

Review article

Liverworts and hornworts of Nepal: a synopsis

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Abstract

This work presents documentation of liverworts and hornworts of Nepal based on field research and compilation of the previous works done in different geographical regions of the country. Altogether, 43 families under 6 orders of the class Hepaticae and 1 family and 1 order of the class Anthocerotae reported in Nepal have been enumerated in this paper. An overall list of 107 genera and 428 species of Hepaticae, and 4 genera and 11 species of Anthocerotae are presented.

Key-words: Anthocerotae, bryologists, Hepaticae.

Introduction

Bryophytes, significant components of the lower plant group, characteristically occupy a portion of the microclimatic niches mostly on rocks, tree barks and moist areas of the forest floor. However, the robust and common species are widespread in various localities and habitat conditions. Some species are interestingly adapted to the epiphytic mode of life. These autotrophic plants possess chlorophyll a and b, starch and cellulose wall. The size of the plant ranges from microscopic to two meters in length. Fountain moss (*Fontinalis dalacarlina*), so far, has been claimed as the largest species (measuring up to 166 cm in length) in world record (Takaki 1984). *Marsupella commutata* (Limpr.) H. Bern. of the family Gymnomitriaceae has been recorded from the highest elevation of 5200 m asl in the Khumbu region of Eastern Himalaya (Pradhan and Shrestha 2002).

Bryophytes possess both the thalloid and leafy forms. Their leaves are arranged in two lateral rows but lack costae. The male and female gametes are represented by the antheridia and archegonia respectively. The gametophytic generation is transferred into the sporophytic generation displaying a distinct pattern of alternation of generation. Bryophytes are generally classified under the division Bryophyta into three distinct classes, viz. Hepaticopsida (Hepaticae), Anthocerotopsida (Anthocerotae) and Bryopsida (Musci). These three classes of bryophytes are also commonly known as liverworts, hornworts, and mosses, respectively.

The latest global data of bryophytes include more than 18,000 species including moss, liverworts and hornworts (Scofield 1985). Of them, 85% are the leafy Jungermanniales (Schuster 1984). The Nepalese record hitherto represents a combined list of 1150 species of hornworts, liverworts and mosses. The liverworts have both the thalloid and the leafy forms and are distributed from tropical to

alpine zones. The hornworts bear a long horn like sporophyte and a dorso-ventrally flattened thallus often in the form of a rosette.

They are widely distributed across tropical to the temperate regions. The mosses display an advanced structural diversity (especially that of the sporophytic generation) than other bryofloral groups.

Tracing back history of the bryophytes in Nepal, Buchanan-Hamilton, a British botanist, first started a remarkable study of plants during 1802-1803 in Kathmandu Valley and its vicinity. About three decades later, Wallich (1832) made an outstanding contribution on Bryophytes of Nepal which included 114 species of this group of plant under various status categories. These specimens were deposited in Kew under the tag of Wallich's Collection. Royle (1839) later published the catalogue of this collection. Mitten (1861) recorded 38 new species of Hepaticae from Nepal. During 1950-2000, many bryological expeditions were organized in the central and eastern part of Nepal and during these periods a number of publications on Hepaticae and Anthocerotae came out (e.g., Banerji 1958; Grolle 1966a, 1966b, 1974; Hattori *et al.* 1973; Manandhar 1982; Long 1993, 2005; Pradhan 2000; Kattel 2002; Pradhan and Shrestha 2003; Pradhan *et al.* 2007; Pradhan and Joshi 2007a,b). Besides these, Amakawa (1967, 1970, 1972) made a series of significant publications on Asiatic Jungermanniales, which also included many species from Nepal. Long and Grolle (1990) studied Hepaticae of Bhutan which also included many species from Nepal. Similarly, Long (2006) recorded 21 new species of Hepaticae mainly from the Sino-Himalayan region which also comprised a list of three new species from Nepal.

Long (2003, 2005) did remarkable work on Hepaticae of east Nepal. Pradhan and Shrestha (2003) reported 233 species of alpine bryoflora which comprised a list of 72 species of Hepaticae. Noteworthy contribution on the bryoflora of the lower belt of Nepal was made by Pradhan (2000) with a record of 294 species of Hepaticae and Anthocerotae belonging to 80 genera and 34 families.

Later studies recorded a new species of liverwort *Monosolenium tenerum* (Pradhan *et al.* 2007), and a new species of hornwort *Folioceros assamicus* D.C. Bhardwaj (Pradhan and Joshi 2007b) from lowland areas of Nepal.

This work presents documentation of liverworts and hornworts of Nepal based on field research and compilation of previous works done in different geographical regions of the country.

Methods

A list of Hepaticae (liverworts) and Anthocerotae (hornworts) have been compiled consulting relevant literature (e.g., Scofield 1985; Smith 1996; Crandol-Stotler and Stotler 2000; Pradhan 2000, Ghimire 2001; Kattel 2002). The author's name of the species has been checked by using Brummitt and Powell (1992). This paper also includes the data of the field studies done in various years and in different regions by the first author. All the collected specimens were placed safely in paper packets and were deposited at the Tribhuvan University Central Herbarium (TUCH) and herbarium of Natural History Museum of Tribhuvan University, Nepal.

Results

The classification of the liverworts and hornworts presented in this paper is based on Smith's concept (Smith 1996), who classified bryophytes into three classes: Anthocerotae (Anthocerotopsida), Hepaticae (Hepaticopsida) and Musci (Bryopsida). Genera and species of each family are arranged in alphabetical order.

CLASS I. HEPATICAE

Subclass I. Jungermanniideae

ORDER 1. CALOBRYALES (1 family, 1 genus, 1 sp.)

Family 1. Haplomitriaceae (1 genus, 1 sp.)

Haplomitrium: *H. hookeri* (Sm.) Nees

ORDER 2. JUNGERMANNIALES (24 families, 77 genera, 353 spp.)

Family 2. Lepicoleaceae (1 genus, 2 spp.)

Mastigophora: *M. sikkimensis* Steph., *M. woodsii* (Hook.) Nees

Family 3. Herbertaceae (1 genus, 9 spp.)

Herbertus: *H. aduncus* (Dicks.) S. Grey, *H. dicranus* (Taylor) Trev., *H. fragilis* (Steph.) Herz., *H. giralduanus* (Steph.) Nichols., *H. himalayana* (Steph.) Herzog., *H. kurzi* (Steph.) Chopra, *H. longifolius* Horik., *H. pseudoceylanica* S. Hatt., *H. sendneri* (Nees) A. Evans

Family 4. Pseudolepicoleaceae (2 genera, 2 spp.)

Blepharostoma: *B. trichophyllum* (L.) Dumort.

Pseudolepicolea: *P. trollii* (Herz.) Grolle & Ando

Family 5. Trichocoleaceae (1 genus, 1 sp.)

Trichocolea: *T. tomentella* (Ehrh.) Dumort.

Family 6. Lepidoziaceae (2 subfamilies, 3 genera, 24 spp.)

Subfamily 1. Lepidozioideae: (2 genera, 5 spp.)

Kurzia: *K. makinoana* (Steph.) Grolle

Lepidozia: *L. brevifolia* Mitt., *L. erosa* Steph., *L. reptans* (L.) Dumort., *L. robusta* Steph.

Subfamily 2. Bazzanioideae: (1 genus, 19 spp.)

Bazzania: *B. angustistiula* N. Kitag., *B. appendiculata* (Mitt.) S. Hatt., *B. bidentula* (Steph.) Steph ex M. Yasuda, *B. decurva* (Nees) Trev., *B. griffithiana* (Steph.) Mizut., *B. himalayana* (Mitt.) Schiffn., *B. imbricata* (Mitt.) S. Hatt., *B. lobulistipa* (Steph.) S. Hatt., *B. ovisstipula* (Steph.) Abeyw., *B. pearsonii* Steph., *B. penniformis* (Steph.) S. Hatt., *B. praerupta* (Reinw *et al.*) Trev., *B. robusta* Steph., *B. sikkimensis* (Gott. ex Steph.) Herzog., *B. sumbavensis* (Steph.) Herz., *B. tricrenata* (Wahlenb.) Lindb., *B. tridens* (Reinw. *et al.*) Trev., *B. uncigera* (Reinw. *et al.*) Trev., *B. wallichiana* (Linden.) Trev.

Family 7. Calypogeaceae (2 genera, 3 spp.)

Calypogeia: *C. cordistipula* (Steph.) Steph., *C. lunata* Mitt.

Metacalypogeia: *M. alternifolia* (Nees.) Grolle

Family 8. Cephaloziaceae (2 subfamilies, 3 genera, 5 spp.)

Subfamily 1. Cephalozioideae (2 genera, 4 spp.)

Cephalozia: *C. herzogiana* Pande & Srivast., *C. gollanii* Steph., *C. terminalis* S. Hatt.

Iwatsukia: *I. jishibae* (Steph.) Grolle

Subfamily 2. Odontoschismatoideae (1 genus, 1 sp.)

Odontoschisma: *O. denudatum* (Mart.) Dumort.

Family 9. Cephaloziellaceae (1 genus, 6 spp.)

Cephaloziella: *C. hampeana* (Nees) Schiffn., *C. magna* Udar & Nath, *C. massalongi* (Spr.) K. Muell., *C. microphylla* (Steph.) Dumort., *C. papillosa* (Douin.) Schiffn., *C. subdentata* Warnst.

Family 10. Antheliaceae (1 genus, 2 spp.)

Anthelia: *A. julacea* (L.) Dumort., *A. Jaratzkana* (Limpr.) Trev.

Family 11. Lophoziaceae (1 genus, 4 spp.)

Lophozia: *L. exeisa* (Dicks.) Dumort., *L. handelii* Herzog., *L. incisa* (Schrad.) Dumort., *L. setosa* (Mitt.) Steph.

Family 12. Jungermanniaceae (3 subfamilies, 18 genera, 71 spp.)

Subfamily 1. Jamesonielloideae (1 genus, 4 spp.)

Jamesoniella: *J. autumnalis* (D.C.) Steph., *J. elongella* (Taylor) Steph., *J. Horikawana* S. Hatt., *J. nipponica* S. Hatt.

Subfamily 2. Mylioideae (1 genus, 1 sp.)

Mylia: *M. taylorii* (Hook.) Gray

Subfamily 3. Jungermannioideae (16 genera, 66 spp.)

Anastrepta: *A. orcadensis* (Hook.) Schiffn.

Anastrophyllum: *A. assimile* (Mitt.) Steph., *A. bidens* (Nees) Steph., *A. donnianum* (Hook.) Steph., *A. joergensenii* Schiffn., *A. minutum* (Schreb.) R. M. Schust.

Andrewsianthus: *A. ferrugineus* Grolle

Chandonanthus: *C. birmensis* Steph., *C. filiformis* Steph., *C. hirtellus* (F. Weber) Mitt.

Diplocolea: *D. sikkimensis* Amakawa

Gerhildiella: *G. rossneriana* Grolle

Horikawaella: *H. grosse-verrucosa* Amakawa & S. Hatt., *H. Subacuta* (Herzog) S. Hatt. & Amakawa

Isopaches: *I. decolorans* (Limpr.) Buch.

Jungermannia: *J. appressifolia* var. *appressifolia* Mitt., *J. appressifolia* var. *minor* (Amakawa) Vana, *J. appressifolia* var. *nigricans* (Amakawa) Vana, *J. atrobrunnea* Amakawa, *J. atrorevoluta* (Mitt.) Amakawa, *J. clavellata* (Mitt.) Amakawa, *J. comata* Nees, *J. conchata* Grolle & Vana, *J. consata* Grolle & Vana, *J. confertissima* Nees, *J. decolyana* Schiffn., *J. duthiana* Amakawa, *J. filamentosa* Amakawa, *J. flagellaris* Amakawa, *J. flaccidula* Amakawa, *J. flavorevoluta* Vana, *J. glauca* Amakawa, *J. gollanii* Steph., *J. heterolimbata* Amakawa, *J. hyalina* Lyell, *J. lanigera* Mitt., *J. limbatifolia* var. *radicellosa* Steph., *J. macrescens* Steph., *J. macrocarpa* Steph., *J. minutiverrucosa* Amakawa, *J. ohbae* Amakawa, *J. parvitexta* Amakawa, *J. poeltii* Amakawa, *J. polyrhizoides* Grolle, *J. pseudocyclops* Inoue, *J. pyriflora* var. *pyriflora* Steph., *J. pyriflora* var. *gracillima* Amakawa, *J. rubripunctata* (S. Hatt.) Amakawa, *J. saccaticoncava* Amakawa, *J. sanguinolenta* D.G. Griffin, *J. schauliana* Steph., *J. subrubra* Steph., *J. subulata* A. Evans, *J. tetragona* Lindenb., *J. truncata* Nees, *J. ventroversa* Grolle

Isopaches: *I. decolorans* (Limpr.) Buch

Nardia: *N. assamica* (Mitt.) Amakawa, *N. nepalensis* Amakawa, *N. poeltii* Vana

Scaphophyllum: *S. speciosum* (Horik.) Inoue

Sphenolobopsis: *S. himalayensis* N. Kitag., *S. pearsonii* (Spruce) Schust.

Sphenolobus: *S. minutes* (Schreb. ex Crantz.) R.M. Schust.

Tetralophozia: *T. filiformis* (Steph.) Urml.

Tritomaria: *T. exsecta* (Schröd.) Loeske

Family 13. Gymnomitriaceae (3 genera, 17 spp.)

Gymnomitrium: *G. crenatilobum* Grolle, *G. laceratum* (Steph.) Horik., *G. mucronatum* (N. Kitag.) N. Kitag., *G. obtusilobum* N. Kitag., *G. papillosum* N. Kitag., *G. revolutum* (Nees) Philip., *G. sinense* Muell. Frib.

Marsupella: *M. alpina* (Gottsche) Bernet, *M. commutata* (Limpr.) H. Bern., *M. crystallocaulon* Grolle, *M. emarginata* (Ehrh.) Dumort., *M. integra* N. Kitag., *M. nitida* N. Kitag., *M. revoluta* (Nees) Dumort., *M. rubida* (Mitt.) Grolle, *M. verrucosa* (W.E. Nicholson) Grolle

Poeita: *P. campylata* Grolle

Family 14. Scapaniaceae (3 genera, 21 spp.)

Delavayella: *D. serrata* Steph.

Diplophyllum: *D. trollii* Grolle

Scapania: *S. bhutanensis* Amakawa, *S. ciliata* Sande Lac., *S. ciliatospinosa* Horik., *S. contorta* Mitt., *S. ensifolia* Grolle, *S. ferruginea* (Lehm. & Lindenb.) Grolle & al., *S. ferrugiana* var. *minor* (Lehm. & Lindenb.) Gottsche & Amakawa, *S. griffithii* Schiffn., *S. harae* Schiffn., *S. himalayica* Muell. Frib. ex. Herog., *S. karlmuelleri* Grolle, *S. levieri* K. Muell., *S. ligulata* Steph., *S. maxima* Horik., *S. nimbose* Taylor ex Lehm., *S. orientalis* Steph. ex Muell. Frib., *S. ornithopodioides* (With.) Waddell, *S. pseudoferruginea* Amak., *S. rotundifolia* W.E. Nicholson, *S. secunda* Steph., *S. stephanii* Muell. Frib.

Family 15. Geocalycaceae (2 subfamilies, 3 genera, 12 spp.)

Subfamily 1. Lophochoideae (1 genus, 4 spp.)

Lophocolea: *L. bidentata* (L.) Dumort., *L. minor* Nees, *L. mollis* (Nees) Nees, *L. sikkimensis* (Steph.) Herzog.

Subfamily 2. Geocalycoideae (2 genera, 8 spp.)

Chilocyphus: *C. flaccidus* (Mitt.) Steph., *C. perfoliatus* (Mont.) Nees, *C. polyanthus* (L.) Corda

Heterocyphus: *H. argustus* (Reinw. et al.) Schiffn., *H. coalitus* (Hook.) Schiffn., *H. inflatus* (Steph.) S.C. Srivast. & A. Srivast., *H. planus* (Mitt.) Schiffn., *H. tener* (Steph.) Schiffn.

Family 16. Plagiochilaceae (4 genera, 65 species)

Herzogiella: *H. renitens* (Mitt.) Z. Iwats.

Plagiochila: *P. alata* Inoue, *P. ambagiosa* Mitt., *P. asymmetrica* Steph., *P. beddomei* Steph., *P. biloba* Inoue., *P. cardotii* Steph., *P. carringtonii* (Balf.) Grolle ssp. *lobuchensis* Grolle, *P. chinensis* Steph., *P. cuspidata* Steph., *P. debilis* Mitt., *P. delavayi* Steph., *P. denticulata* Mitt., *P. deterrmii* Steph., *P. durelii* Schiffn., *P. duthiana* Steph., *P. elegans* Mitt., *P. ferruginea* Steph., *P. flexuosa* Mitt., *P. firma* Mitt., *P. fragillima* Steph., *P. fruticosa* Mitt., *P. gollanii* Steph., *P. gracilis* Lindenb. & Gottsche, *P. grollei* Inoue, *P. hamulispina* Herzog., *P. harae* Inoue, *P. kitagawae* Inoue, *P. khasiana* Mitt., *P. mayebarae* S. Hatt., *P. microphylla* Steph., *P. mittenii* Steph., *P. monalata* Inoue, *P. mundaliensis* Steph., *P. neorupicola* Inoue, *P. nepalensis* Lindenb., *P. oblonga* Inoue, *P. orientalis* Taylor, *P. parvifolia* Lindenb., *P. parviramifera* Inoue, *P. parvivittata* Inoue, *P. perserrata* Herzog., *P. phalangea* Taylor, *P. pocsii* Inoue, *P. poeltii* Inoue & Grolle, *P. pseudocapillaris* Inoue, *P. pseudofirma* Herz., *P. pseudomicrophylla* Inoue, *P. pseudopoeltii* Inoue, *P. pseudorenitens* Schiffn., *P. renitens* (Nees) Lindenb., *P. retusa* Mitt., *P. sciophila* Nees, *P. secretifolia* Mitt., *P. semidecurrans* (Lehm. & Lindenb.) Lindenb., *P. semidecurrans* (Lehm. & Lindenb.) Lindenb. var. *longifolia* Inoue, *P. seminuda* Inoue, *P. sikutzuisana* Massari, *P. simlana* Steph., *P. subsymmetrica* Steph., *P. togashii* Inoue, *P. terquescens* Hetz. *P. ventricosa* Steph., *P. vexans* Schiff. ex Steph., *P. zonata* Steph., *P. zongiensis* Inoue.

Plagiochilon: *P. mayebarae* S. Hatt.

Xenochila: *X. integrifolia* (Mitt.) Inoue

Family 17. Arnelliaceae (2 genera, 2 spp.)

Gongylanthus: *G. gollanii* (Steph.) Grolle**Southbya:** *S. grollei* N. Kitag.

Family 18. Acrobolbaceae (1 genus, 1 sp.)

Acrobolbus: *A. ciliates* (Mitt.) Schiffn.

Family 19. Pleuroziaceae (1 genus, 1 sp.)

Pleurozia: *P. purpurea* Lindb.

Family 20. Radulaceae (1 genus, 8 spp.)

Radula: *R. auriculata* Steph., *R. complanata* (L.) Dumort., *R. constricta* Steph., *R. javanica* Grottsche, *R. madagascariensis* Grottsche, *R. obscura* Mitt., *R. perrottetii* Steph., *R. tjobodensis* K.I. Geobel

Family 21. Ptilidiaceae (1 genus, 2 spp.)

Ptilidium: *P. celeare* (L.) Hampe, *P. pulcherrimum* (G. Web.) Vainio

Family 22. Porellaceae (1 genus, 13 spp.)

Porella: *P. appendiculata* ssp. *appendiculata* (Sreph.) S. Hatt., *P. caespitans* (Steph.) S. Hatt., *P. caespitans* (Steph.) S. Hatt. var. *setigera* (Steph.) S. Hatt., *P. campylophylla* (Lehm. & Lindenb.) Trev., *P. Denticulata* (Lehm. & Lindenb.) S. Hatt., *P. densifolia* (Steph.) S. Hatt., *P. densifolia* ssp. *appendiculata* (Steph.) S. Hatt., *P. frullanioides* (Steph.) S. Hatt., *P. ligulifera* (Taylor) Trez., *P. nitens* (Steph.) S. Hatt., *P. platyphylla* (L.) Pleiff., *P. plumosa* (Mitt.) S. Hatt., *P. revoluta* (Lehm. & Lindenb.) Trev.

Family 23. Frullaniaceae (1 genus, 25 spp.)

Frullania: *F. arecae* (Spring.) Gott., *F. arelae* Mitt., *F. atrata* Mitt., *F. berthoumieul* Steph., *F. duthiana* var. *appendiculata* S. Hatt., *F. duthiana* var. *laevis* S. Hatt., *F. ericoides* (Nees & Monten) Nees & Monten, *F. giraldiana* Mass., *F. incisoduthiana* S. Hatt., *F. inflexa* Mitt., *F. muscicola* Steph., *F. nepalensis* var. *grevilleana* (Taylor) S. Hatt., *F. nepalensis* var. *nepalensis* (Spring.) Lehm. & Lindenb., *F. neurota* Taylor, *F. neurota* var. *pfliderei* S. Hatt., *F. orbicularis* Aust., *F. pallide-virens* Steph., *F. physantha* Mitt., *F. polyptera* Taylor, *F. pyriflora* Steph., *F. retusa* Mitt., *F. schensiana* Massari, *F. subclavata* Steph., *F. tamarisci* Steph., *F. yumanensis* Steph.,

Family 24. Jubulaceae (1 genus, 1 sp.)

Jubula: *J. hutchinsiae* (Hook.) Dumort.

Family 25. Lejeuneaceae (21 genera, 56 spp.)

Acanthocoleus: *A. gilvus* (Gott.) Krujit**Acrolejeunea:** *A. pusilla* (Steph.) Grolle & Gradst., *A. recurvata* Gradst.**Bryopteris:** *B. nepalensis* Steph.**Cheilejeunea:** *C. imbricata* (Nees) S. Hatt., *C. khasiana* (Mitt.) N. Kitag., *C. laeviuscula* (Mitt.) Steph., *C. minutissima* (Sm.) Schiffn., *C. spinosa* (Horik.) S. Hatt., *C. subopaca* (Mitt.) Mizut., *C. plurinlicata* Pearson**Cololejeunea:** *C. bhutanica* Grolle & Mizut., *C. lanciloba* Steph.,*C. latiloba* (Herzog.) Tixier, *C. longiana* D.G. Long, *C. raduliloba* Steph.**Colura:** *C. tenuicornis* (Evans) Steph.,**Dicranolejeunea:** *D. javanica* Steph., *D. sikkimensis* Steph.**Drepanolejeunea:** *D. angustifolia* (Mitt.) Grolle, *D. erecta* (Steph.) Mizut., *D. pulla* (Mitt.) Grolle, *D. monophthalma* (Herzog.) Mizut.**Frullanoides:** *F. tristis* (Steph.) van Slageren**Hygrolejeunea:** *H. princeps* Steph.**Jubula:** *J. hutchinsiae* (Hook.) Dumort.**Lejeunea:** *L. bidentula* Herzog., *L. cavifolia* (Ehrh.) Lindb., *L. discreta* Lindenb., *L. flava* (Sw.) Nees, *L. mittenii* Mizut., *L. neelgherriana* Gott., *L. nepalensis* Steph., *L. obfusca* Mitt., *L. princeps* (Steph.) Mizut., *L. stevensiana* (Steph.) Mizut., *L. subacuta* Mitt., *L. tuberculosa* Steph., *L. ulicina* (Taylor) Gottsche et al., *L. wallichiana* (Lehm. & Lindenb.) Gottsche et al., *L. wightii* Lindenb.**Leptolejeunea:** *L. elliptica* Lehm. & Lindenb.**Leucolejeunea:** *L. turgida* (Mitt.) Verd.**Lopholejeunea:** *L. nigricans* (Lindenb.) Schiffn., *L. sikkimensis* Steph., *L. subfusca* (Nees) Schiffn.**Mastigolejeunea:** *M. humilis* (Gottsche) Schiffn., *M. repleta* (Taylor) Evans, *M. nepalensis* Steph.**Microlejeunea:** *M. punctiformis* (Taylor) Steph., *M. pulla* (Mitt.) Steph.**Ptychanthus:** *P. strictus* (Lehm. & Lindenb.) Nees**Spruceanthus:** *S. semirepandus* (Nees) Verd.**Trocholejeunea:** *T. infuscata* (Mitt.) Verd., *T. sandvicensis* (Gottsche) Mizut.**Tuzibeanthus:** *T. chinensis* (Steph.) Mizut.

ORDER 3. TAKAKIALES (1 family, 1 genus, 2 spp.)

Family 26. Takakiaceae (1 genus, 2 spp.)

Takakia: *T. ceratophylla* (Mitt.) Grolle, *T. lepidozoides* S. Hatt. & Inoue

ORDER 4. METZGERIALES (6 families, 8 genera, 24 spp.)

Family 27. Pelliaceae (1 genus, 4 spp.)

Pellia: *P. endiviifolia* (Dicks.) Dumort., *P. epiphylla* (L.) Corda, *P. fjabbroniana* (L.) Raddi, *P. neesiana* (Grottsche) Limpr.

Family 28. Allisoniaceae (1 genus, 1 sp.)

Calycularia: *C. crispula* Mitt.

Family 29. Pallaviciniaceae (1 genus, 2 spp.)

Pallavicinia: *P. indica* Schiffn., *P. lyellii* (Hook.) Carruth.

Family 30. Blasiaceae (1 genus, 1 sp.)

Blasia: *B. pusilla* L.

Family 31. Aneuraceae (2 genera, 4 spp.)

Aneura: *A. blasioides* (Horik.) Furuki, *A. pinguis* (L.) Dumort.**Riccardia:** *R. cardotii* (Steph.) Pande & S.C. Srivast. ex Srivast.,

R. multifida (Linn.) Gray

Family 32. Metzgeriaceae (2 genus, 12 spp.)

Apometzgeria: *A. pubescens* (Schrank) Kuwah., *A. pubescens* var. *kinabaluensis* (Schrank) Kuwah.

Metzgeria: *M. conjugata* Lindb., *M. conjugata* ssp. *japonica* (S. Hatt.) Kuwah., *M. decipiens* (Massari) Schiffn., *M. hamata* Lindb., *M. harae* Kuwah., *M. involvens* S. Hatt., *M. leptoneura* Spruce, *M. lindbergii* Schiffn., *M. macrospora* Kuwah., *M. molokaiensis* Kuwah.

Subclass II. Marchantiideae

ORDER 5. SPHAEROCARPALES (1 family, 1 genus, 3 spp.)

Family 33. Sphaerocarpaceae (1 genus, 3 spp.)

Sphaerocarpos: *S. nepalensis* Br., *S. bracteata* L., *S. stipitatus* Bisch ex Lindbn.

ORDER 6. MARCHANTIALES (10 families, 19 genera, 45 spp.)

Family 34. Targioniaceae (2 genera, 3 spp.)

Cyathodium: *C. cavernarum* Kunze, *C. tuberosum* Kashyap

Targionia: *T. hypophylla* L.

Family 35. Exomothecaceae (1 genus, 1 sp.)

Exomotheca: *E. tuberifera* Kashyap

Family 36: Lunulariaceae (1 genus, 1 sp.)

Lunularia: *L. cruciata* (L.) Dumort. ex Lindb.

Family 37. Wiesnerellaceae (2 genera, 3 spp.)

Dumortiera: *D. hirsuta* (Sw.) Nees, *D. hirsuta* (Sw.) Nees var. *nepalensis* (Tayler) Frye & Clark

Wiesnerella: *W. denudata* (Mitt.) Steph.

Family 38. Conocephalaceae (1 genus, 2 spp.)

Conocephalum: *C. conicum* (L.) Underw., *C. japonicum* (Thunb.) Grolle

Family 39. Sauteriaceae (2 genera, 2 spp.)

Athalamia: *A. pinguis* Falconer.

Sauteria: *S. spongiosa* (Kashyap) S. Hatt.

Family 40. Aytoniaceae (5 genera, 16 spp.)

Asterella: *A. blumeana* (Nees) Pande, *A. khasiana* (Griff.) Pande et al., *A. multiflora* (Steph.) Pande et al., *A. missuriensis* (Kashyap) Verd., *A. reticulata* (Kashyap) Pande, *A. sanguina* (Lehm. & Lindenb.) Kachroo, *A. wallichiana* (Lehm. & Lindenb.) Grolle

Mannia: *M. fragrans* (Balb.) Frey & L.Clark., *M. rupestris* (Nees.) Frye & L. Clark

Plagiochasma: *P. appendiculatum* Lehm. & Lindb., *P. cordatum* Lehm. & Lindenb., *P. nepalensis* Steph., *P. pterospermum* C. Massal, *P. simlensis* Kashyap

Reboulia: *R. hemisphaerica* (L.) Raddi

Tritomaria: *T. exsecta* (Schrad) Loeske

Family 41. Marchantiaceae (2 genera, 10 spp.)

Marchantia: *M. cruciata* (L.) Dumort. ex Lindb., *M. emarginata* Reinw. et al., *M. hartlessiana* Steph., *M. linearis* Lehm. & Lindenb., *M. paleacea* Bertol. ssp. *paleacea* Bertol., *M. papillata* Raddi ssp. *grossibarba* (Steph.) Bischler, *M. polymorpha* L., *M. simlana* Steph., *M. subintegra* Mitt.

Preissia: *P. quadrata* Nees

Family 42. Monosolenaceae (1 genus, 1sp.)

Momosolenium: *M. tenetum* Griff.

Family 43. Ricciaceae (2 genera, 6 spp.)

Ricciocarpos: *R. natans* (L.) Corda

Riccia: *R. fluitans* L., *R. himalayensis*, *R. pathankotensis* Kashyap, *R. robusta* Kashyap, *R. sanguina* Kashyap

CLASS II. ANTHOCEROTAES

ORDER 1. ANTHOCEROTALES (1 family, 4 genera, 11 spp.)

Family 1. Anthocerotaceae (4 genera, 11 spp.)

Anthoceros: *A. chambensis* Kashyap, *A. erectus* Kashyap, *A. formosae* Steph., *A. gollanii* Steph., *A. longii* Steph., *A. punctatus* L.

Folioceros: *F. assamicus* D. C. Bhardwaj, *F. glandulosus* (Lehm. & Lindenb.) D.C. Bhardwaj

Phaeoceros: *P. laevis* (L.) Prosk., *P. himalayensis* (Kashyap.) Prosk.

Noththylas: *N. levieri* Schiffn.

Discussion

So far 1150 species of bryophytes have been recorded from Nepal. Out of these, 428 species are Hepaticae, 11 species belong to Anthocerotae and the rests are mosses (Musci). In this paper, all the species of Hepaticae and Anthocerotae, so far documented from Nepal, have been enumerated. Nepalese bryoflora also comprise 31 endemic species, of which 27 species belong to Hepaticae (Appendix 1). *Folioceros assamicus* DC. Bhardwaj of Anthocerotaceae and *Monosolenium tenerum* Griff. of Monosoleniaceae are the rare species and were reported recently from the Tarai of west Nepal (Pradhan et al. 2007; Pradhan and Joshi 2007b).

Jungermanniales is the largest order with 24 families, 77 genera and 353 species. Similarly, among the families Jungermanniaceae is the largest family with 71 species, followed by Plagiochilaceae (65 spp.) and Lejeuneaceae (56 spp.). The order Marchantiales has 19 genera and 45 species under 10 families. Families like Haplomitriaceae, Trichocoleaceae, Jubulaceae, Allisoniaceae, Blasiaceae, Exomothecaceae, Lunulariaceae and Monosolenaceae are poorly represented as each of them include single species. Two rare species of *Takakia* are known from the eastern region which is specially confined to the highland areas >4000 m asl (Pradhan 2000).

Appendix 1. List of endemic bryophytes (Source: Joshi and Joshi 1991).

S. No	Latin name	Family	Altitude (m asl)	Region*
1	<i>Sphenobolopsis himalayensis</i> N. Kitag.	Jungermanniaceae	4000-47000	E
2	<i>Horikawaella grosse-verracosa</i> Amakawa & Hatt.	Jungermanniaceae	4000-4550	E
3	<i>Jungermannia flaccidula</i> Amakawa	Jungermanniaceae	2500	E
4	<i>Jungermannia glauca</i> Amakawa	Jungermanniaceae	2500-3000	E
5	<i>Jungermannia obhae</i> Amakawa	Jungermanniaceae	4200	C
6	<i>Jungermannia saccaticoncava</i> Amakawa	Jungermanniaceae	4550	E
7	<i>Nardia nepalensis</i> Amakawa	Jungermanniaceae	4150-4350	E
8	<i>Nardia poeltii</i> Vana	Jungermanniaceae	3800	E
9	<i>Diplocolea sikkimensis</i> Amakawa	Jungermanniaceae	3700-4000	E
10	<i>Plagiochila alata</i> Inoue	Plagiochilaceae	3300-3900	E
11	<i>Plagiochila biloba</i> Inoue	Plagiochilaceae	2700-2800	E
12	<i>Plagiochila grollei</i> Inoue	Plagiochilaceae	2500-3000	E
13	<i>Plagiochila harae</i> Inoue	Plagiochilaceae	2600-3000	E
14	<i>Plagiochila neorupicola</i> Inoue	Plagiochilaceae	2000	E
15	<i>Plagiochila poeltii</i> Inoue & Grolle	Plagiochilaceae	3200-4200	E
16	<i>Plagiochila pseudomicrophylla</i> Inoue	Plagiochilaceae	2600-3000	E
17	<i>Plagiochila pseudopoeltii</i> Inoue	Plagiochilaceae	3300-3900	E
18	<i>Plagiochila seminuda</i> Inoue	Plagiochilaceae	1500-2500	E
19	<i>Plagiochila togashii</i> Inoue	Plagiochilaceae	2000-3300	E
20	<i>Plagiochila zongiensis</i> Inoue	Plagiochilaceae	1800-2700	E
21	<i>Marsupelia nitida</i> N. Kitag.	Marsupellaceae	3200-3900	E
22	<i>Metzgeria harae</i> Kuwah.	Metzgeriaceae	2700-3800	E
23	<i>Diplophyllum trollii</i> Grolle	Scapaniaceae	3400-4300	E
24	<i>Scapania karlmulleri</i> Grolle	Scapaniaceae	4100	E
25	<i>Gymnomitrium obtusilobum</i> N. Kitag.	Gymnomitriaceae	4750	E
26	<i>Gymnomitrium papillosum</i> N. Kitag.	Gymnomitriaceae	4000-4550	C, E
27	<i>Marsupella crystallocaulon</i> Grolle	Gymnomitriaceae	3300	E

*C – Central Nepal; E – East Nepal; W – West Nepal.

IUCN Red List of bryophytes currently includes 92 species. Nepalese species of bryophytes inlisted in IUCN Red List comprise *Andrewsianthus ferrugineus* Grolle (status: endangered), *Diplocolea sikkimensis* Amakawa (status: endangered), *Scaphophyllum speciosum* (Horik.) Inoue (status: vulnerable) and *Takakia ceratophylla* (Mitt.) Grolle (status: vulnerable). These are severely threatened species, highly affected due to habitat destruction and rapid process of urbanization.

Bryophytes are still a least studied group of plants in Nepal. Most of the species of Hepaticae and Anthocerotae enumerated in this paper represent lower-altitude species. Only few bryophyte species have been recorded from high altitude regions of the Himalaya. The current data on the Himalayan species of bryoflora are very scarce and awaits for further extensive explorations covering east to west and south to north extensions of Himalayan mountains. Some of the high altitude bryophytes of the Himalaya are expected to be severely affected by the current trend of global climate change. A wide use of such species for research can help to bring a significant result about the changing situation of the Himalayan climatic condition.

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