

Species Composition of Bryophytes at Different Altitudinal Habitats in Langtang National Park, Bagmati Province, Nepal

Nirmala Pradhan*

Natural History Museum, Tribhuvan University, Kathmandu, Nepal

*Email: bryonep@yahoo.com

Abstract

The highland bryophytes of the Langtang National Park have not yet been published, despite the fact that it is an easily accessible high-altitude national park for study and research. This study carried out in different locations in and around this park in August 2010, September 2011 and October 2016, revealed a diversity of 80 species of this plant at various elevated habitats. This plant's diversity was observed high at 2800 to 3000 m of elevations. The lowest known altitude of this study began at 1500 meters in Syabrubesi and went up to 3900 meters in Kyangjn and 4380 meters at the Gosainkund Lake. Some areas like Kutumsng and Gul Bhanjyang (2100-2500 m), Tarkyghyang and Shermathan (2440-2460 m), Nosim Pati (3650 m), Parbati Kund (2600 m), Golphu Bhanjyang (2150 m) and Panch Pokhari (4000 m) were among the unexplored buffer zones that were also considered in this study.

Keywords: Buffer zone, Distribution, Documentation, Habitats, Unpopular

Introduction

Bryophytes, primitive and non-flowering land plants, occupy different habitat complexities within a varying altitudinal range from 62 m to 6500 m in the Himalayan regions of Nepal. To date, the country's record indicates the occurrence of 1318 species, including 11 species of hornworts, 541 species of liverworts (Pradhan & Shrestha, 2021) and 766 species of mosses (Pradhan, 2000), equaling 6.5% in global context (Magill, 2010; Soderstrom et al., 2016). The differing physical gradients at rising altitudes play a significant role in bringing about changes in the species composition and distribution pattern of this plant between 1500 and 4500 m above sea level in the Langtang National Park. These non-vascular plants are distributed in different elevated zones which prefer a shaded, damp, and mesic environment displaying rich diversity in wet months. The gametophyte stage of this plant is thalloid or leafy with rhizoids on the ventral surface of the thallus or clusters at the base or ventral surface of the stem, especially in pleurocarpous mosses. Their function comparatively matches the function of roots in vascular plants. The gametophyte stage has photosynthetic tissue which is long-lived and eventually follows the sporophytic phase. This phase has single terminal sporangium-bearing spores.

This tiny flora has a high dispersal capacity. The elaters in Marchantiophyta and peristome teeth in bryophyta have greater roles in the dehiscence of spores (Goffinet et al. 2008).

The high diversity of this plant has been recorded in the temperate region as it is a meeting zone for subtropical and subalpine specie (Pradhan & Shrestha, 2021). This plant's endemism has been found greater in mid-hills than other areas (Joshi & Joshi, 1991).

The appearance of the sporophytic stage of this plant varies with geographical regions, altitudes and seasons. At varying altitudinal habitats, humidity plays a significant role for the good growth of this plant. The good season for the diversity and spore growth of plants commences immediately after rainy days, showing well-developed features that are essentially important for identifying species properly. Epiphytic species are generally found in the shaded areas and northern parts of the mountain, while hygrophilous species with perfect morphological features can be noticed throughout the year (Goffinet et al., 2008).

Grau et al. (2007) compared the altitudinal species richness patterns of bryophytes with other plant groups in central Himalaya of Nepal and concluded

that different climatic variables such as available energy and water may be the main reason for the differences between the observed patterns for the four plant groups including bryophytes.

None of publications on bryophytes of the Langtang National Park is available yet. So the main objective of this study is based to carry out a survey of this plant's diversity and assess their local status in and out of this park which also includes its bufferzone areas. This work has been expected to assist in the management and develop conservation policy in this park.

Materials and Methods

Langtang National Park is located in central-northern part of the Kathmandu, at 28°10'26.2" N, 85°33'21.2" E. The distribution of flora in this park is diverse, with representations of *Alnus nepalensis*, *Prunus cerosoides*, *Xanthoxylum nepalensis*, *Quercus semicarpifolia*, *Rhododendron arboreum*, *Rhododendron barbetum*, *Rhododendron setosum*, and Gymnosperms like *Pinus roxburghii*, *Pinus wallichiana*, *Juniperus recurva*, *Abies spectabilis*,

Larix nepalensis and *Psuga dumosa*. This Park is well known for accommodating diverse medicinal herbs at its differing altitudinal ranges (Khanal, 2013).

A field study was made in August 2010, September 2011 and October 2016 at different altitudinal habitats ranging from 1500 m at Syabrubeshi to the maximum elevation to Gosainkund at 4380 m and Kyangjin at 3900 m of the Langtang National Park including some of its buffer zone areas (Figure 1). Of the total 300 specimens, only sporophyte-bearing specimens were selected for this study. These specimens after proper identification have been deposited at the Natural History Museum, Tribhuvan University.

Specimens were collected from different habitats like shaded marshy earth, exposed ground, boulder stones, mountain slopes, tree canopies and trunks of different floral species. A simple knife was used to collect sample specimens, and a hand lens of 5-40 X was also used for field identification. Families of Marchantiophyta and Bryophyta are given in alphabetical order in Appendix. The valid or accepted names in each family are also arranged alphabetically. Pradhan & Shrestha (2022), Brummitt & Powell (1992) and TROPICOS (www.tropicos.org) were consulted for author's citation in each name. Soderstrom et al., (2016) and Goffinet et al., (2008) have been considered for classification.

Relevant literatures and books such as Gangulee (1969-1980), Chopra (1975), Eddy (1988, 1990, 1996), Furuki & Higuchi (1995), Higuchi & Takaki (1990), Smith (1996), Yang (2009, 2011), Pradhan (2000, 2013), Pradhan & Shrestha (2021, 2022) were also consulted for identification besides consulting reference specimens at the Natural History Museum, Kathmandu.

Shannon-Wiener Diversity Index (H) was used to measure the rarity and commonness of species in this study (Poole, 1974). This diversity index is based on assumption that all species are represented in a sample which was calculated using the following equation:

$$H = - \sum p_i \ln (p_i)$$

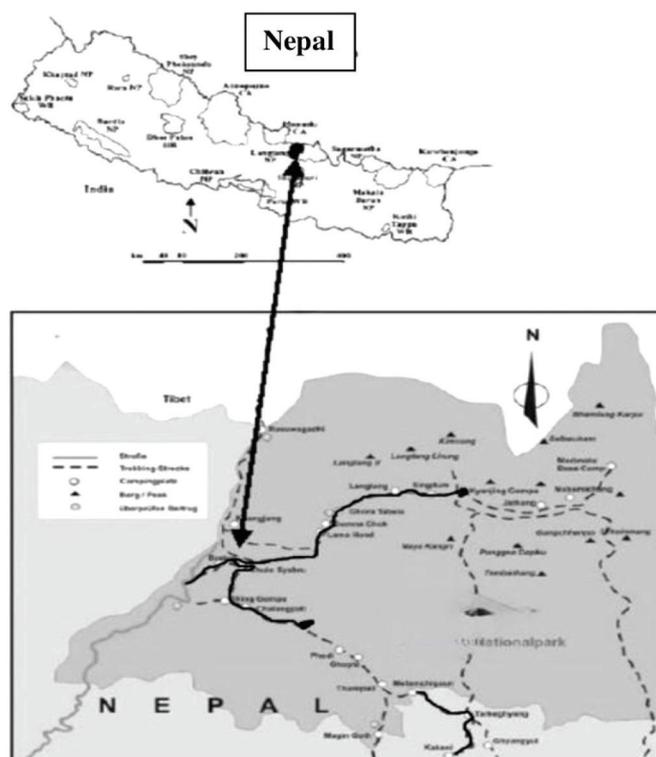


Figure 1: Study area map: Black lines indicate study routes

Here,

p_i = the proportion of total number of species made up of the species

n = number of individuals of species

N = a total number of individuals and \ln is the natural log

Richness (S): Total number of species in the community

Evenness (E): $E = H / \ln(S)$

Results and Discussion

The total species of bryophytes recorded in the Langtang National Park and its buffer zones represented 59 genera and 80 species categorized into 40 families. Records of 27 species of liverworts (Marchantiophyta) and 53 species of mosses (Bryophyta) have been made in total (Appendix). Of this record, 16 species were rare, 33 species as fairly common, and 29 species were assessed common in local status. A rare and endemic leafy liverwort, *Gymnomitrium papillosum* of the family Gymnomitriaceae was recorded at the highest elevation of 4400-4500 m (Pradhan & Shrestha, 2021), which also shared its lower habitat at 2000 m in Dhunche (2000 m).

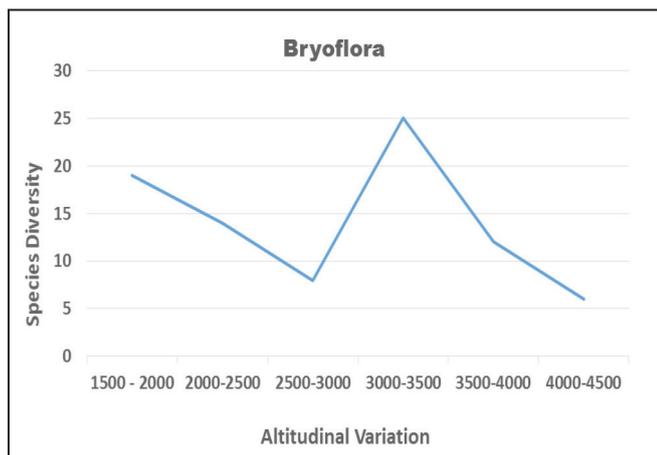


Figure 2: Altitudinal diversity of bryophytes at Langtang National Park

Moderate diversity of bryophyte (0.546) has been revealed by the Diversity Index (H) and species are almost to equal proportion to each other and evenly distributed (0.787).

Table 1: Diversity Index and Evenness of bryophytes

Marchantiophyta	Bryophyta	H	E
27	53	0.546	0.787

Note: H = Diversity Index; E = Evenness

The influence of different biophysical factors like low temperature, less humid condition, lack of canopy trees and unfavorable habitats cause its species decline above 3000 m to 4400 m of elevation. The elevated habitats between 1500 m to 3000 m displayed optimum altitudinal gradients like warm and humid condition, sufficient rain, optimum humidity with favorable habitat condition and canopy provided rich diversity of this plant. A humped, unimodal relationship between species richness and altitude was observed for both liverworts and mosses, with maximum richness at 2800 m and 2500 m respectively. Endemic liverworts have their maximum richness at 3300 m, whereas non-endemic liverworts show their maximum richness at 2700 m. The proportion of endemic species is highest at about 4250 m (Grau et al, 2007).

Conclusion

The subtropical climate at 1500-2000 m accommodated diverse bryophyte species where warm and humid conditions prevailed, besides the presence of suitable canopy trees like *Alnus nepalensis*, *Schima wallichii*, *Lyonia ovalifolia* etc. Bryophyte species sheltered in this forest included *Syrrhopodon gardneri*, *Riccardia planiflora*, *Cephaloziella massalongi* and *Marchantia emarginata*. The upper temperate zone, which lies between 2000 and 3000 m, was noticed by the presence of flora like *Rhododendron arboreum*, *Rhododendron anthopogan*, *Quercus semicarpifolia*, and *Juniperus recurva*. Bryoflora species found in this forest included *Reboulia hemispherica*, *Riccardia multifida*, *Dumortiera hirsutsa* and *Bazzania sikkimensis*. The cold climate above 3000 m to 4000 m accommodated *Juniperus recurva*, *Rhododendron barbetum*, *R. campanulatum*, *Psuga dumosa* and *Betula utilis* whereas bryoflora species like *Frullania dilatata*, *Plagiochasma pterospermum*, *Herbertus aduncus*, *Jungermannia appressifolia* and

Bazzania imbricata were observed at this elevation. A decrease in floral diversity was noticed followed with the rise in elevation above 4000 m, where limited floral species like *Rhododendron setosum* and *R. lepidatum* were present along with shrubs like *Meconopsis paniculata* and *Caragana* spp. This elevation accommodated a few bryophyte species like, *Plagiochasma pterospermum*, *Gymnomitrium papillosum*, *Jungermannia appressifolia*, *Bryum apiculatum*, *Microcampylopus khasianus* and *Thuidium cambifolium*.

This study also noticed significant bryophyte habitats being impacted due to physical construction, especially around Dhunche (2000 m), Langtang village (2900 m) and Kyangjin areas (3400 m). The next side, or the route to Gosainkund, is receiving still more impact than the Langtang side. Thousands of pilgrims visit Gosainkund every year including high flow of trekkers to this part. The buffer zones considered in this study, like Kutumsang-Gul Bhanjyang (2100-2400 m) are also receiving habitat impacts with anthropogenic causes. The next buffer zones considered in this study were Panch Pokhari and Helambu areas of Sindhupalchok district. A rare species, *Bryum dichotomum* was recorded at 4000 m in the Panch Pokhari area. Similarly, *Dumortiera hirsutisa*, a rare bryophyte was also recorded at Tarkyghyang, Helambu (2500 m), which is most common in subtropical region at 1500-1800 m of elevation. Many of the species observed in the Langtang National Park also shared their habitats in the buffer zones like Golphu Bhanjyang-Kutumsang (2100 m), Tarkyghyang (2400 m) in Helambu and the Panchpokhari area (3700-4000 m).

The distribution of this plant was found to be less diverse above 3500 m, revealed that altitudinal gradients such as temperature, humidity, canopy and habitat structure are important gradients in determining the diversity and distribution of bryophytes in the changing habitats of the mountains.

Author Contributions

The author has done extensive study of bryophytes of the Langtang National Park and its buffer zone

mostly, Panch Pokhari, Helambu and nearby areas. This article is based on study conducted in different years.

Acknowledgments

Rufford Small Grant Foundation is highly acknowledged for the support to this work. I am thankful to Professor Dr. Bhaiya Khanal for providing me some specimens of bryophytes of the Langtang to add to my list. I would also like to thank Mr. Damodar Pradhan, Associate Professor and Mr. Puran Kurmi, senior botanist for bryofloral specimens which were brought from the Rasuwa district including Langtang areas. I would like to thank the Chief of Natural History Museum for the access to consult some of the reference specimens deposited here.

References

- Brummitt, R. K., & Powell, C.E. (1992). *Authors of plant names*. Royal Botanic Garden, Kew.
- Chopra, R. S. (1975). *Taxonomy of Indian mosses: an introduction*. Council of Scientific & Industrial Research.
- Eddy, A. (1988). *A handbook of Malesian mosses* (Vol. 1). The Natural History Museum (BM).
- Eddy, A. (1990). *A handbook of Malesian mosses* (Vol. 2). The Natural History Museum.
- Eddy, A. (1996). *A handbook of Malesian mosses* (Vol. 3). The Natural History Museum (BM).
- Furuki, T., & Higuchi, M. (1995). Hepatics from Nepal collected by the Botanical Expedition of the National Science Museum, Tokyo in 1988. 2. Metzgeriales and Marchantiales. In M. Watanabe, & H. Hagiwara (Eds.), *Cryptogams of the Himalayas Nepal and Pakistan*. (Vol.3) (pp. 143-149). National Science Museum.
- Gangulee, H. C. (1969-1980). *Mosses of eastern India and adjacent region Fas.1-7*.
- Goffinet, B., Buck, W. R., & Shaw, J. (2008). *Morphology and Classification of Bryophyta*.

- In B. Goffinet, & A. J. Shaw (Eds.). *Bryophyte Biology* (pp. 55-138). Cambridge University Press.
- Grau, O., Grysten, J., A., & Birks, H. J. B. (2007). A comparison of altitudinal species richness patterns of bryophytes with other plants groups in Nepal, central Himalaya. *Journ. Biogeography* 34, 1907-1915.
- Higuchi, M., & Takaki, N. (1990). Mosses of Nepal collected by Botanical expedition of National Science Museum, Tokyo. In M. Watanabe, & M. Malla (Eds.), *Cryptogams of the Himalaya* (Vol. 2) (pp. 121-161). National Science Museum.
- Joshi, A. R., & Joshi, D. P. (1991). Endemic plants of Nepal Himalaya: Conservation status and future direction. *Journ. of Mountain Environment and Development, EMA Gr.*, 1(2),1-32.
- Khanal, B. (2013). *Study on changes in butterfly fauna at different altitudinal levels in central Nepal*. (Unpublished doctoral dissertation), Mizoram University, India.
- Magill, R. E. (2010). Moss diversity: new look at old number. *Phytotaxa*, 9, 167-174.
- Poole, R. W. (1974). *An introduction to quantitative ecology*. McGraw-Hill.
- Pradhan, N. (2000). *Materials for a checklist of bryophytes of Nepal*. The Natural History Museum (BM).
- Pradhan, N. (2013). Diversity and status of bryophytes in Panch Pokhari region of Northern Sindhupalchok district of central Nepal. *Journal of Natural History Museum*, 27, 45-58.
- Pradhan, N., & Shrestha, P. (2021). *A handbook of the bryophytes of Nepal* (Vol. 1). National Herbarium and Plant Laboratories.
- Pradhan, N., & Shrestha, P. (2022). *A handbook of the bryophytes of Nepal* (Vol. 2). National Herbarium and Plant Laboratories.
- Smith, A. J. E. (1996). *The liverworts of Britain and Ireland*. Cambridge University Press.
- Sodertrom, L., Hagborg, A., Konrat, M., Bartholomew-Began, S., Bell, D., Briscoe, L., Brown, E., Cargell, D.C., Costa, D.P., Crandall-Stotler, B.J., Cooper, E.D., Dauphin. G., Engel, J.J., Feldberg, K., Glenney, D., Gradstein, S.R., He, X., Heimrichs, J., Hentschel, J., Ilkin-Borges, A.L., Katagiri, T., Konstantinova, N.A., Larrain, J., Long, D.G., Nebel, M., Pocs, T., Puche, F., Reiner-Drchwald, E., Renner, A.M., Sass-Gyarmati, A., Schafer-Verwimp, A., Moragues, J.G.S., Stotler, R.E., Sukkharak, P., Thiers, B.M., Uribe, J., Vaca, J., & Villareal, J.C. (2016). World checklist of hornworts and liverworts. *Phytokeys*, 59, 1-828.
- Yang, J. D. (2009). *Liverworts and hornworts of Taiwan* (Vol. 1). Endemic species Research Institute, NANTOU.
- Yang, J. D. (2011). *Liverworts and hornworts of Taiwan* (Vol. 2). Endemic species Research Institute, NANTOU.

Appendix: Altitudinal distribution of bryophytes in Langtang National Park (LNP)

S.N.	Division	Family	Scientific name	Locality	Elevation (m)	Habitats	Local status
1	Marchantiophyta	Aytoniaceae	<i>Asterella wallichiana</i> (Lehm. & Lindenb.) Grolle	Dhunche	2000	Soil	FC
2		Lophoziaceae	<i>Bazzania imbricata</i> (Mitt.) S. Hatt.	Dhunche-Shin Gompa, Goshin Kund	2800-3000 4200	Tree trunk, Soil	FC
3		Lophoziaceae	<i>Bazzania sikkimensis</i> (Steph.) Herzog	Kutumsang-Gul Bhanjyang	2100-2400	Bark	FC
4		Cephaloziellaceae	<i>Cephaloziella massalongi</i> (Spruce.) Muell. Frib.	Dhunche	2000	Soil	R
5		Conocephalaceae	<i>Conocephalum conicum</i> (L.) Dumort.	Tarkeghyang, Chetre,	2460; 3000	Mountain slope	FC
6		Cyathodiaceae	<i>Cyathodium tuberosum</i> Kashyap	Dhunche;	2000	Stone wall	FC
7		Dumortieraceae	<i>Dumortiera hirsutsa</i> (Sw.) Nees	Tarkeghyang	2400	Mountain slope	R
8		Frullaniaceae	<i>Frullania dilatata</i> (L.) Dumort.	Chandanbari	3100	Forest Flore	R
9		Gymnomitriaceae	<i>Gymnomitrium papillosum</i> N. Kitag. & S. Hatt.	Goshain Kund- , Laurebina Pass	4400-4500	Rock	R, EN (Joshi & Joshi, 1991)
10		Herbertaceae	<i>Herbertus aduncus</i> (Dicks.) Gray	Laurebina Pass	3550	Rocky cliffs, tree trunk	R
11		Jungermanniaceae	<i>Jungermannia appressifolia</i> Mitt.	Tharepati Pass	3500	Soil	R
12		Jungermanniaceae	<i>Jungermannia subrubra</i> Steph.	Top Kharka,	3550	Forest flore	C
13		Marchantiaceae	<i>Marchantia emarginata</i> Reinw., Blume & Nees	Thulo Syabru	2200	Soil	C
14		Marchantiaceae	<i>Marchantia paleacea</i> Bertol.	Dhunche	2000	Soil	C
15		Metzgeriaceae	<i>Metzgeria leptoneura</i> Spruce	Laurebina- Ghoda Tabela	3100	Mountain slope	R
16		Pallaviciniaceae	<i>Pallavicinia lyellii</i> (Hook.) Carruth	Dhunche	2000	Humus soil	R
17		Pelliaceae	<i>Pellia epiphylla</i> (L.) Corda.	Kutumsang-Gul Bhanjyang	2100-2500	Rock	R
18		Aytoniaceae	<i>Plagiochasma pterospermum</i> C. Massal	Paire; Langtang bridge	3500	Soil	FC
19		Plagiochilaceae	<i>Plagiochila cuspidata</i> Steph.	Chitre, Nosim,	3100 3800	Tree bark, rock	FC
20		Plagiochilaceae	<i>Plagiochila sciophila</i> Nees ex Lindenb.	Above Syabru	3500	Tree bark	FC
21		Aytoniaceae	<i>Reboulia hemispherica</i> (L.) Raddi	Chetre,	3000	Rock, soil	FC
22		Aneuraceae	<i>Riccardia multifida</i> (L.) Gray	Par Dhungo	2850	Soil	FC
23		Aneuraceae	<i>Riccardia planiflora</i> (Steph.) S. Hatt.	Dhunche	2000	Decaying log	R
24		Scapaniaceae	<i>Scapania ciliata</i> Sande Lac.	Tarkeghyang	2400	Tree bark	R
25		Scapaniaceae	<i>Scapania uliginosa</i> (Lindenb.) Dumort.	Above Dhimsa	3200	Rock	FC
26		Targioniaceae	<i>Targionia hypophylla</i> L.	Dhunche; Langtang bridge	2000 2100	Rock	FC
27		Trichocoleaceae	<i>Trichocolea tomentella</i> (Ehrh.) Dumort.	Tarkeghyang-Sharmathang	2440 2460	Soil	FC
28		Bryophyta	Thuidaceae	<i>Actinothuidium hookeri</i> (Mitt.) Broth.	Dhunche-Goshin Kund; Laurebina Pass	2000-3600; 3650	Soil, Bark

S.N.	Division	Family	Scientific name	Locality	Elevation (m)	Habitats	Local status
29		Bryaceae	<i>Anomobryum auritum</i> (Mitt.) A. Jaeger	Daurali- Laurebina	2000	Soil	C
30		Bryaceae	<i>Anomobryum julaceum</i> (Schrad ex G. Gaertn., B.Mey & Scherb.) Schimp.	Daurali	2000	Soil	C
31		Polytrichaceae	<i>Atrichum undulatum</i> (Hedw.) P. Beauv.	Chholangpati	2000-2500	Soil	FC
32		Pottiaceae	<i>Barbula constricta</i> Mitt.	Kyangin	3400	Soil	C
33		Pottiaceae	<i>Barbula cylindrica</i> Wilson	Above Chtre	3050	Soil	FC
34		Bartramiaceae	<i>Bartramia pomiformis</i> Hedw.	Dhimsa	3200	Soil	FC
35		Bryaceae	<i>Brachytenium exile</i> (Dozy & Molk.) Bouch & Sande Lac.	Dhunche	2000	Exposed rock	FC
36		Brachytheciaceae	<i>Brachythecium buchananii</i> (Hook.) A. Jaeger	Dhunche, Kutumsang	2000; 2100	Soil	C
37		Pottiaceae	<i>Bryoerythrophyllum recurvirostrum</i> (Hedw.) P.C. Chen	Shermathang	2450	Rock	C
38		Bryaceae	<i>Bryum apiculatum</i> Schwaegr.	Langtang-Ghora Tabela	3300-4000	Soil	C
39		Bryaceae	<i>Bryum argenteum</i> Hedw.	Dhunche, Goshin Kund	2000; 4300	Soil, Rock	C
40		Bryaceae	<i>Bryum dichotomum</i> Hedw.	Panch Pokhari	4000	Exposed rock	R
41		Bryaceae	<i>Bryum paradoxum</i> Schwaegr.	Dhunche, Tharepati-Kutumsang, Shim Gompa	2000; 3300-3500	Soil	C
42		Leucobryaceae	<i>Campylopus latinervis</i> (Mitt.) A. Jaeger	Thulo Syabru	2250	Soil	FC
43		Leucobryaceae	<i>Campylopus schwarzii</i> Schimp.	Ghopte Goshin Kund	3500-3600 4350	Rock, Soil	FC
44		Leucobryaceae	<i>Campylopus umbellatus</i> (Arn.) Paris	Dhunche	2000	Soil	FC
45		Brachytheciaceae	<i>Cirriphyllum cameratum</i> (Mitt.) Broth	Daurali	2000	Mountain slope	FC
46		Dicranaceae	<i>Dicranum himalayanum</i> Mitt.	Par Dhungo, Gosain Kund; Tharepati Pass	2800; 3600; 3500	Rock, soil	FC
47		Hypnaceae	<i>Ectropothecium sikkimense</i> (Renauld & Cardot) Renauld & Cardot	Dhunche	2000	Bark	R
48		Entodontaceae	<i>Entodon prorrepens</i> (Mitt.) A. Jaeger	Dhunche	2000	Soil	FC
49		Entodontaceae	<i>Entodon pylaisioides</i> R.L.Hu. & Y.F. Wang.	Langtang Village	2900	Soil	C
50		Fissidentaceae	<i>Fissidens ceylonensis</i> Dozy & Molk.	Dhunche	2000	Soil	C
51		Fissidentaceae	<i>Fissidens taxifolius</i> Hedw.	Syabru	2200	Soil covered rock	FC
52		Sematophyllaceae	<i>Foreauella orthothecia</i> (Schwaegr.) Dixon & P. de la. Varde	Kyangin,	3400	Soil, tree trunk	FC
53		Funariaceae	<i>Funaria hygrometrica</i> Hedw.	Dhunche; Langtang Village	2000; 3500	Soil	C
54		Grimmiaceae	<i>Grimmia affinis</i> Hornch.	Kyangin,	3400	Rock	C
55		Grimmiaceae	<i>Grimmia ovalis</i> (Hedw.) Lindb.	Langtang Village, Kyangin	3500; 3900	Rock	FC

S.N.	Division	Family	Scientific name	Locality	Elevation (m)	Habitats	Local status
56		Thuidaceae	<i>Herpetineuron toccoeae</i> (Sull. & Lesq.) Cardot	Ghoda Tabela	3200	Bark	FC
57		Pottiaceae	<i>Hyophila involuta</i> (Hook.) A. Jaeger	Thulo Syabru	2250	Soil	C
58		Hypnaceae	<i>Hypnum cupressiforme</i> Hedw.	Ghoda Tabela	3200	Soil	FC
59		Leskeaceae	<i>Lescuraea incurvata</i> (Hedw.) E. Lawton	Kyangin	3400	Bark	FC
60		Orthotrichaceae	<i>Macromitrium nepalense</i> (Hook. & Grev.) Schwaegr.	Chipa	1500-1850	Bark	FC
61		Dicranaceae	<i>Microcampylopus khasianus</i> (Griffiths) Giese & J.-P. Frahm.	Laurebina Pass	4000-4200	Soil	C
62		Mniaceae	<i>Mnium punctatum</i> Hedw.	Nosim Pati	3750	Root bark	R
63		Bartramiaceae	<i>Philonotis fontana</i> (Hedw.) Brid.	Chandanbari	3200	Soil	C
64		Bartramiaceae	<i>Philonotis thwaitesii</i> Mitt.	Dhunchu	2000	Mountain slope	C
65		Plagiotheciaceae	<i>Plagiothecium neckeroideum</i> Schimp.	Ghoda Tabela, Laurebina Pass, Chholangpati	2350; 3600; 2500	Soil, tree trunk	C
66		Polytrichaceae	<i>Pogonatum microstomum</i> (Schwaegr.) Brid.	Ghoda Tabela; Above Langtang Village	3200, 3500	Soil	C
67		Polytrichaceae	<i>Pogonatum perichaetiale</i> (Mitt.) A. Jaeger	Above Langtang Village	3500	Soil	FC
68		Bryaceae	<i>Pohlia elongata</i> Hedw.	Dhunchu; Thulo Syabru	2000; 2250	Bark	FC
69		Pottiaceae	<i>Pseudosymblepharis subduriuscula</i> (Mull. Hal.) P.C. Chen	Syabrubesi, Chandanbari	2200, 3100	Rock, soil and Forest flore	C
70		Grimmiaceae	<i>Racomitrium himalayanum</i> (Mitt.) A. Jaeger	Kyangin,	3400	Soil	R
71		Bryaceae	<i>Rhodobryum giganteum</i> (Schwaegr.) Paris	Nosim Pati	3650	Soil	C
72		Sphagnaceae	<i>Sphagnum cuspidatulum</i> Mull. Hal.	Chitre, Ghopte - Tharepati Pass	3000, 3500	Wet rock	R
73		Sphagnaceae	<i>Sphagnum palustre</i> L.	Parbati Kund	2600	Semi aquatic	FC
74		Dicranaceae	<i>Symblepharis reinwardtii</i> (Dozy & Molk.) Mitt.	Laurebina Pass,	3500-4000	Tree bark, Soil	C
75		Calymperaceae	<i>Syrrhopodon gardneri</i> (Hook.) Schwaegr.	Dhunchu	2000	Decaying log	FC
76		Thuidaceae	<i>Thuidium cambifolium</i> (Dozy & Molk.) Dozy & Molk.	Langtang Valley, Shim Gompa, Laurebina	2500; 3500; 4200	Bark	C
77		Thuidaceae	<i>Thuidium glaucinum</i> (Mitt.) Bosch & Sande Lac.	Galphu Bhanjyang; Chandanbari	2150; 3200	Bark	C
78		Thuidaceae	<i>Thuidium tamariscellum</i> (Mull. Hal.) Busch & Sande Lac.	Syabru Besi	2200	Bark	C
79		Trachypodaceae	<i>Trachypodopsis serrulata</i> (P. Beauv.) M. Fleisch.	Golphu Bhanjyang	2150	Bark	FC
80		Bruchiaceae	<i>Trematodon longicollis</i> Michx.	Lama Hotel	2600	Soil	R

Note: C = Common; EN = Endemic; FC = Fairly Common; LNP = Langtang National Park; R = Rare