perennial; the plant is small 1-2 cm, without main shoot, leaves like fern leaves, small and microscopic: 0.3 cm long in two rows; erect lanceolated to acuminated, bright round, stem about 1.5 cm long. It lacks prestom. Stem comes from protonema. Found in Shanadar cave (Smith, 1979: 358, Fig.170).

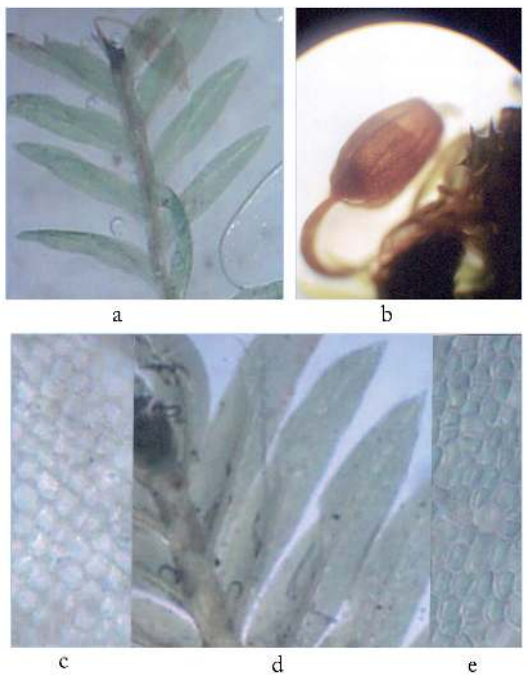


Fig. 10. *Schistostega pennata* (Hedw). Web. and Mohr.
a- *Gametophyte* with ferns like Leaf (x100)
b- Capsule (x100) c- Leaf cells (x400)
d- Leaf of gametophyte (x400)
e- Leaf cells (x400)

11- *Bryum rubens* Mitt.

Dioecious, plant (2-15 mm tall) is shortly extended, midlet call 16-20 × 60 µm long, thin walled, with 2-3 marginal rows, deeply coluored, wall leaves broad shortly attenuated, stem solitary. In Aquban and Kawlokan village (Smith, 1978: p. 429, Fig. 206, 1-5).

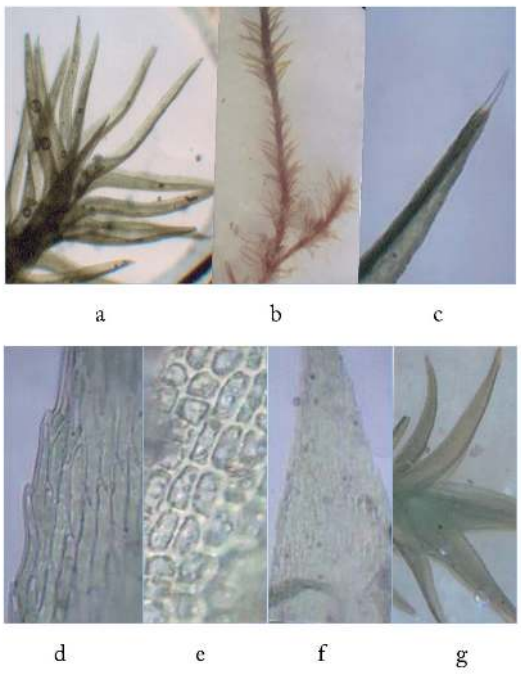


Fig. 11. *Bryum rubens* Mitt
a- *Gametophyte* (x100)
b- *Gametophyte* (x10)
c- Leaf (x400)
d- Leaf cells (x400)
g- Leaves of *gametophyte* (x200)

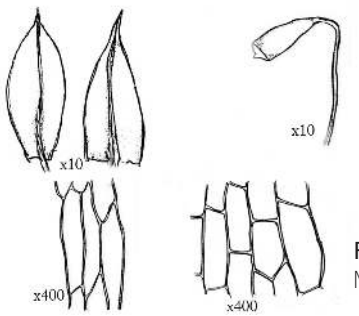


Fig. 11. *Bryum rubens* Mitt. (Smith, 1978)

12- *Plagiomnium rostratum* (Schrad). Kop. **= *Mnium rostratum Schrad.* = *Mnium longirostrum Brid.***

It is a rare species forming loose, green patches in shady places, present in cold streams in mountain areas, prostrated, straggly branched; stem green that grows up to about 5 cm, leaves oval with slightly toothed or plane acute edges, yellowish-brownish, green during a short period, spirally arranged leaves.

Cells rounded to hexagonal, 30 × 15-50 µm; capsule ellipsoid. Found at the base of Halgord mountain in streams (Smith, 1978: p. 497-448, Fig. 217, 1-4; Scott et al., 1980: p. 304; Philips, 1994: p. 134).

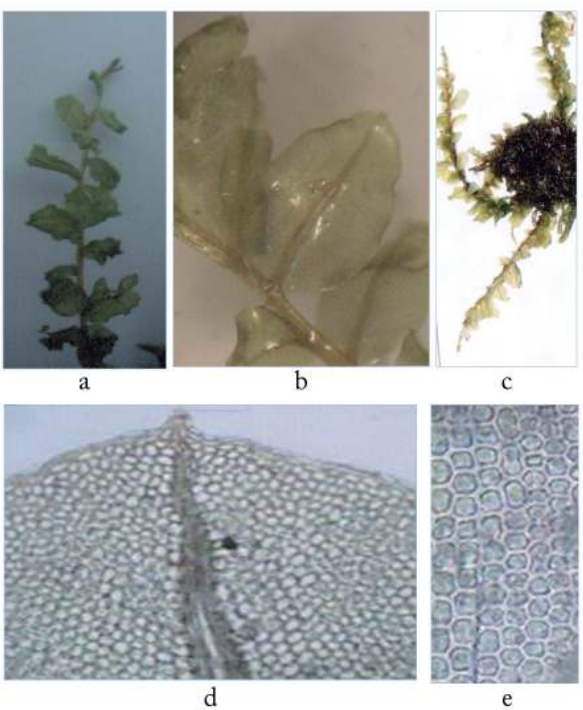


Fig. 12. *Plagiomnium rostratum* (Schrad.) Kop.
a- Gametophyte (x100) b-Gametophyte (x400)
c-Gametophyte (x20) d- Leaf cells (x200)
e- Leaf cells (X400)

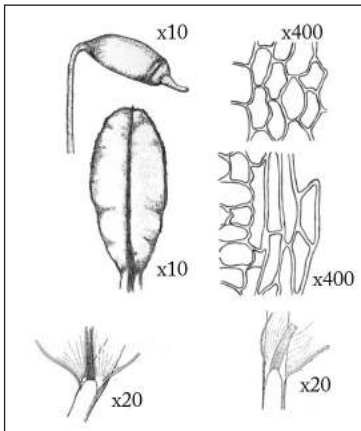


Fig.12. *Plagiomnium rostratum* (Schrad.) Kop. (Smith, 1978)

13- *Drepanocladus revolvens* (Sw) Warnst. = ***D. revolvens*** var. ***intermedia*** us (Lindb.) Grout. **= *D. intermedus*** (Lindb.) Warnst. **= *Hypnum revolvens*** Sw**. = *H. intermedius Lindb.***

Dioecious plant, slender to robust, procumbent to ascending, up to 10 cm long; stem branched with a single outer layer. Cell large, leaves ovate, tapering to long channeled acumen, cells mostly incrassate regular, hyaline; very fragile capsule, if present, inclined cylindrical, short, cured pant yellowish to golden green. On shaded, wet rocks in Duhok –Denarta-kosk (Smith, 1978: p. 567, Fig 277, 5-8).

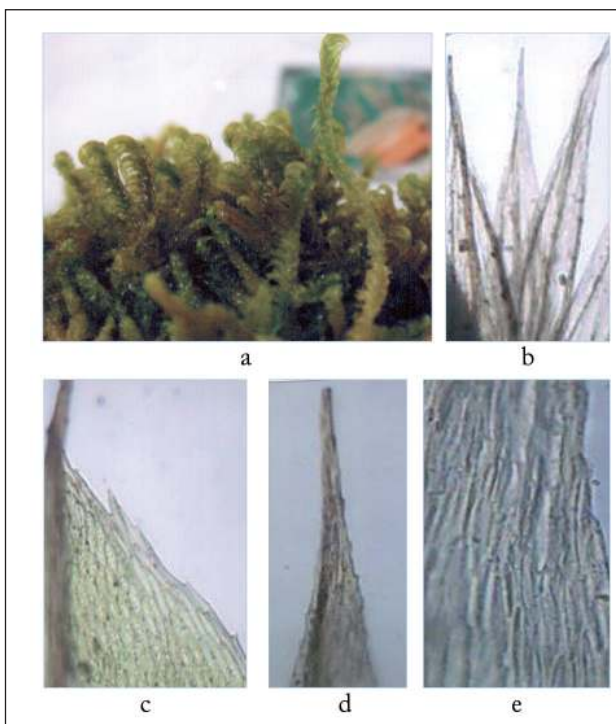


Fig. 13. *Drepanocladus revolvens* (Sw.) Warnst.
a- Gametophyte (x100) b- Leaves (x200)
c- Leaf cells (x200) d- Leaf cells (x100)
e- Leaf cells (x400)

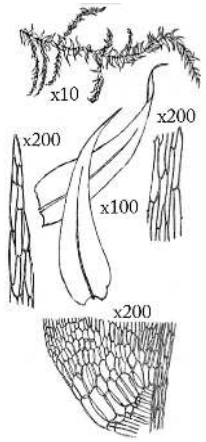


Fig. 13. *Drepanocladus revolvens* (Sw.) Warnst. (Smith, 1978)

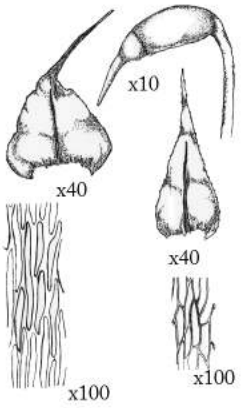


Fig. 14. *Eurhynchium paraelongum* var. *paraelongum* (Hedw.) Br. Eur. (Smith, 1978)

Brachytheceae

14- Eurhynchium paraelongum var. ***paraelongum*** (Hedw.) Br. Eur.

Dioecious plant; stem slender, up to 12 cm long, procumbent or acute, bipinnately branched, curved or not. Leaves cordate-triangular, largely decurrent, branch-leaves different in shape to lanceolate. Cells enlongated, rhomboidal, rectangular. Seta papillose; capsules horizontal, ellipsoid, curved, with small black spots at maturity, with long subulate beak, found in streams in Ahmad-awa and Balayian valley (Smith, 1974: p. 612-613, Fig. 297, 1-5).

15- *Plagiothecium denticulatum* (Hedw.) B.S. and G. (Var. denticulatum)

Worldwide species, from pale green to yellowish-brown, wish glossy green. Stems 2 cm long, and 2-5-3 mm wide. Shoot form an open tuft. Leaves widely ovate, symmetric. Vascular bundles very short, margin plane. Hyaline cells, cells shortly rectangular. Found in moist or aquatic regions in mountain areas, at the base of Qandel mountain, Asha-Qualka village Rania town Sulaimani. (Scott et al., 1980: p. 436; Smith, 1978: p. 622-625; Watson, 1980: p. 363).

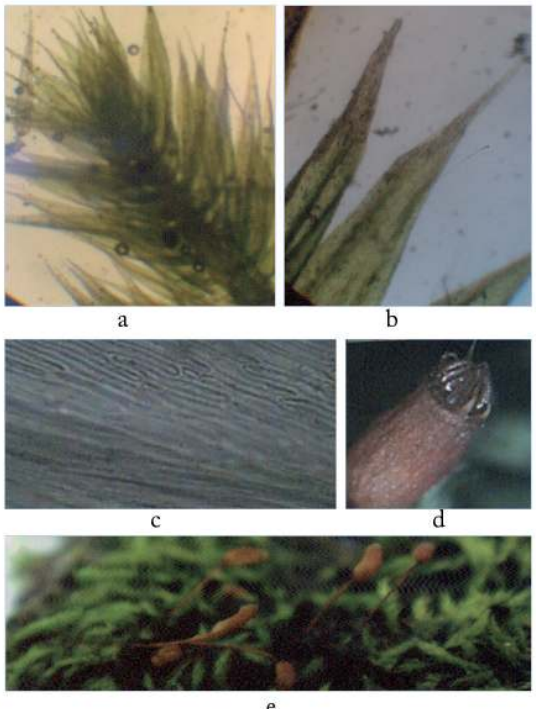


Fig. 14. *Eurhynchium paraelongum* var. *paraelongum* (Hedw.) Br. Eur.
a- Gametophyte (x200) b- Leaf and Leaf cells (x400)
c- Leaf cells (x400) d- Capsule (x200)
e- Gametophyte and Capsule (x100)

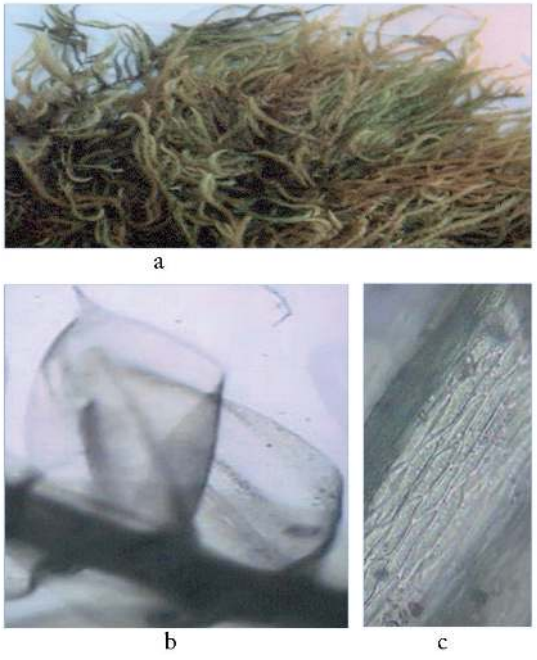


Fig. 15. *Plagiothecium denticulatum* (Hedw.) B.S. and G.
a- Gametophyte (x40) b- Leaves (X200)
c- Leaf cells (x400)

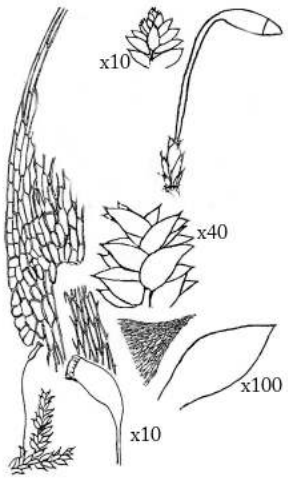


Fig. 15. *Plagiothecium denticulatum* (Hedw.) B.S. and G. (Var venticulatum) (Scott et al., 1976; Watson, 1980)

16- *Isopterygium elegans* (Brid.) Lindb. = ***Plagiothecium elegans*** (Brid.) Schimp**.**

Dioecious plant; cylindrical, medium-size stem, procumbent, numerous branches, hairs pointed in one direction. Leaves ovate, long, tapering, slightly denticulate near apex. Hardly differentiated angular cells, elongated. Capsule inclined, red with Seta ovoid, lid conical. Found on rocks near stream edges in mountain areas. In Fagin village, Rawandiz town (Smith, 1978: p. 636, Fig. 309, 1-5; Mizelle, 1951: p. 271).

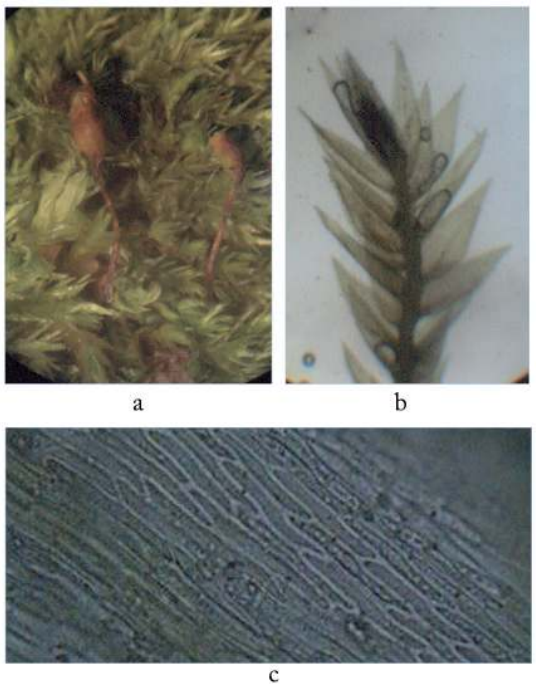


Fig. 16. *Isopterygium elegans* (Brid.) Lindb.
a- Gametophyte (x40) b- Gametophyte (x100)
c- Leaf cells (x400)

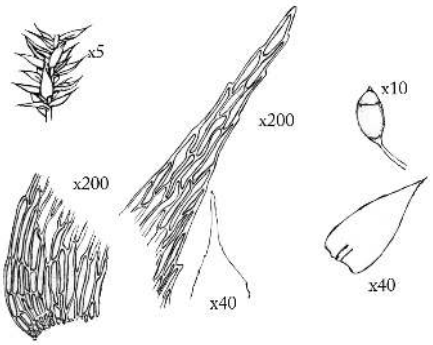


Fig. 16. *Isopterygium elegans* (Brid.) Lindb. (Mizelle, 1951; Smith, 1978)

17- *Rhytidiadelphus loreus* Warnst.

Dioecious, robust, erect, long irregularly and pinnately branched stem, paraphyllia absent, pseodoprahyllia (if present) very small. Stem erect, leaves stoloniform squarrose, spreading branches at the base to acutely narrow, margin denticulate. Cells incrassate, prose, angular, linear at the upper portion. Long capsule, horizontal ovoid or ovoid, gibbous; lid conical or mamillate (Smith, 1978: p. 664, Fig. 324, 1-3).

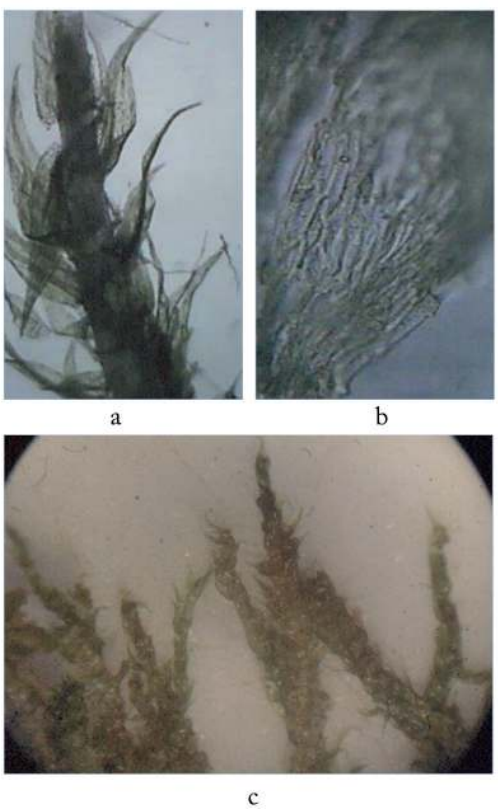


Fig. 17. *Rhytidiadelphus loreus* Warnst.
a- Gametophyte (x200) b- Leaf cells (x400)
c- Gametophyte (x100)

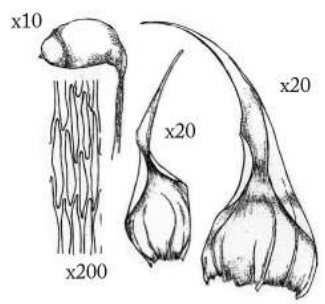


Fig. 17. *Rhytidiadelphus* loreus Warnst. (Smith, 1978)

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IDENTIFICATION KEYS

1a- Plants with many spreading recurved branches along the stem and clustered at the tip. Cells in one layer, circular and rectangular……..……..***Dicranoweisia cirrata***

1b- Plants, branches, stems and cells otherwise

2a- Small living plants in shaded areas; leaves pinnately lobed, growing fern-like leaves…..…… ***Schistostega pennata***

2b- Plants living either directly or partially under sunshine conditions

3a- Leaves with midrib

3b- Leaves without midrib or very short

4a- Leaves broadly ovate, attenuated margin, deeply denticulate…....….....….....…..…..... ***Ephemerum cristatum***

4b- Leaves smooth or entire

5a- Leaves made of 2 layers of cells, midrib extending out of leaves, denticulate, acute leaf ends, long hairs, hyaline ….. ….....….....….....….....….....….....….....***Grimmia doniana***

5b- Midrib shortly extending out of the leaf, hyaline

6a- Leaf apex broad or rounded, midrib not extending, leaves slightly toothed, cells inflated…....***Campylopus schimperi***

6b- Leaf apex narrow attenuated or acute tapering

7a- Double midrib, short entire capsules, lid raised up on the columell…....….....….. **G*ymnostomum recurvirostrum***

7b- Plant small calyptra elongated, with few leaves; leaves with end-pointed midrib

8a- Leaves entire, smooth, elongated, small; shoot with few leaves, midrib not extended; capsule erect, elongated cells

8b- End elongated, midrib…....….....….....***Pottia truncata***

8c- Capsule down ward curred, elongated; leaves filiform or elongated in whorl, midrib thick, black denticulate ….....….....….....….....….....…***Pottia willsonni,* var. *Crinata***

9a- Leaves not papilose, cells with long semi-hexagonal and odimetric cells…....….....….....….....**Bryum *rubens***

9b- Leaves papilose elongated, cells not hexagonal

10a- Aquatic plant, large leaves, erect, spreading; leaves up to 5 mm long, with 2 short ribs…..... ***Rhytidiadephus loreus***

10b- Not-aquatic plant; leaves more or less falcute-secund; shoot hooked

11a- Leaves slenderly acute, midrib short; outer layer cells of stem larger, thinner-walled..... ***Drepanocladus revolvens***

11b- Leaves semi-rounded with short extended midrib, end clear

12a- Leaves lanceolate, broadly rounded at apex with a stout, colourless apiculus, midrib complete, slightly extending,

entire margin; cells at the base quadrate or transversely elongated; capsule narrow long; stem spriled…... ***Barbula uniguiculata***

12b- Leaves ovate at the mouth, acute at the tip, base obliquely attached to the stem, leaves acute, sharply serrated, mid-rib weak, elongated to half of the cell…...***Eurhyncbium paralongum***

13a- Leaves plicate; cells large, quadrate or oblonging denticulate or smooth; capsule small, elongate bent-down ……..…….…….…….…….…….…….. ***Rhytlidiadelphus loreuss***

13b- Shoots essentially cylindrical; large leaves falcate and sharply attenuated; cells elongated capsule short, thick, calyptras short…….…….…….. ***Plagiothecium denticulatum***

14a- Leaves either not or slightly elongated and denticulated; cells irregularly elongated; capsule short and thick ……..…….…….…….…….…….…….. **Isopterygium elagans**

14b- Leaves, not smooth, or not entire, moderately elongated; capsule rises between two branches, small, elongated, erect; cells semi-rounded or irregular…….....**Eucladium virticellatum**

15a- Enlarged, elongated cells, not hexagonal, with three rounded angles, capsule elongated with rounded end when dry ……..…….…….…….…….…….…….. ***Bryum rubens***

15b- Cells rounded, hyaline, with midrib cells at the edge; denticulated, thick, capsule with short stem, short and enlarged…….…….…….…….…….. ***Plagiomnium rostratum***