Moss flora of Munsiyari (Uttarakhand), Western Himalayas, India

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Abstract: The present contribution is an enumerated account of mosses of Munsyari (Pithoragarh), Western Himalayas. The study revealed the presence 8 orders, 20 families, 32 genera and 44 species in the area. Moss species viz. *Anoectangium walkeri* Broth., *Actinothuidium hookeri* (Mitt.) Broth. *Stereophyllum ligulatum* Jaeg., *Anomodon minor* (Hedw.) Fŭrnr., *Hageniells assamica* Dixon, *Schoenobryum cocavifolia* (Griff.) Gang., *Entodon luteonitens* Ren. et Card. and *Physcomitrium pulchellum* (Grif.) Mitt. are reported for the first time from Munsiyari hills as well as western Himalayas as welcome additions to the bryoflora of Uttarakhand (Western Himalaya).
Keywords: Bryopsida, Mosses, Western Himalayas, Munsiyari, Uttarakhand.

1. Introduction

The geographical area of the Munsiyari is 19.68 km^2 (7.60 sq mi). It is located at a height of 1645 m above sea level It lies between 30°4′2.69″N, 80°14′18.82″E. The northern hilly zone is covered with dense forests, particularly on northern slopes, with an elevation of about 14,000 feet. The area has great variation in temperature due to much altitude gradient. The temperature starts intensifying from mid March until mid June. Munsiyari is one of the prominent region of this district. The flora of the Munsiyari includes variety of plants including many Bryophytes, Pteridophytes, Gymnosperms and Angiosperms (Champion and Seth, 1968; Alam et al., 2012).

However, the area is still under explored and only few records of bryodiversity from here are available sporadically by Kashyap (1929), Vohra (1970), Chopra (1975), Chopra and Kumar (1981), Tewari and Pant (1994), Nath et al. (2002), Lal (2005), Saxena and Gangwar (2005), Saxena et al. (2006), Nath et al. (2007), Aziz and Vohra (2008), Nath et al. (2008), Saxena and Arfeen (2009) Singh et al. (2010), Saxena et al. (2007; 2010), Alam et al. (2012) and Asthana and Sahu (2013). To fill this gap an attempt has been made and in present study, Munsiyari has been explored extensively to find out the current status of mosses. Many moss specimens both terrestrial as well as corticolous have been collected from the locality.

The enumeration is based on the recent collection trips to the region as well as the previously available data about the western Himalayas. The significant survey and collections of mosses were made with the purpose to provide the complete moss flora of Munsiyari and enumerated here for the first time.

2. Materials and Methods

This study is initially based on recent collection trip to Munsiyari (Pithoragarh) which was made during the month of June and November, 2012. Several epiphytic and terrestrial populations of mosses were collected. Simple methodology was used for collection of plant specimens from the field. The collected specimens were first dried at room temperature then on blotting paper and placed vigilantly in simple brown paper envelopes. All the crucial field data were noted down including locality, date of collection, altitude etc. Various relevant literatures were consulted for identification work. The collected bryophytes were identified carefully and deposited to Banasthali Vidyapith Herbarium (BVH), Banasthali University, Rajasthan. The families are arranged according to the classification provided by Buck and Goffinet (2000) followed by genera and species

Enumeration of mosses

(A) ORDER POLYTRICHALES M. FLEISCH
I. Polytrichaceae Schwägr. in Willd., Sp. P. ed. 4. 5(2): 1. 1830. T: *Polytrichum* Hedw.
i. *Atrichum* Card.
1. *Atrichum undulatum* (Hedw.) P. Beauv.
Ecology: They form loose cushions and are very frequent in all kind of forests, especially on loamy soils.
Distribution in India**:** Western Himalayas and Eastern Himalayas.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2110 m; 24.6.2012, leg. *A. Alam et al.*, *786284* (BVH), det. A. Alam
ii. *Pogonatum* P. Beauv.
2. *Pogonatum aloides* (Hedw.) P. Beauv.
Ecology: This species is found on soil and rocks. Usually in dry exposed or partially shaded places such as road banks. This is a pioneer species on moist exposed soil, road-cuts, and tip-up mounds.
Distribution in India**:** Western Himalayas, Eastern Himalayas and South India.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2000 m; 24.6.2012, leg. *A. Alam et al.*, *786273* (BVH), det. A. Alam
(B) ORDER ENCALYPTALES DIXON
II. Encalyptaceae Schimp. Coroll. Bryol. Eur. 38. 1855-1856. T: *Encalypta* Hedw.
iii. *Encalypta* Hedw.
3. *Encalypta vulgaris* Hedw.
Ecology: This species is a calciphile found on shaded ledges.
Distribution in India**:** Western Himalayas
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2120 m; 24.6.2012, leg. *A. Alam et al.*, *786288* (BVH), det. A. Alam
(C) ORDER FUNARIALES M. FLEISCH**.**
III. Funariaceae Schwägr. in Willd., Sp. Pl. ed. 4. 5(2): 43. 1830. T: *Funaria* Hedw.
iv. *Funaria* Hedw.
4. *Funaria hygrometrica* Hedw.
Ecology: A weed, common on wet soil, frequent on burned over sites, lawns (Bapna, 1975).
Distribution in India**:** Western Himalayas, Eastern Himalayas, Western Himalayas, Central India, Gangetic Plains and South India.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2150 m; 24.6.2012, leg. *A. Alam et al.*, *786272* (BVH), det. A. Alam
v. *Physcomitrium* (Brid.) Brid.
5. *Physcomitrium pulchellum* (Griff.) Mitt.

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Ecology: This species is a cosmopolitan weed growing on disturbed ground in dry open areas and sometimes on old roofs.
Distribution in India**:** Western Himalayas, Eastern Himalayas and Gangetic Plains.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2100 m; 24.6.2012, leg. *A. Alam et al.*, *786272* (BVH), det. A. Alam

6. *Physcomitrium cyathicarpum* Mitt.

Ecology: This species is most often found on sandy soil in dry open woods, frequently on disturbed soil, tip-up mounds, tree bases and along trails (Chaudhary and Sharma, 2002).
Distribution in India**:** Western Himalayas, Eastern Himalayas, Central India, Gangetic plains, Rajasthan and South India.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2050 m; 24.6.2012, leg. *A. Alam et al.*, 786279 (BVH), det. A. Alam

(D) ORDER-GRIMMIALES M. FLEISCH

IV. Grimmiaceae Arn., Disp. Meth. Mousses 19. 1825. T: *Grimmia* Hedw.
vi. *Grimmia* Hedw.

7. *Grimmia ovalis* (Hedw.) Lindb.

Ecology: It is an acid loving species found on disturbed, moist soils in coniferous forests generally on road banks, along trails and often on tip-up mounds.
Distribution in India**:** Western Himalayas, Eastern Himalayas and South India.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2070 m; 24.6.2012, leg. *A. Alam et al.*, 786276 (BVH), det. A. Alam

(E) ORDER DICRANALES H. PHILIB. *ex* M. FLEISCH.

V. Fissidentaceae Schimp. Coroll. Bryol. Eur. 20. 1855-1856. T: *Fissidens* Hedw.
vii. *Fissidens* Hedw.

8. *Fissidens bryoides* Hedw.

Ecology: This genus is common on calcareous soils, or soil over rock, but may also be found on the base of trees.
Distribution in India**:** Western Himalayas, Eastern Himalayas, Gangetic plains and South India.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2150 m; 23.6.2012, leg. *A. Alam et al.*, *786241* (BVH), det. A. Alam

9. *Fissidens taxifolius* Hedw.

Ecology: This genus is common on calcareous soils, or soil over rock, but may also be found on the base of trees.
Distribution in India**:** Western Himalayas, Eastern Himalayas, Gangetic plains, Andaman and South India.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2100 m; 24.6.2012, leg. *A. Alam et al.*, *786279* (BVH), det. A. Alam

VI. Dicranaceae Schimp. Coroll. Bryol. Eur. 11. 1855-1856. T: *Dicranum* Hedw.
viii. *Campylopus* Brid.

10. *Campylopus gracilis* (Mitt.) Jaeg.

Ecology: This species prefers bare, disturbed, calcium-free soils, often sandy soil frequently found on road banks.
Distribution in India**:** Western Himalayas, Eastern Himalayas and South India.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 1900 m; 23.6.2012, leg. *A. Alam et al.*, *786132* (BVH), det. A. Alam

VII. Rhabdoweisiaceae Limpr. in Rabenh. Kryptogamen Fl., ed. 2. 4: 271. 1886. T: *Rhabdoweisia* B. S. G.
ix. *Amphidium* Schimp.

11. *Amphidium lapponicum* (Hedw.) Schimp.

Ecology: This species commonly grows on soil or humus, but it can also be found growing on rock, at the base of trees and on rotten wood. It can be found in dry and open woodlands and also in dense moist forests.
Distribution in India: Western Himalayas
Specimen examined: INDIA, Western Himalayas: Uttarakhand- Pithoragarh: Munsiyari; alt. ca. 1950 m; 23.6.2012, leg. *A. Alam et al.*, *786249* (BVH), det. A. Alam

(F) ORDER POTTIALES M. Fleisch.

VIII. Family- Pottiaceae Schimp., Coroll. Bryol. Eur. 24. 1855 (1856). T: *Pottia* (Reichenb.) Furnr.

x. *Anoectangium* Schwägr.

12. *Anoectangium clarum* Mitt.
Ecology: Grows on basic rocks, stone walls or in crevices, common in alpine regions.
Distribution in India: Eastern Himalayas, Western. Himalayas (Nath et al., 2007)
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2100 m; 23.6.2012, leg. *A. Alam et al.*, *786266* (BVH), det. A. Alam

13. *Anoectangium walkeri* Broth.
Ecology: Grows on rocks or cliffs in dense population.
Distribution in India: Earlier only known from South India. Now this species is new addition to Western Himalayas as well as to Himalayas (Lal, 2005).
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2050 m; 20.11.2012, leg. *A. Alam et al.*, *786319* (BVH), det. A. Alam

xi. *Barbula* Hedw.

14. *Barbula funalis* Dixon *et* Badhw. (Please correct the format as I correct above from here)
Ecology: Grows on rocks, forest ground, or on soil walls.
Distribution in India: Western Himalayas.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari;alt. ca. 2100 m; 23.6.2012, leg. *A. Alam et al.*, *786312* (BVH), det. A. Alam

15. *Barbula obscura* Mitt.
Ecology: It can be found on soil, rotten wood, and soil and humus overlying rock.
Distribution in India: Western Himalayas.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2150 m; 23.6.2012, leg. *A. Alam et al.*, *786308* (BVH), det. A. Alam

xii. *Hydrogonium* (C. Müll.) Jaeg.

16. *Hydrogonium subpellucidum* (Mitt.) Hilp.
Ecology: On rocks or ground in shade.
Distribution in India: Western Himalayas and Eastern Himalayas
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2000 m; 20.11.2012, leg. *A. Alam et al.*, *786301* (BVH), det. A. Alam

xiii. *Hyophila* Brid.

17. *Hyophila involuta* (Hook.) Jaeg.
Ecology: Grows usually near water source or dripping water as terrestrial species (Chaudhary and Deora, 2001).
Distribution in India: Western Himalayas, Eastern Himalayas, Central India, Rajasthan, South India and Gangetic plains.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2000 m; 23.6.2012, leg. *A. Alam et al.*, *786257* (BVH), det. A. Alam

17. *Hyophila rosea* Williams
Ecology: Terrestrial, grows on wet and shady soil and rocks (Gangulee, 1969-80).
Distribution in India: Western Himalayas, Eastern Himalayas, Central India and Gangetic plains.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2100 m; 23.6.2012, leg. *A. Alam et al.*, *786299* (BVH), det. A. Alam

19. *Hyophila spathulata* (Harv.) Jarg.
Ecology: Terrestrial, grows in wet soil (Gangulee, 1969-80).
Distribution in India: Western Himalayas and Eastern Himalayas
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2150 m; 23.6.2012, leg. *A. Alam et al*., 786292-94 (BVH), det. A. Alam
xiv. *Molendoa* Lindb**.**
20. *Molendoa roylei* (Mitt.) Broth.
Ecology: Grows on wet on rocks and soil.
Distribution in India: Western Himalayas
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2000 m; 23.6.2012, leg. *A. Alam et al.*, *786241-42* (BVH), det. A. Alam
21. *Molendoa sendtneriana* (B.S.G.) Limpr.
Ecology: Terrestrial.
Distribution in India: Western Himalayas
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 1950 m; 23.6.2012, leg. *A. Alam et al.*, *786244* (BVH), det. A. Alam
(G) ORDER BRYALES LIMPR.
IX. Bartramiaceae Schwägr. *in* Willd., Sp. Pl. ed. 4. 5(2):90. 1830. T: *Bartramia* Hedw.
xv. *Philonotis* Brid.
22. *Philonotis falcata* (Hedw.) Brid.
Ecology: Grows on moist calcareous soil (Gangulee, 1969-80).
Distribution in India**:** Western Himalayas, Eastern Himalayas, Western Himalayas, Gangetic Plains and South India.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2000 m; 24.6.2012, leg. *A. Alam et al.*, *786277* (BVH), det. A. Alam
xvi. *Bartramia* Hedw.
23. *Bartramia subulata* B.S.G.
Ecology: It grows on humus or humic soils in moist forests and on decaying logs.
Distribution in India**:** Western Himalayas and Eastern Himalayas.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2000 m; 23.6.2012, leg. *A. Alam et al.*, *786257-58* (BVH), det. A. Alam
X. Bryaceae Schwaegr. *in* Willd., Sp. Pl. ed. 4. 5(2): 47 (1830). T: *Bryum* Hedw.
xvii. *Brachymenium* Schwägr.
24. *Brachymenium bryoides* Hook. ex Schwaegr.
Ecology: This species can be found growing on humus or humic soils in moist forests, often associated with the remains of highly decayed logs and stumps.
Distribution in India**:** Western Himalayas, Eastern Himalayas and South India.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2050 m; 24.6.2012, leg. *A. Alam et al.*, *786277-78* (BVH), det. A. Alam
xviii. *Bryum* Hedw.
25. *Bryum alpinum* Huds. ex With.
Ecology: It grows on bare disturbed soils, along roads and paths, and in the cracks of sidewalks. It loves nitrogen and is often found in sites where nitrogen readily accumulates.
Distribution in India**:** Western Himalayas, Eastern Himalayas and South India.
Specimen examined: Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2050 m; 23.6.2012, leg. *A. Alam et al.*, *786261* (BVH), det. A. Alam
26. *Bryum argenteum* Hedw.
Ecology: This species can be found growing on moist rotten logs and stumps, and is one of the few species of moss that grows on the bark of pines.

Distribution in India**:** Western Himalayas, Eastern Himalayas, Rajasthan, Central India and South India.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2100 m; 23.6.2012, leg. *A. Alam et al.*, *786258* (BVH), det. A. Alam
xix. *Pohlia* Hedw.
27. *Pohlia flexuosa* Hook.
Ecology: This species is common on soil, decaying logs, the tops of rotten stumps, old *Sphagnum* hummocks, and soil in rock crevices.
Distribution in India**:** Western Himalayas, Eastern Himalayas, Gangetic plains and South India.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2000 m; 24.6.2012, leg. *A. Alam et al.*, *786279* (BVH), det. A. Alam
xx. *Rhodobryum* (Schimp.) Limpr.
28. *Rhodobryum giganteum* (Schwaegr.) Par.
Ecology: This species is commonly found growing in the thin soil over calcareous rock, moist, shaded sites, most often mixed with several other species.
Distribution in India**:** Western Himalayas, Eastern Himalayas and South India.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2000 m; 23.6.2012, leg. *A. Alam et al.*, *786263* (BVH), det. A. Alam
(H) ORDER HYPNALES (M. FLEISCH.) W. R. BUCK & VITT
XI. Helodiaceae (M. Fleisch.) Ochyra.
xxi. *Actinothuidium* (Besch.) Broth.
29. *Actinothuidium hookeri* (Mitt.) Broth.
Ecology: Grows in moist and shady places on fallen logs, wet soil etc.
Distribution in India: Earlier only known from Eastern Himalayas. Now this species is new addition to Western Himalayas.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2050 m; 20.11.2012, leg. *A. Alam et al.*, *786318-19* (BVH), det. A. Alam
XII. Thuidiaceae Schimp., Syn. Musc. Eur. 493 (1860). T: *Thuidium* B. S. G.
xxii. *Thuidium* Bruch & Schimp.
30. *Thuidium cymbifolium* (Doz. *et* Molk.) Doz*. et* Molk.
Ecology: This species is found growing on xeric calcareous rock or soil.
Distribution in India**:** Western Himalayas, Eastern Himalayas, Central India and South India.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2000 m; 23.6.2012, leg. *A. Alam et al.*, *786253-57* (BVH), det. A. Alam
XIII. Brachytheciaceae Schimp., Syn. Musc. Eur., ed. 2 xcv sic (cxv), 637 (1876). T: *Brachythecium* B. S. G.
xxiii. *Brachythecium* Schimp.
31. *Brachythecium campestre* (C. Muell.) B.S.G.
Ecology: This species is found on shaded calcareous rock or soil.
Distribution in India**:** Western Himalayas.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2050 m; 23.6.2012, leg. *A. Alam et al.*, *786232-45* (BVH), det. A. Alam
xxiv. *Eurhynchium* Bruch & Schimp.
32. *Eurhynchium swratzii* (Tum.) Curn.
Ecology: Grows in moist condition on trunk bases.
Distribution in India**:** Earlier only known from Eastern Himalayas. Now this species is new addition to Western Himalayas.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2000 m; 24.6.2012, leg. *A. Alam et al.*, *786288* (BVH), det. A. Alam
xxv. *Rhynchostegium* Bruch
33. *Rhynchostegium vagans* (Harv.) Jaeg.

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Ecology: On weak basic soil, in turf, among rocks.
Distribution in India**:** Western Himalayas, Eastern Himalayas and South India.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2050 m; 24.6.2012, leg. *A. Alam et al.*, *786289* (BVH), det. A. Alam
XIV. Stereophyllaceae (Fleisch.) Buck & Ireland, Nova Hedwigia 41: 95 (1985) - Plagiotheciaceae subfam. Stereophylloideae Fleisch., Musci Fl. Buitenzorg 4: 1158 (1923), "Stereophylleae".
xxvi. *Stereophyllum* Mitt.
34. *Stereophyllum ligulatum* Jaeg.
Ecology: Grows on tree bark usually in shaded condition (Chaudhary and Sharma, 2002).
Distribution in India**:** Earlier only known from South and Central India. Now this species is reported as new addition to Western Himalayas.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2100 m; 23.6.2012, leg. *A. Alam et al.*, *786249* (BVH), det. A. Alam
35. *Stereophyllum wightii* (Mitt.) Jaeg.
Ecology: Grows on tree bark usually in shaded condition.
Distribution in India**:** Western Himalayas, Eastern Himalayas, Central India, Gangetic plains and South India.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2000 m; 24.6.2012, leg. *A. Alam et al.*, *786255* (BVH), det. A. Alam
XV. Meteoriaceae Kindb. Gen. Eur. Northamer. Bry. 7. 1897 T: *Meteorium* (Brid.) Doz. et Molk.
xxvii. *Diaphanodon* Renauld & Cardot
36. ***Diaphanodon blandus*** (Harv.) Renauld *et* Cardot
Ecology: Grows on logs, tree trunk and rocks in forests.
Distribution in India**:** Western Himalayas, Eastern Himalayas, South India and Gangetic plains.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2000 m; 23.6.2012, leg. *A. Alam et al.*, *786249-51* (BVH), det. A. Alam
XVI. Entodontaceae Kindb., Gen. Eur, Northamer, Bryin, 7 (1897). T: *Entodon* C. Muell.
xxviii. *Entodon* Müll. Hal.
37. *Entodon luteonitens* Renauld & Cardot
Ecology: In wet places, or mesophytic; occurring in basic habitats. On well drained basic soil, in turf, among rocks or scree, occasionally in chalk or limestone.
Distribution in India**:** Earlier only known from Eastern Himalayas. Now this species is new addition to Western Himalayas.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2050 m; 24.6.2012, leg. *A. Alam et al.*, *786271* (BVH), det. A. Alam
38. *Entodon pulchellus* (Griff.) Jaeg.
Ecology: On weak basic soil, in turf, among rocks, occasionally in chalk or limestone.
Distribution in India**:** Earlier only known from Eastern Himalayas. Now this species is new addition to Western Himalayas.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2100 m; 24.6.2012, leg. *A. Alam et al.*, *786269* (BVH), det. A. Alam
39. *Entodon subplicatus* Renauld & Cardot
Ecology: On well drained basic soil, in turf, among rocks, occasionally in chalk or limestone.
Distribution in India**:** Western Himalayas and Eastern Himalayas.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2100 m; 24.6.2012, leg. *A. Alam et al.*, *786273* (BVH), det. A. Alam
XVII. Family- Hypnaceae Schimp., Coroll. Bryol. Eur. 113. 1855 (1856). T: *Hypnum* Hedw.
xxix. *Hageniella* Broth

40. *Hageniella assamica* Dixon
Ecology: The habitat is as important in identifying this species as the morphology. It is most often found growing on stumps and logs in a high degree of decay (soft), or on peaty soils, and it can sometimes be found on moist sandstone associated with streams.
Distribution in India: Earlier only known from Eastern Himalayas. Now this species is new addition to Western Himalayas.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2000 m; 23.6.2012, leg. *A. Alam et al.*, *786237-38* (BVH), det. A. Alam
XVIII. Cryphaeaceae Schimp. Coroll. Bryol. Eur. 97. 1855-1856. T: *Cryphaea* Mohr in Web.
xxx. *Schoenobryum* Doz. *et* Molk.
41. *Schoenobryum concavifolium* (Griff.) Gangulee
Ecology: Usually terrestrial, grows on calcareous substrate.
Distribution in India**:** Western Himalayas, Eastern Himalayas and South India.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2000 m; 24.6.2012, leg. *A. Alam et al.*, 786272 (BVH), det. A. Alam
XIX. Leucodontaceae Schimp., Coroll. Bryol. Eur. 108. 1855 (1856). T: *Leucodon* Schwaegr.
xxxi. *Leucodon*Schägr.
42. ***Leucodon secundus*** (Harv. *in* Hook.) Mitt.
Ecology: Grows on logs, tree trunk and rocks in forests.
Distribution in India**:** Western Himalayas, Eastern Himalayas and South India.
Specimen examined: Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2100 m; 23.6.2012, leg. *A. Alam et al.*, *786248* (BVH), det. A. Alam
XX. Anomodontaceae Kindb. Gen. Eur. North Amer. Bryin. 6 (1867). Type: *Anomodon* Hook. & Taylor.
xxxii. *Anomodon* Hook. & Taylor
43. *Anomodon minor* (Hedw.) Fürnr.
Ecology: This species is most common on tree bases, but can also be found on shaded moist rock.
Distribution in India**:** Western Himalayas and Eastern Himalayas.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2000 m; 24.6.2012, leg. *A. Alam et al.*, *786256* (BVH), det. A. Alam
44. *Anomodon planatus* Mitt.
Ecology: This species is the most common member of the genus. It occurs on moist to dry limestone rocks in the sun or shade. It is also commonly found growing on the bases of trees in calcareous regions.
Distribution in India**:** Western Himalayas, Eastern Himalayas, Western Himalayas, Central India, Gangetic Plains and South India.
Specimen examined: INDIA, Western Himalayas: Uttarakhand-Pithoragarh: Munsiyari; alt. ca. 2100 m; 24.6.2012, leg. *A. Alam et al.*, *786268* (BVH), det. A. Alam

3. Result

The present study of Munsiyari tehsils of Pithoragarh revealed the occurrence of 44 species of mosses which are belonging to 8 orders; 20 families and 32 genera. The addition of 8 species of mosses on the basis of present study proofs the potential of this region of Himalayas in terms of bryodiversity specifically the mosses.

4. Discussion

The critical study of mosses of this region reveals that the most diversified order is Hypnales with 10 families, 12 genera and 16 species. While the most prominent family is Pottiaceae consisting of 5 genera with 10 species. Genera like *Entodon* and *Hyophila* are most diversified with three species each. These are followed by *Anoectangium*, *Anomodon*, *Barbula*, *Bryum*, *Molendoa* and *Physcomitrium* and which have 2 species each. The other genera are represented by single species. Orders Encalyptales and Grimmiales are represented by single species in the area (Fig. 2).

The distribution of mosses of Munsiyari is also very interesting, only 5% species are restricted to Western Himalayas, maximum (28%) species are common to Eastern Himalayas, 18% species are common to Eastern Himalayas and South India and 18% species are present in all bryogeographical regions of India. This shows great dispersal or similarity of western Himalayan species to other regions of India (Fig. 1).

However, this work is a foundation to assess the bryofloristic (mosses) wealth of the region and many more explorations are needed to these lesser known remote areas of this district in future to be acquainted with the current status of bryodiversity.

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6. Literature

ALAM, A., SHARMA, V., SHARMA, S. C. & TRIPATHI A. **(**2012). Bryoflora of Munsiyari and Dharchula Tehsil of Pithoragarh, Uttarakhand, Western Himalayas, India. Archive for Bryology 140: 1–11.

ASTHANA, V. & SAHU, V. (2013). Bryophyte Diversity in Mukteshwar (Uttarakhand): an overview. Archive for Bryology 154: 1-11.

AZIZ, M. N. & VOHRA, J. N. **(**2008). Pottiaceae (Musci) of India, Bishen Singh & Mahendra Pal Singh, Dehra Dun, India. pp. 366.

BAPNA, K. R. (1958). A note on hepatic flora of Mt. Abu. Current Science 27: 259–260.

BAPNA, K. R. **(**1975). On *Funaria* (*Entosthodon*) *nutans* (Mitt.) Broth. from Rajasthan and its distribution. Journal of Hattori Botanical Laboratory 54: 234–237.

BUCK, W. R. & GOFFINET, B. (2000). Morphology and classification of mosses. *In* A.J. Shaw & B. Goffinet (eds.), Bryophyte Biology. Cambridge University Press.: 71– [119].

CHAMPION, H. G. & SETH, A. K. **(**1968). A revised survey of the forest types of India. 1st Edn., Govt. of India Press, New Delhi, India, Pages: 404.

CHAUDHARY, B. L. & DEORA, G. S. (2001). The mosses of Mt. Abu (India). In: Nath, V. and A. K. Asthana (eds.), Perspectives in Indian Bryology, Bishen Singh Mahendra Pal Singh, Dehra Dun, India. pp. 87–125.

CHAUDHARY, B. L. & SHARMA, T. P. **(**2000). Epiphytic mosses of Udaipur, Rajasthan, India. Vasundhara 5: 85–89.

CHAUDHARY, B. L. & SHARMA, T. P. **(**2002). Occurrence of epiphytic *Stereophyllum* Mitt. On Girnar hill, Gujarat (India). Phytomorphology 52: 273-277.

CHOPRA, R. S. & KUMAR, S. S. (1981). Mosses of the western Himalaya. Annales

CHOPRA, R. S. (1975). Taxonomy of Indian Mosses. C.S.I.R. Publication, New Delhi, India. Cryptogamici et phytopathologici, vol 5. The Chronica Botanica Co. New Delhi, India.

DEORA, G. S. & CHAUDHARY, B. L. **(**1996). Occurrence of *Bryum* Hedw. in Rajasthan. Phytomorphology **46**: 299–304.

GANGULEE, H. C. (1969-1980). Mosses of Eastern India & Adajacent regions. Fascicles 1-8. Books and Allied Limited, Calcutta.

KASHYAP, S. R. (1929). Liverworts of the Western Himalaya and Panjab Plain Part 1. The

LAL, J. & PARIHAR, N.S. (1979). Contributions to the Bryoflora of Central Indian zone 1-Liverworts. J. Ind. bot. Soc. 58: 110–114.

LAL, J. **(**2005). A checklist of Indian Mosses, Bishen Singh Mahendra Pal Singh. Dehra Dun, India. pp. 1–164.

NATH, V., ASTHANA, A. K. & SAHU, V. (2007). *Fabronia secunda* Mont. – A New addition to

NATH, V., ASTHANA, A. K. & SAHU, V. **(**2008). Addition of three moss species to West Himalayan Bryoflora. Cryptogamie Bryologie 29(4): 387-392.

NATH, V., ASTHANA, A. K. &KAPOOR, R. (2007). Enumeration of the Mosses in Amarkantak (Madhya Pradesh), India – I. Taiwania 52(2): 168–176.

NATH, V., SHARMA, S. & ASTHANA, A.K. (2002). *Anastrophyllum jorgensenii* Schiffn. from western Himalayas. Geophytology 30 (1& 2): 111-112.
Pal Singh. Dehradun, India.

SAXENA, D. & ARFEEN, M. S. **(**2009). Taxonomy and distribution status of moss *Racomitrium crispulum* in Kumaon hill of Western Himalaya (India)". Iranian Journal of Botany 15 (2): 248–256.

SAXENA, D. & GANGWAR, R. **(**2005). Taxonomical study of *Dicranum scoparium* Hedw. from Kumaon hills. Geophytology 35 (1& 2). 61–64.

SAXENA, D., SINGH, S & SRIVASTAVA, K. **(**2006). Distribution of Some Mosses in Nainital, Almora and Pithoragarh District of Kumaon Region, India." Environment Conservation 7: (1–2): 83–87.

SAXENA, D., SINGH, S & SRIVASTAVA, K. **(**2007). Taxonomy of moss *Isopterygium elegans* (Brid.) Lindb., Not Sallsk. F. Fl Fenn. Forh., 1874 from Kumaon hills". Research Journal (Sci.), Panjab University Research Journal (Sci.). 57: 213–216.

SAXENA, D., SONYIA & SUARABH. (2010). First report of the moss *Rhynchostegiella divaricatifolia* (Renauld & Cardot) Broth. from Western Himalayan region of India, *Phtyospecies*, U.K **. 8**: 59–64.

SINGH, H., V. SAHU, HUSAIN T. & ASTHANA, A.K. **(**2010). *Macromitrium rigbyanum* Dixon. In: Bryological Notes: New national and regional bryophyte records, 24. Journal of Bryology 32: 232–241.

TEWARI, S. D. & PANT, G. (1994). Bryophytes of Kumaon Himalaya. Bishen Singh Mahendra University of Panjab, Lahore.

VOHRA, J. N. **(**1970). A contribution to the moss flora of Western Himalaya. II. Bulletin Botanical Survey of India. 12: 97–103.
western Himalayas. Indian Journal of Forestry 30(3): 353-354.

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Figure 1: Distribution of Mosses of Munsiyari in other Bryo-geographical regions of India
WH-Western Himalayas, E-Eastern Himalayas, C-Central India, G-Gangetic plains, S-South India, R-Rajasthan

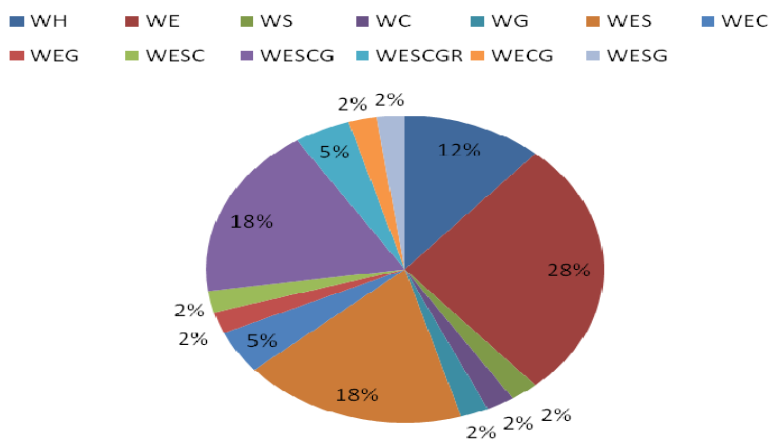

Figure 2: Distribution of Mosses in Munsiyari, Uttarakhand (W. H.)