

# Enumeration of liverworts and mosses of Valley of Flowers, Garhwal Hills, Uttarakhand, India

Virendra Nath, A. K. Asthana and Vinay Sahu

National Botanical Research Institute, Rana Pratap Marg, Lucknow-226001, India

E-mail: drvirendranath2001@rediffmail.com; drakasthana@rediffmail.com;  
sahuvinay28@rediffmail.com

## ABSTRACT

Nath V., Asthana A. K. & Sahu V. 2010. Enumeration of liverworts and mosses of Valley of Flowers, Garhwal Hills, Uttarakhand, India. *Geophytology* 39(1-2): 49-63.

An enumeration of 80 taxa of bryophytes of Valley of Flowers, Garhwal Hills, Uttarakhand, India, has been made. It includes an account of 49 species of mosses belonging to 18 families and 30 species of liverworts belonging to 14 families. During the study, 6 liverworts, viz. *Heteroscyphus hyalinus* (St.) Srivast. & Srivast., *Pseudolepicolia trolli* (Herz.) Grolle & Ando, *Scapania ferruginea* (Lehm. & Lindb.) Gott., Lindb. & Nees, *Lepidozia stahlia* Steph., *Anastrophyllum donnianum* (Hook.) Steph., and *Jungermannia pseudocyclops* Inoue and three mosses, viz. *Brotherella curvirostris* (Schwaegr.) Fleisch., *Trachycladiella sparsa* (Mitt.) Menzel and *Trachyphyllum inflexum* (Harv.) Gepp. are newly added to the west Himalayan region in general and Valley of Flowers in particular.

**Key-words:** Liverworts, mosses, distribution, ecology, Valley of Flowers.

## INTRODUCTION

The diversity of Indian bryoflora needs a serious attention so that bryophytic wealth of the country may be assessed in its real form. It will help in forming the conservation strategies and utilization of plant resources for human welfare and biological studies. Among the Indian biogeographical regions, western Himalaya possesses the plants inhabiting comparatively dry and cold climatic conditions. Various workers from time to time made attempt to document the bryophytes of this area. The monumental work of Kashyap (1929) on the liverworts marked the beginning in this direction. Some years later Chopra (1975) provided an account of Indian mosses. Subsequently, Chopra and Kumar (1981), Vohra (1983), Tewari and Pant (1994) provided consolidated account on bryophytes of western Himalaya. However, Valley of Flowers did not receive much attention from bryological point of view. Valley of Flowers is the most important and favourite spot of botanists due to its rich and diverse vegetation. It is situated in upper expansions of Bryundar Ganga in the far interior of Garhwal Hills, between altitude range of 3250m to 6750m above the mean sea level.

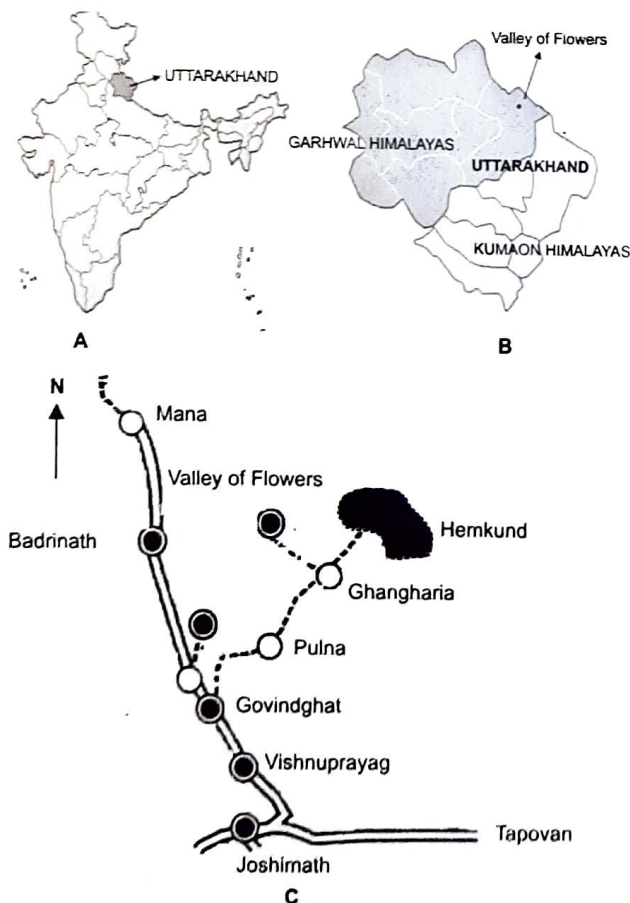
Puspavati River flows through the Valley and there are many water falls enhancing the beauty of the Valley. The Valley was declared National Park in 1982. Valley of Flowers is renowned for its meadows of endemic alpine flowers and outstanding beauty, about 300 species of the wild flowers bloom here in natural way. The maximum temperature is 17°C and minimum temperature is 7°C in the area. The study suggested that a little attention has been paid to the bryophytes of Valley of Flowers as compared to flowering plants. However, some scattered references are available on the liverworts of this area, viz. Srivastava (1986) and Kumar (1987) described new *Apometzgeria* and *Cephalozia*, respectively from Valley of Flowers. Sharma and Srivastava (1993) described five species of Lepidoziineae, *Lepidozia reptans* (L.) Dumort., *Bazzania imbricata* (Mitt.) Hatt., *B. praerupta* (Reinw., Bl. & Nees) Trev., *Metacalypogeia alternifolia* (Nees) Grolle, and *Calypogeia azurea* Stotler & Crotz., Srivastava and Srivastava (2001) provided an account of three species of family Geocalycaceae: *Lophocolea minor* Nees., *L. himalayensis*, and *Geocalyx graveolens* (Schrad.)



Nees., while Rawat and Srivastava (2007) described four species of *Plagiochila* i.e. *P. semidecurrans* (Lehm. & Lindenb.) Lindenb., *P. sciophila* Nees ex Lindenb., *P. retusa* Mitt. and *P. nepalensis* Lindenb. Besides this some contributions (Nath et al. 2002, 2007, 2008; Sharma et al. 2002, Srivastava 2008) are also available on liverworts *Anastrophyllum*, *Jungermannia* and mosses, viz. *Fabronia*, *Entodon* and *Hypnum*. An enumeration of bryophytes of Valley of Flowers is provided with ecology and distribution, range in India and abroad along with details of specimens examined. Classifications of Vitt (1984) for mosses and Schuster (1984) for liverworts have been followed.

## MATERIAL

The plants were collected from Govindghat, Ghangaria, on way to Hemkund and Valley of Flowers. The specimens have been deposited in the Bryophyte Herbarium, National Botanical Research Institute, Lucknow (LWG) (Text-figure 1).



Text-figure 1. A. Map of India showing Uttarakhand State. B. Map of Uttarakhand showing Valley of Flowers. C. Route Map showing localities of bryophyte collection in Valley of Flowers.

## ENUMERATION

### Bryopsida (Mosses)

#### Family: Polytrichaceae

1. *Oligotrichum semilamellatum* (Hook. F.) Mitt. in Musci Ind. Or.: 150 (1859).

**Ecology and distribution:** On soil, on way to Hemkund, 3343-3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Sikkim, Khasi Hills), western Himalaya (Kumaon); Bhutan, Nepal, Sumatra, Yunnan, Indonesia.

**Specimens examined:** India, on way to Hemkund, 20.10.1964, leg. S. Chandra; 200851 F, 200868 D, 200893 A, 200900 B, 200914 B (LWG).

2. *Pogonatum urnigerum* (Hedw.) P. Beauv. in Prodr. 84, (1805).

**Ecology and distribution:** On soil, on way to Ghangaria, 3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling), western Himalaya (Himachal Pradesh, Khadrila, Dalhousie, Lahul); Nepal, Eastern China, Siberia, Kamchakta, Japan, Persia, Caucasus, Europe, North and South America, West Indies, New Guinea, New Zealand, Africa, Pakistan, Tasmania, Antarctica.

**Specimens examined:** India, on way to Ghangaria, 18.10.1964, leg. S. Chandra; 200663 B, 200665, 200681, 200683 B, 200693, 200698 E, 200729 (LWG); Valley of Flowers, 20.10.1964, leg. S. Chandra; 200729, 200732 B, 200734, 200741, 200748, 200783, 200784, 200797, 200808 C, 200817 C, 200822 (LWG); on way to Hemkund, 20.10.1964, leg. S. Chandra; 200852 B, 200859, 200861C, 200864 D, 200876, 200877 B, 200879 D, 200898 B (LWG).

3. *Pogonatum perichaetiale* (Mont.) Jaeg. in Ber. S. Gall. Naturw. Gos, 1873-74: 257 (1875).

**Ecology and distribution:** On soil, on way to Hemkund, 3343m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Sikkim), western Himalaya (Mussoorie, Chakrata, Nainital, Himachal Pradesh, Khadrila, Dalhousie, Lahul, Beas Valley, Kulu, Mandi), South India (Nilgiris); Bhutan, Nepal, China.



**Specimen examined:** India, on way to Hemkund, 20.10.1964, leg. S. Chandra; 200897 B (LWG).

**Family:** Bryaceae

4. *Anomobryum filiforme* ssp. *concinatum* (Spruc.) Amann in Rev. Bryol. 20: 43 (1893).

**Ecology and distribution:** On soil, on way to Ghangaria, 3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling), western Himalaya (Nainital, Almora, Ranikhet, Mussoorie, Simla); Bhutan, Nepal, Ceylon, Tonkin, China, Taiwan, Japan, Korea, Siberia, Riukiu Island, Europe, North America, Mexico.

**Specimens examined:** India, on way to Ghangaria, 18.10.1964, leg. S. Chandra; 200683 A, 200697 B (LWG); Valley of Flowers, 20.10.1964, leg. S. Chandra; 200729 D (LWG); on way to Hemkund, 20.10.1964, leg. S. Chandra; 200852 E (LWG).

5. *Brachymenium bryoides* (Hook.) ex Schwaegr. in Sp. Musci. Suppl. 2(1): 13 (1824).

**Ecology and distribution:** On soil, Govindghat, Valley of Flowers, 1823-3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Khasi Hills), western Himalaya (Almora, Simla), South India (Nilgiri); Nepal.

**Specimens examined:** India, Govindghat, 18.10.1964, leg. S. Chandra; 200656 B (LWG); India, Valley of Flowers, 20.10.1964, leg. S. Chandra; 200744 A, 200880 B (LWG).

6. *Bryum argenteum* Hedw. in Sp. Musci: 181 (1801).

**Ecology and distribution:** On soil, Govindghat, Valley of Flowers, 1823-3510m.

**Range of distribution:** Eastern Himalaya (Sikkim, Darjeeling, Arunachal Pradesh, Khasi Hills), western Himalaya (Nainital, Kausani, Pithoragarh, Kashmir), Central India (Rajasthan: Mount Abu), South India (W. Ghats, Nilgiri, Palni, Orissa); Nepal, Ceylon, Vietnam, Europe, Korea, Siberia, China, Japan, Philippines, Java, Africa, North, Central and South America, Hawaii, Australia, New Zealand.

**Specimens examined:** India, Govindghat, 18.10.1964, leg. S. Chandra; 200643 A (LWG); Valley

of Flowers, 20.10.1964, leg. S. Chandra; 200819 A, 200822 B, 200836 A (LWG).

7. *Bryum atrovirens* (Brid.) in Musci. Rec., 2(3): 48 (1803).

**Ecology and distribution:** On soil, on way to Hemkund, 3343m.

**Range of distribution:** Eastern Himalaya (Sikkim, Darjeeling, Assam), western Himalaya (Mussoorie); Japan, Taiwan, Siberia, Caucasus, North and South Africa, Central Europe, Britain, North and South America.

**Specimens examined:** on way to Hemkund, 20.10.1964, leg. S. Chandra; 200893 C (LWG).

8. *Bryum capillare* L. Hedw. in Sp. Musc.: 182 (1801).

**Ecology and distribution:** On soil, Govindghat, 1823m.

**Range of distribution:** Eastern Himalaya (Sikkim, Darjeeling), western Himalaya (Rishikesh, Tehri, Kashmir), South India (Nilgiri), central India (Amarkantak, Rajasthan: Mount Abu); Nepal, Bhutan, Western Tibet, China, Thailand, North Vietnam, Taiwan, Korea, Japan, Siberia, Central Asia, Caucasus, Europe, North and Central Africa, North and South America, Australia, New Zealand, Hawaii.

**Specimen examined:** India, Govindghat, 18.10.1964, leg. S. Chandra; 200649 B (LWG).

9. *Bryum uliginosum* (Brid.) B.S.G. in Bryol. Eur, 4: 88 (1839).

**Ecology and distribution:** Epiphytic as well as on soil, Valley of Flowers, on way to Hemkund, 3343-3510m.

**Range of distribution:** Eastern Himalaya (Sikkim), western Himalaya (Kashmir); Manchuria, Korea, Europe, North and South America.

**Specimens examined:** India, Valley of Flowers, 20.10.1964, leg. S. Chandra; 200812 (LWG); on way to Hemkund, 20.10.1964, leg. S. Chandra; 200921 B (LWG).

10. *Pohlia minor* ssp. *acuminata* (Hoop. & Hornsch.) Wijk & Marg. in Taxon, 8: 74 (1959); *Pohlia acuminata* Hopp. & Hornsch. in Flora, 2: 94 (1819).



**Ecology and distribution:** On soil, on way to Ghangaria, Valley of Flowers, on way to Hemkund, 3343-3510m.

**Range of distribution:** Eastern Himalaya (Sikkim, Darjeeling), western Himalaya (Mussoorie); Japan, Nepal, Bhutan, Europe, North America.

**Specimens examined:** India, on way to Ghangaria, 18.10.1964, leg. S. Chandra; 200669 F, 200670 A, 200695 B, 200697 D, 200703 D, 200717 A (LWG); Valley of Flowers, 20.10.1964, leg. S. Chandra; 200727 A, 200783 B, 200808 B, 200814 A, 200818 A, 200829 C (LWG); on way to Hemkund, 20.10.1964, leg. S. Chandra; 200851 A, 200842 E (LWG).

#### Family: Mniaceae

11. *Mnium lycopodioides* Schwaegr., Spec. Musc. Suppl. 2(2): 24. 160 (1826). *Mnium laevinerve* Card. in Bull. Soc. Bot. Geneve. Ser. 2, 1:128 (1909).

**Ecology and distribution:** On soil, on way to Hemkund, 3343m.

**Range of distribution:** Eastern Himalaya (Sikkim, Darjeeling, Arunachal Pradesh), western Himalaya (Garhwal); Bhutan, Nepal, Taiwan, Korea, Japan, China.

**Specimen examined:** on way to Hemkund, 20.10.1964, leg. S. Chandra; 200913 B (LWG).

12. *Mnium marginatum* (With.) P. Beauv. in Prodr. : 75 (1805).

**Ecology and distribution:** On soil, Valley of Flowers, 3510m.

**Range of distribution:** Eastern Himalaya (Sikkim, Darjeeling, Khasi Hills), western Himalaya (Mussoorie, Garhwal, Chitra); China, Japan, Siberia, Nepal, Canada, Br. Columbia, Mexico, Central and North Europe.

**Specimen examined:** India, Valley of Flowers, 20.10.1964, leg. S. Chandra; 200755 A (LWG).

13. *Mnium thomsonii* Schimp. in Syn. ed. 2: 485 (1876).

**Ecology and distribution:** On soil, Valley of Flowers, on way to Hemkund, 3510m.

**Range of distribution:** Eastern Himalaya (Sikkim, Darjeeling, Arunachal Pradesh), western Himalaya (Simla); Nepal, Bhutan, Burma, W. Tibet, Central Asia, China, Sakhalin, Korea, Japan, Central and North Europe, North America.

**Specimens examined:** India, Valley of Flowers, 20.10.1964, leg. S. Chandra; 200823 A, 200832 B, 200837 C, 200839 A (LWG), on way to Hemkund, 20.10.1964, leg. S. Chandra; 200866 E (LWG).

14. *Orthomnium bryoides* (Griff.) Norkett. in Trans. Brit. Bryol. Soc. 3: 445 (1958).

**Ecology and distribution:** On soil, on way to Ghangaria, 3510m.

**Range of distribution:** Eastern Himalaya (Sikkim, Darjeeling, Arunachal Pradesh, Assam, Khasi Hills), western Himalaya (Garhwal); Bhutan, Nepal, Burma, Thailand, China, Laos, Philippines.

**Specimens examined:** India, on way to Ghangaria, 18.10.1964, leg. S. Chandra; 200669 C, 200693 C, 200697 C, 200708 C (LWG).

15. *Plagiomnium cuspidatum* T. Kop. Ann. Bot. Fenn. 5: 146 (1968).

**Synonym:** *Mnium cuspidatum* Hedw. in Sp. Musc.: 192 (1801).

**Ecology and distribution:** On soil, Govindghat, Valley of Flowers, 1823-3510m.

**Range of distribution:** Western Himalaya (Kumaon, Mussoorie, Tehri, Simla, Kashmir); China, Japan, Central Asia (Tronshaikal), Manchuria, Ussuri, Amur, Kamchatka, Korea, Caucasus, Europe, North America, North Africa.

**Specimens examined:** India, Govindghat, 18.10.1964, leg. S. Chandra; 200643 C, 200644 A, 200647 B, 200650 C, 200659 A (LWG); Valley of Flowers, 20.10.1964, leg. S. Chandra; 200764 C (LWG).

16. *Plagiomnium integrum* T. Kop. Hikobia 6: 57 (1972).

**Synonym:** *Mnium integrum* Bosch & Lac. Bryol. Jav. 1: 153 (1861).

**Ecology and distribution:** On soil, Govindghat, Valley of Flowers, 1823-3510m.



**Range of distribution:** Eastern Himalaya (Sikkim, Darjeeling), western Himalaya (Nag Tibba); East Nepal, Burma, Thailand, Sumatra, Java, North Borneo, Philippines, Taiwan, China, Korea, Japan, Europe.

**Specimens examined:** India, Govindghat, 18.10.1964, leg. S. Chandra; 200652 D, 200653 B, 200655 B (LWG); Valley of Flowers, 20.10.1964, leg. S. Chandra; 200722 A (LWG).

**Family: Bartramiaceae**

**17. *Bartramia ithyphylla*** Brid. in Musci. Rec., 2 (3): 132 (1803).

**Ecology and distribution:** Epiphytic as well as on soil, on way to Ghangaria, Valley of Flowers, 3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling), western Himalaya (Kashmir); Nepal, Bhutan, China, Siberia, Taiwan, Japan, Kamchatka, Europe, North America, South America, Mexico, North Africa.

**Specimens examined:** India, on way to Ghangaria, 18.10.1964, leg. S. Chandra; 200668 A, 200669 B, 200683 C, 200692 A, 200693 D, 200707, 200711 A (LWG); Valley of Flowers, 20.10.1964, leg. S. Chandra; 200735 A (LWG).

**18. *Bartramia subpellucida*** Mitt. in Musci Ind. Or.: 59 (1859).

**Ecology and distribution:** On soil, on way to Ghangaria, Valley of Flowers, 3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling), western Himalaya (Garhwal, Kumaon, Mussoorie); Nepal.

**Specimens examined:** India, on way to Ghangaria, 18.10.1964, leg. S. Chandra; 200713 A, 200719 A, 200775 A (LWG); Valley of Flowers, 20.10.1964, leg. S. Chandra; 200783 B, 200808 A, 200809 A, 200824 A, 200829 B, 200872A (LWG).

**19. *Philonotis thwaitesii*** Mitt. in Ind. Or.: 60 (1859).

**Ecology and distribution:** On soil, Govindghat, 1823m.

**Range of distribution:** Eastern Himalaya (Sikkim), western Himalaya (Simla), South India (Palni Hills, Orissa); Nepal, Taiwan, China, Korea, Japan,

Hongkong, Ceylon, Sumatra, Borneo, New Guinea.

**Specimens examined:** India, on way to Ghangaria, 18.10.1964, leg. S. Chandra; 200650 B, 200652 A (LWG).

**Family: Thuidiaceae**

**20. *Thuidium assimile*** (Mitt.) Jaeg. in Ber. S. Gall. Naturw. Ges. 1876-77: 260 (1878).

**Ecology and distribution:** Epiphytic as well as on soil, on way to Ghangaria, Valley of Flowers, 3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling), western Himalaya (Garhwal, Kumaon, Himachal Pradesh); Yunnan.

**Specimens examined:** India, on way to Ghangaria, 18.10.1964, leg. S. Chandra; 200682 B, 200698 A (LWG); Valley of Flowers, 20.10.1964, leg. S. Chandra; 200724 A, 200746 A, 200777 A, 200831 C (LWG).

**21. *Thuidium cymbifolium*** (Doz. & Molk) Doz. & Molk. in Bryol. Jav, 2: 115 (1865).

**Ecology and distribution:** On soil, Govindghat, 1823m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Sikkim, Arunachal Pradesh, Khasi Hills, Assam, Manipur, Naga Hills), western Himalaya (Chakrata, Dhanolti), South Indian Hills, Nicobar Islands; Nepal, Bhutan, Ceylon, Burma, Thailand, Vietnam, Malaya, Taiwan, China, Korea, Sumatra, Java, New Guinea, Philippines, Australia, Oceania.

**Specimen examined:** India, Govindghat, 18.10.1964, leg. S. Chandra; 200655C (LWG).

**22. *Thuidium haplohymenium*** (Harv.) Jaeg. in Ber. S. Gall. Naturw. Ges. 1876-77: 251 (1878).

**Ecology and distribution:** Epiphytic, on way to Ghangaria, 3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Sikkim), western Himalaya (Garhwal, Kumaon); Nepal, Bhutan, Yunnan.

**Specimen examined:** India, on way to Ghangaria, 18.10.1964, leg. S. Chandra; 200701 B (LWG).

**23. *Trachyphyllum inflexum*** (Harv.) Gepp. in Hiern: Cat. Weln. Afr. Pl. 2, 21: 299 (1901).



**Ecology and distribution:** Epiphytic, Valley of Flowers, 3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Sikkim, Khasi Hills), Central India (Madhya Pradesh: Amarkantak), Orissa, South India (Palni Hills, Kanara); Nepal, Bangladesh, Burma, Thailand, Cambodia, Java, Moluccas, Central Vietnam, China, Australia, Philippines, New Caledonia, Madagascar.

**Specimens examined:** India, Valley of Flowers, 20.10.1964, leg. S. Chandra; 200756 A, 200769 B (LWG).

**Family: Amblystegiaceae**

**24. *Campylium lacerulum*** (Mitt.) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3):1042 (1908); Chopra, Tax. Ind. Mosses: 532 (1975).

**Ecology and distribution:** On soil, Valley of Flowers, 3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Arunachal Pradesh), western Himalaya (Kumaon).

**Specimens examined:** India, Valley of Flowers, 20.10.1964, leg. S. Chandra; 200751 C, 200753 A, 200762 D, 200766 C, 200767 A, 200776 B, 200780 A, 200784 E, 200795 A, 200798 B, 200825 A, 200826 A, 200829 A, 200835 B (LWG).

**25. *Campylophyllum halleri*** (Hedw.) Fleisch. Nov. Guinea 12 Bot. 2: 123 (1914).

**Synonym:** *Campylium halleri* (Hedw.) Lindb. in Musci Scand.: 38 (1879).

**Ecology and distribution:** On soil, on way to Ghangaria, 3343m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Sikkim), western Himalaya (Kumaon); Nepal, China, Caucasus, Europe, New Foundland, Labrador, Br. Columbia, Northern Rockies.

**Specimens examined:** India, on way to Ghangaria, 18.10.1964, leg. S. Chandra; 200673 A, 200675 B (LWG).

**26. *Sarnia uncinata*** (Hedw.) Loeske, Hedwigia 46: 309 (1907).

**Synonym:** *Drepanocladus uncinatus* (Hedw.) Warnst. in Beih. Bot. Centralbl 13: 417 (1903).

**Ecology and distribution:** On soil, on way to Hemkund, 3343m.

**Range of distribution:** Eastern Himalaya (Sikkim), western Himalaya (Garhwal, Jammu & Kashmir, Kangra, Lahul), Punjab and West Rajasthan; Nepal, China, Japan, North and Central Asia, North and South America, Greenland, Europe, Mountains of Central Africa, Australia, New Zealand, Kerguelen Island, Pakistan.

**Specimens examined:** India, on way to Hemkund, 20.10.1964, leg. S. Chandra; 200843 A, 200845 D, 200851 B, 200852 B, 200868 C, 200870 B, 200872 B, 200873 A, 200879 F, 200892 A, 200895 A, 200899 E, 200900 D, 200905 A, 200908 B, 200910 D, 200912 C, 200913 D, 200917 F, 200920 B (LWG).

**Family: Brachytheciaceae**

**27. *Brachythecium buchananii*** (Hook.) Jaeg. in Ber. S. Gall. Naturw. Gess. 1876-1877: 341(1878).

**Ecology and distribution:** Epiphytic, Valley of Flowers, 3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Khasi Hills, Naga Hills), western Himalaya (Mussoorie, Garhwal, Himachal Pradesh, Hazara), South India (Nilgiri); Nepal, Burma, Thailand, Vietnam, Laos, Philippines, China, Korea, Japan.

**Specimen examined:** India, Valley of Flowers, 20.10.1964, leg. S. Chandra; 200832 A (LWG).

**28. *Brachythecium garhwalense*** Vohra in Bull. Bot. Surv. Ind. 22: 120 (1980).

**Ecology and distribution:** Epiphytic as well as on soil, Valley of Flowers, 3510m.

**Range of distribution:** Western Himalaya (Jaunsar Bahar, Deoban).

**Specimens examined:** India, Valley of Flowers, 20.10.1964, leg. S. Chandra; 200734 C, 200736 A, 200738 A, 200761 B, 200821 A (LWG).

**29. *Brachythecium procumbens*** (Mitt.) Jaeg. Ber. S. Gall. Naturw. Gess. 1876-1877: 341(1878); Takaki in Journ. Hattori Bot. Lab. 5: 12 (1955).



**Ecology and distribution:** Epiphytic, Valley of Flowers, 3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Meghalaya), western Himalaya (Tehri-Garhwal, Jammu & Kashmir), South India (Nilgiri, Palni Hills); Nepal, Korea, Japan, Sri Lanka.

**Specimens examined:** India, Valley of Flowers, 20.10.1964, leg. S. Chandra; 200792 A (LWG).

**Family: Hypnaceae**

**30. *Bryosedgwickia aurea*** (Schwaegr.) Fleisch. in Hedwigia, 63: 211 (1922).

**Ecology and distribution:** On soil, Valley of Flowers, on way to Hemkund, 3343-3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Sikkim, Khasi Hills), western Himalaya (Dharamsala, Ranikhet), central India (Amarkantak); Nepal, Bhutan.

**Specimens examined:** India, Valley of Flowers, 20.10.1964, leg. S. Chandra; 200784 C, 200801 A (LWG); India, on way to Hemkund, 20.10.1964, leg. S. Chandra; 200841 B (LWG).

**31. *Hypnum cupressiforme* ssp. *imponens*** (Hedw.) Boul. in Musci in. France, 1: 34 (1884). *Hypnum imponens* Hedw. in Sp. Musc.: 290 (1801).

**Ecology and distribution:** Epiphytic, on way to Ghangaria and on way to Hemkund, 3343-3510m.

**Range of distribution:** Eastern Himalaya (Khasi Hills, Sikkim), western Himalaya (Kashmir), South India (Palni, Chennai); Central Asia, Caucasus, Siberia, China, Japan, Europe, Africa, Canada, U.S.A., America, Australia, New Zealand.

**Specimens examined:** India, on way to Ghangaria, 18.10.1964, leg. S. Chandra; 200686 A (LWG); India, on way to Hemkund, 20.10.1964, leg. S. Chandra; 200902 A (LWG).

**32. *Taxiphyllum taxirameum*** (Mitt.) Fleisch. in Musci Fl. Buitenz., 4: 1435 (1923).

**Ecology and distribution:** On soil, Govindghat, 1823m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Assam, Khasi Hills, Arunachal Pradesh), western Himalaya (Mussoorie, Nainital, Ranikhet,

Almora, Simla), South India (Palni Hills, Orissa); Bangladesh, Bhutan, Nepal, Burma, Coorg, Ceylon, N. Vietnam, Sumatra, Java, New Guinea, Philippines, Taiwan, Yunnan, Korea, Japan, Siberia, Oceania, Australia.

**Specimens examined:** India, Govindghat, 18.10.1964, leg. S. Chandra; 200649 A, 200657 A, 200660 D (LWG).

**Family: Entodontaceae**

**33. *Entodon luteonitens*** Ren. & Card. in Bull. Soc. R. Bot. Belg., 38 (1): 34 (1900)

**Ecology and distribution:** on Soil, Govindghat, on way to Ghangaria, 1823-3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling), western Himalaya (Binsar, Pithoragarh).

**Specimens examined:** India, Govindghat, 18.10.1964, leg. S. Chandra; 200651 A, 200653 A (LWG); on way to Ghangaria, 18.10.1964, leg. S. Chandra; 200708 D (LWG).

**Family: Sematophyllaceae**

**34. *Brotherella curvirostris*** (Schwaegr.) Fleisch. in Nov. Guinea. 12 (2): 120 (1914).

**Ecology and distribution:** On soil, on way to Ghangaria, on way to Hemkund, 3343-3510m.

**Range of distribution:** Eastern Himalaya (Sikkim, Khasi Hills); Nepal, Bhutan

**Specimens examined:** India, on way to Ghangaria, 18.10.1964, leg. S. Chandra; 200669 A (LWG); on way to Hemkund, 20.10.1964, leg. S. Chandra; 200844 (LWG).

**Family: Leskeaceae**

**35. *Anomodon rugelii*** (C. Muell.) Keissl. in Ann. Naturh. Hofm. Wien. 15: 214 (1900).

**Ecology and distribution:** On soil, on way to Ghangaria, Valley of Flowers and on way to Hemkund, 3343-3510m.

**Range of distribution:** Eastern Himalaya (Sikkim), western Himalaya (Garhwal); Nepal, Tonkin, Korea, Japan, Caucasus, Siberia, Europe, N. America.

**Specimens examined:** India, on way to Ghangaria, 18.10.1964, leg. S. Chandra; 200701 A (LWG); Valley of Flowers, 20.10.1964, leg. S.



Chandra; 200747 A, 200748 B, 200750 C, 200758 A, 200759 B, 200777 B, 200780 D, 200781 A, 200786 A, 200791 C, 200792 B, 200797 B, 200800 B, 200815 A, 200821 B, 200826 B, 200828 A (LWG); on way to Hemkund, 20.10.1964, leg. S. Chandra; 200842 A, 200866 D, 200894 G, 200899 A (LWG).

**36. *Leptoterigynandrum subintegrum*** (Mitt.) Broth. in Engl. & Prantl, Nat. Pflanzenfam. ed. 2 (11): 309 (1925).

**Ecology and distribution:** On soil, Valley of Flowers, 3510m.

**Range of distribution:** Western Himalaya (Simla); Nepal.

**Specimens examined:** India, Valley of Flowers, 20.10.1964, leg. S. Chandra; 200742 B, 200745 A, 200748 C, 200820 A (LWG).

**37. *Leskeella incrassata*** (Broth.) Broth. in Engl. & Prantl, Nat. Pflanzenfam. 1(3): 996 (1907); *Leskea incrassata* Lindb. ex Broth. in Ac. Soc. Sc. Fenn. 19 (12): 96 (1892).

**Ecology and distribution:** Epiphytic, Valley of Flowers, 3510m.

**Range of distribution:** Kashmir, Europe, Caucasus.

**Specimens examined:** India, Valley of Flowers, 20.10.1964, leg. S. Chandra; 200728 A, 200752 A, 200760 B, 200762 B, 200773 A, 200779 A, 200810 A, 200812 A, 200816 A, 200830 A, 200834 A (LWG).

#### Family: Fabroniaceae

**38. *Fabronia secunda*** Mont. in Ann. Sc. Nat. Bot. Ser. 2. 17: 251 (1842).

*Fabronia assamica* Dix. in Journ. Bombay Nat. Hist. Soc. 39:787. Syn. nov.

**Ecology and distribution:** On soil, Govindghat, 1823m.

**Range of distribution:** Eastern Himalaya (Meghalaya, Manipur), western Himalaya (Govindghat), South India (Nilgiri, Palni Hills); Srilanka, Nepal.

**Specimens examined:** India, Govindghat, 18.10.1964, leg. S. Chandra; 200642, 200645, 200658 (LWG).

#### Family: Leucodontaceae

**39. *Leucodon secundus*** (Harv.) Mitt. in Musci India Or.: 124 (1859).

**Ecology and distribution:** Epiphytic as well as on soil, Valley of Flowers, 3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Sikkim, Arunachal Pradesh), western Himalaya (Almora, Mussoorie, Deoban, Simla, Dalhousie to Khajiar), South India (Mahabaleshwar); Nepal, China, Yunnan, North Vietnam, Western Tibet, Japan.

**Specimens examined:** India, Valley of Flowers, 20.10.1964, leg. S. Chandra; 200728 A, 200731 A, 200739 A, 200760 A, 200762 A, 200769 A, 200781 C, 200796 A, 200812 B, 200841 A (LWG).

#### Family - Meteoriaceae

**40. *Trachycladiella sparsa*** (Mitt.) Menzel in Menzel & Schutze-Motel (1994).

*Floribundaria chloronema* (C. Muell.) Broth. in Nat. Pfl., 1(3): 822 (1906).

**Ecology and distribution:** Epiphytic, Valley of Flowers, 3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling), South India (Palni Hills); Bhutan, E. Nepal.

**Specimens examined:** India, Valley of Flowers, 20.10.1964, leg. S. Chandra; 200804 A (LWG).

#### Family - Pottiaceae

**41. *Anoetangium thomsonii*** Mitt., J. Linn Soc. Bot. Suppl., 1: 31 (1859).

**Synonym:** *Anoetangium bicolor* Ren. & Card. in Bull. Soc. R. Bot. Belg, 41(1): 19 (1905).

**Ecology and distribution:** Epiphytic as well as on soil, Valley of Flowers, 3343-3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling), western Himalaya.

**Specimens examined:** India, Valley of Flowers, 20.10.1964, leg. S. Chandra; 200774 A, 200788, 200790 B (LWG); on way to Hemkund, 20.10.1964, leg. S. Chandra; 200846 A (LWG).

**42. *Bryoerythrophyllum wallichii*** (Mitt.) Chen. in Hedwigia, 80: 260 (1941).



**Ecology and distribution:** Epiphytic as well on soil, on way to Ghangaria, 3510m.

**Range of distribution:** Eastern Himalaya (Sikkim), western Himalaya (Kashmir); Nepal, Gilgit, Central Asia.

**Specimens examined:** India, on way to Ghangaria, 18.10.1964, leg. S. Chandra; 200714 B, 200740 B, 200746 B, 200776 A, 200826 E, 200838 A, 200850 B (LWG).

**43. *Oxystegus cylindrothecus*** (Mitt.) Gangulee, *Nova Hedwigia*, 12: 430 (1966).

**Synonym:** *Oxystegus cylindricus* (Brid.) Hilp. in *Beih. Bot. Centralbl.*, 50(2): 620 (1933). *Weissia cylindrica* Brid. *Bryol. Chiv.I* (1826).

**Ecology and distribution:** Epiphytic as well as on soil, Valley of Flowers, 3343-3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Sikkim, Khasi Hills, Naga Hills), western Himalaya (Ramgaon, Tehri, Kashmir), South India; Ceylon, Burma, Nepal, Europe, Central Asia, Korea, China, Japan, Africa, America, Greenland.

**Specimens examined:** India, Valley of Flowers, 20.10.1964, leg. S. Chandra; 200739 A (LWG); on way to Hemkund, 20.10.1964, leg. S. Chandra; 200878 D (LWG).

**Family: Dicranaceae**

**44. *Dicranum spurium*** Hedw. in *Sp. Musc.*: 141 (1801).

**Ecology and distribution:** Epiphytic as well as on soil, Valley of Flowers, on way to Hemkund, 3343-3510m.

**Range of distribution:** Eastern Himalaya (Sikkim), western Himalaya; Bhutan, Siberia, Europe, North America.

**Specimens examined:** India, Valley of Flowers, 20.10.1964, leg. S. Chandra; 200802 B, 200803 C (LWG); on way to Hemkund, 20.10.1964, leg. S. Chandra; 200852 F, 200861 B, 200862 B, 200872 D, 200916 A, 200917 A (LWG).

**45. *Paraleucobryum enerve*** (Thed.) Loesk. in *Hedwigia*, 47: 171 (1908).

**Ecology and distribution:** On soil, on way to Hemkund, 3343m.

**Range of distribution:** Eastern Himalaya (Sikkim), western Himalaya; Nepal, Taiwan, Europe, Caucasus, North America.

**Specimens examined:** India, on way to Hemkund, 20.10.1964, leg. S. Chandra; 200858 B (LWG).

**Family: Rhabdoweisiaceae**

**46. *Rhabdowesia crenulata*** (Mitt.) James. in *Rev. Bryol.*, 17: 6 (1890).

**Ecology and distribution:** Epiphytic as well as on soil, Valley of Flowers, 3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Sikkim), western Himalaya; Europe, China, Formosa, North and South Africa, North, Central and South America.

**Specimens examined:** India, Valley of Flowers, 20.10.1964, leg. S. Chandra; 200754 A, 200788 A, 200789 B, 200791 A, 200798 A, 200815 D (LWG).

**Family: Fissidentaceae**

**47. *Fissidens viridulus*** (Sw.) Wahlenb. in *Fl. Lapp*: 334 (1812).

**Ecology and distribution:** On soil, on way to Hemkund, 3510m.

**Range of distribution:** Western Himalaya (Ranikhet); Nepal, Europe, Siberia, China, Caucasus, North and Central Africa, North America, New Zealand.

**Specimens examined:** India, on way to Hemkund, 20.10.1964, leg. S. Chandra; 200869 C (LWG).

**Family: Grimmiaceae**

**48. *Racomitrium crispulum*** (Hook. f. Wils) Hook. f. Wils. in *Fl. Nov. Zd.* 2: 75 (1854).

**Ecology and distribution:** On soil, on way to Ghangaria, on way to Hemkund, 3343-3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Sikkim), western Himalaya (Kumaon, Garhwal), South India (Kodaikanal); East Nepal, Bhutan, Taiwan, Japan, Yunnan, Ceylon, Sumatra, Java,



Borneo, Australia, Tasmania, New Zealand, Hawaii, South Africa, Central and South America, Antarctica.

**Specimens examined:** India, on way to Ghangaria, 18.10.1964, leg. S. Chandra; 200675 A, 200682 A, 200684 A, 200697 A, 200699 A, 200702 A, 200703 A, 200718 A (LWG); on way to Hemkund, 20.10.1964, leg. S. Chandra; 200849 A, 200852 A, 200853 A, 200854 A, 200855 A, 200857 A, 200858 A, 200859 A, 200860 A, 200861 A, 200862 A, 200864 A, 200865 B, 200866 C, 200867 A, 200868 B, 200869 A, 200870 A, 200873 B, 200874 A, 200875 B, 200876 A, 200877 A, 200880 A, 200892 B, 200895 B, 200904 A, 200905 E, 200906 B, 200909 A, 200911 A, 200912 B, 200913 A, 200914 A, 200916 B, 200918 A, 200922 A (LWG).

**49. *Racomitrium subsecundum*** (Hook. & Grev) Mitt. in Kew J. Bot., 9: 324 (1857).

**Ecology and distribution:** Epiphytic as well as on soil, on way to Hemkund, 3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Sikkim, Naga Hills), western Himalaya, South India; Nepal, Ceylon, Yunnan, Java, Borneo.

**Specimens examined:** India, on way to Hemkund, 20.10.1964, leg. S. Chandra; 200802A, 200803 A, 200847 A (LWG).

### Hepaticopsida (Liverworts)

#### Family: Metzgeriaceae

**1. *Apometzgeria pubescens*** (Schrank) Kuwah., Rev. Bryol. Lichenol. 34: 264 (1966).

**Ecology and distribution:** Epiphytic as well as on soil, Valley of Flowers, on way to Hemkund, 3343-3510m.

**Range of distribution:** Eastern Himalaya (Jongri, Darjeeling), western Himalaya; East Nepal, North Borneo, Korea, Japan, China, Sakhalin, Aleutians, North America, Europe and Caucasus.

**Specimens examined:** India, Valley of Flowers, 20.10.1964, leg. S. Chandra; 200764 A, 200766 A, 200780 B, 200798 C, 200826 C, 200831 A (LWG); on way to Hemkund, 20.10.1964, leg. S. Chandra; 200842 C, 200848 A, 200850 A, 200905 H, 200915 B (LWG).

#### Family: Herbertaceae

**2. *Herbertus ceylanica*** (Steph.) Abeywickrama, Ceylon J. Sci. (Bio. Sci.) 2: 43 (1959).

**Ecology and distribution:** On soil, on way to Hemkund, 3343m.

**Range of distribution:** Eastern Himalaya (Meghalaya); Ceylon.

**Specimens examined:** India, on way to Hemkund, 20.10.1964, leg. S. Chandra; 200901C, 200906 G, 200920 A (LWG).

#### Family: Blepharostomataceae

**3. *Blepharostoma trichophyllum*** (L.) Dum. Rec. d'Obs. 18 (1835): Hep. Eur. 95. (1874).

**Ecology and distribution:** Epiphytic as well as on soil, on way to Ghangaria, Valley of Flowers, on way to Hemkund, 3343-3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Sikkim), western Himalaya (Kumaon); Bhutan, Nepal, Europe, North and Central America, Canada, E. Africa, Philippines and New Guinea, Korea, Japan, China, Taiwan, Costa Rica, Siberia.

**Specimens examined:** India, on way to Ghangaria, 18.10.1964, leg. S. Chandra; 200707 C (LWG); Valley of Flowers, 20.10.1964, leg. S. Chandra; 200800 C (LWG); on way to Hemkund, 20.10.1964, leg. S. Chandra; 200851I, 200855 E, 200867 B, 200875 G, 200894 E, 200900 F, 200902 B, 200918 E, 200919 E, 200920 D, 200921 C (LWG).

**4. *Pseudolepicolea trollii*** (Herz.) Grolle & Ando, Hikobia 3: 177 (1963), Hatt. & Mizutani, J. Hattori Bot. Lab. 31: 252 (1968).

**Ecology and distribution:** On soil, on way to Hemkund, 3343m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Sikkim); Bhutan, Nepal, China, Taiwan, Borneo.

**Specimens examined:** India, on way to Hemkund, 20.10.1964, leg. S. Chandra; 200894 C, 200899 F, 200904 G, 200912 E, 200916 G, 200917 G (LWG).



**Family: Lepidoziaceae**

5. *Bazzania imbricata* (Mitt.) Hatt. in Hara, Fl. E. Himalaya 505 (1966); Mizut., J. Hattori Bot. Lab. 30; 78 F III (1-4) (1967); 43: 313 (1979).

**Ecology and distribution:** On soil, on way to Hemkund, 334 m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Sikkim), western Himalaya (Valley of Flowers); Nepal, Bhutan, Taiwan, China.

**Specimens examined:** India, on way to Hemkund, 20.10.1964, leg. S. Chandra; 200848 C, 200851 D, 200857 C, 200858 F, 200857 A, 200879 E, 200906 C, 200908 D, 200909 B, 200919 A, 200920 C (LWG).

6. *Lepidozia brevifolia* Mitt. J. Linn. Soc. London 5: 104 (1861).

**Ecology and distribution:** Epiphytic as well as on soil, Valley of Flowers, on way to Hemkund, 3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Sikkim, Kurseong), western Himalaya (Dehradun); Nepal, Java.

**Specimens examined:** India, Valley of Flowers, 20.10.1964, leg. S. Chandra; 200800 A (LWG); on way to Hemkund, 20.10.1964, leg. S. Chandra; 200894 A (LWG).

7. *Lepidozia stahlia* St. Sp. Hep. 3: 616 (1909).

**Ecology and distribution:** Epiphytic as well as on soil, on way to Ghangaria, 3510m.

**Range of distribution:** Eastern Himalaya (Sikkim); Bhutan, Java.

**Specimens examined:** India, on way to Ghangaria, 18.10.1964, leg. S. Chandra; 200683 B, 200703 B, 200704 C (LWG).

**Family: Calypogeiaceae**

8. *Matecalypogeia alternifolia* (Nees) Grolle, Osterr. Bot. Zeitscher. 111: 185(1964).

**Synonym:** *Calypogeia hartlessiana* Steph. Spec. Hepat. 3: 399 (1908).

**Ecology and distribution:** Epiphytic as well as on soil, on way to Ghangaria, Valley of Flowers, on way to Hemkund, 3343-3510m.

**Range of distribution:** Eastern Himalaya (Sikkim, Darjeeling), western Himalaya; Nepal, China, Taiwan, Japan, Indomalaya, Hawaii.

**Specimens examined:** India, on way to Ghangaria, 18.10.1964, leg. S. Chandra; 200664 A (LWG); Valley of Flowers, 20.10.1964, leg. S. Chandra; 200800 F (LWG); on way to Hemkund, 20.10.1964, leg. S. Chandra; 200864 H, 200901A (LWG).

**Family: Cephaloziellaceae**

9. *Cephaloziella magna* Udar & Nath, Geophytology 6(1): 105 (1976).

**Ecology and distribution:** On soil, on way to Hemkund, 3343m.

**Range of distribution:** Western Himalaya (Almora).

**Specimens examined:** India, on way to Hemkund, 20.10.1964, leg. S. Chandra; 200794 C, 200842 G, 200894 F (LWG).

**Family: Lophoziaceae**

10. *Anastrophyllum assimile* (Mitt.) Steph., Hedwigia 32: 140 (1893).

**Ecology and distribution:** On soil, on way to Hemkund, 3343m.

**Range of distribution:** Eastern Himalaya (Sikkim); Nepal, Bhutan, Yunnan, Sichuan, Austria, Switzerland, Italy, Norway, Alaska, Yukon, British Columbia, Labrador, Greenland, Japan, Korea, Borneo and Papua New Guinea.

**Specimens examined:** India, on way to Hemkund, 20.10.1964, leg. S. Chandra; 200917 E (LWG).

11. *Anastrophyllum donnianum* (Hook.) Steph., Hedwigia 32: 140 (1893).

**Ecology and distribution:** On soil, on way to Hemkund, 3343m.

**Range of distribution:** Eastern Himalaya (Sikkim, Darjeeling); W. Tibet, Bhutan, Nepal, Europe, Norway, Poland, Scotland, Faroes, China, Alaska, Canada, Czech Republic.

**Specimen examined:** India, on way to Hemkund, 20.10.1964, leg. S. Chandra; 200918 F (LWG).



**12. *Anastrophyllum alpinum*** Steph., Spec. Hep. 6: 103 (1917).

**Ecology and distribution:** On soil, on way to Hemkund, 3343m.

**Range of distribution:** Eastern Himalaya (Sikkim), western Himalaya (Mussoorie); Bhutan, Nepal, China, Europe, Scotland, Norway.

**Specimen examined:** India, on way to Hemkund, 20.10.1964, leg. S. Chandra; 200919 D (LWG).

**13. *Lophozia alpestris*** (Schleich) Evan., in Kennedy & Collins, Rhodora, 3: 181 (1901); Macv. Studs. Handb. Brit. Hep. ed. 2: 185 (1926).

**Ecology and distribution:** On soil, Valley of Flowers, 3510m.

**Range of distribution:** Western Himalaya (Zanskar, Gurdhar Pass Kashmir), Maharashtra (Khandala); Europe, England, Scotland, W. America, Canada, Asia Minor, Siberia, Sakhalin.

**Specimen examined:** India, Valley of Flowers, 20.10.1964, leg. S. Chandra; 200777 D (LWG).

#### Family: Jungermanniaceae

**14. *Jungermannia appresifolia*** Mitt. J. Proc. Linn. Soc. London 5: 91 (1861).

**Ecology and distribution:** On soil, on way to Hemkund, 3343m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Kurseong, Sikkim, Khasi Hills, Assam), western Himalaya (Dehradun, Mussoorie); Bhutan, Nepal, China, Japan, Taiwan, Borneo, Malaya, Java, West Trion, Papua New Guinea, Australia, Sri Lanka, Vietnam.

**Specimens examined:** India, on way to Hemkund, 20.10.1964, leg. S. Chandra; 200908 C, 200910 A, 200912 A, 200916 C (LWG).

**15. *Jungermannia pseudocyclops*** Inoue, Bull. Nat. Sci. Mus. Tokyo 9(1): 1 (1966); Amak. J. Hattori Bot. Lab. 30: 192 (1967).

**Ecology and distribution:** On soil, on way to Hemkund, 3343m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Manebhanjang); Bhutan, Nepal, Taiwan.

**Specimens examined:** India, on way to Hemkund, 20.10.1964, leg. S. Chandra; 200897 A (LWG).

#### Family – Scapaniaceae

**16. *Scapania ferruginea*** (Lehm. & Lindenb.) Gott., Lindenb. & Nees; Syn Hepat. 72(1844).

**Synonym:** *Diplophyllum ferrugineum* (L. & L.) Steph., Spec. Hepat. 4: 115 (1910).

**Ecology and distribution:** On soil, on way to Hemkund, 3343m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Sikkim); Nepal, Java, Formosa, Bhutan, Taiwan, China.

**Specimens examined:** India, Valley of Flowers, 20.10.1964, leg. S. Chandra; 200868 A (LWG).

#### Family: Geocalyceae

**17. *Heteroscyphus inflatus*** (St.) Srivas. & Srivas., Geophytology, 16 (1): 129–132 (1986). *Chiloscyphus inflatus* St. Sp. Hep, 3: 206 (1906).

**Ecology and distribution:** Epiphytic as well as on soil, on way to Hemkund, 3343m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Sikkim), western Himalaya, Himachal Pradesh; Nepal.

**Specimens examined:** India, on way to Hemkund, 20.10.1964, leg. S. Chandra; 200800 E, 200906 A (LWG).

**18. *Heteroscyphus hyalinus*** (St.) Srivas. & Srivast. Indian Geocalyceae: 118 (2002); Basionym: *Lophocolea hyalina* St., Soc. Roy. Belg., 38: 254 (1899); *Chiloscyphus hyalinus*, Engel & Schust., Nova Hedwigia, 39: 385–463 (1984).

**Ecology and distribution:** on soil, on way to Hemkund, 3343m.

**Range of distribution:** Eastern Himalaya (Sikkim, Kurseong, Mungpoo).

**Specimens examined:** India, on way to Hemkund, 20.10.1964, leg. S. Chandra; 200848 E, 200875 C, 200876 C, 200879 C (LWG).

**19. *Lophocolea cuspidata*** (Nees) Limpr., in Cohn, Krypt-Fl. Schlesien 1: 303 (1876).



**Ecology and distribution:** On soil, on way to Hemkund, 3343m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Sikkim), western Himalaya (Bhowali, Kalika, Mussoorie, Nainital, Munsyari, Ranikhet, Seetalkhet), South India (Kerala, Kodaikanal, Ootacomund); Europe, Africa, North America, China, Japan.

**Specimens examined:** India, on way to Hemkund, 20.10.1964, leg. S. Chandra; 200908 E, 200910 B, 200912 G, 200914 F (LWG).

**Family: Plagiopilaceae**

**20. *Plagiopilula dorelii*** Schiffn. Oster. Bot. Z. 49: 131 (1899); St. Sp. Hep. 2: 34 (1906) Syn: *P. ferruginea* St., Bull. Herb. Boissier, Ser 2, 3: 879 (1903).

**Ecology and distribution:** On soil, on way to Hemkund, 3343m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Sikkim, Kurseong, Meghalaya), western Himalaya (Mussoorie, Simla); Bhutan, Nepal, Vietnam, China, Nepal.

**Specimen examined:** India, on way to Hemkund, 20.10.1964, leg. S. Chandra; 200864 C (LWG).

**21. *Plagiopilula duthiana*** St. Bull. Herb. Boissier, Ser. 2, 3: 527 (1903); Sp. Hep. 2: 331 (1903).

**Ecology and distribution:** Epiphytic, on way to Ghangaria, 3510m.

**Range of distribution:** Eastern Himalaya (Meghalaya), western Himalaya (Kashmir).

**Specimen examined:** India, on way to Ghangaria, 18.10.1964, leg. S. Chandra; 200706 D (LWG).

**22. *Plagiopilula gracilis*** Lindenb. & Gott., in Gott., Lindenb. and Nees, Syn. Hepat. 632 (1847); Long and Grolle, Journ. Hattori Bot. Lab. 6: 406 (1990).

**Ecology and distribution:** On soil, on way to Hemkund, 3343m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Sikkim, Meghalaya), western Himalaya (Himachal Pradesh, Simla).

**Specimen examined:** India, on way to Hemkund, 20.10.1964, leg. S. Chandra; 200854 F (LWG).

**23. *Plagiopilula pseudopoeltii*** Inoue, Bull. Nat. Sci Mus., Tokyo 8(3): 382 (1965); So, Syst Bot. Monogr. 60: 51 (2001).

**Ecology and distribution:** On soil, on way to Hemkund, 3343m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Sikkim), western Himalaya (Himachal Pradesh, Simla).

**Specimens examined:** India, on way to Hemkund, 20.10.1964, leg. S. Chandra; 200852 C, 200879 B, 200896 B, 200897 C, 200899 B, 200900 C, 200904 B (LWG).

**Family: Porellaceae**

**24. *Porella gracillima*** Mitt. sub sp. *urogla* (Mass.) Hatt. & Zhang, J. Jap. Bot. 60 (11): 323 (1985).

**Ecology and distribution:** Epiphytic, Valley of Flowers, 3510m.

**Range of distribution:** Western Himalaya (Almora, Manali); China, Taiwan, E. Siberia, Sakhalin, Japan.

**Specimens examined:** India, Valley of Flowers, 20.10.1964, leg. S. Chandra; 200781 E, 200831 B (LWG).

**Family: Cleveaceae**

**25. *Sauteria spongiosa*** (Kash.) Hatt. in Shim. & Hatt. J. Hatt. Bot Lab. 12: 62 (1954); Udar, J. Indian Bot. Soc. 37: 300 (1958); *Sauchia spongiosa* Kash., J. Bombay Nat. Hist. Soc. 24: 347 (1916); Liverworts of the W. Himalaya and Punjab Plains 1: 82 (1929).

**Ecology and distribution:** On soil, Valley of Flowers, 3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling), western Himalaya (above Alwas on the Pangi road, Rohtang Pass, Chandra Valley Manh Pass, Kashmir, Kansa Nag, Tsera); E. Nepal.

**Specimens examined:** India, Valley of Flowers, 20.10.1964, leg. S. Chandra; 200763 A (LWG).



**Family: Aytoniaceae**

**26. *Plagiochasma appendiculatum*** Lehm. & Lindenb; Pag. IV. 14 (1832).

**Ecology and distribution:** On soil, Govindghat, 1823m.

**Range of distribution:** Eastern Himalaya (Darjeeling), western Himalaya (Nainital, Ranikhet, Mussoorie, Dhanolti, Himachal Pradesh), central India, South India; Nepal, China, Manila.

**Specimens examined:** India, Govindghat, 18.10.1964, leg. S. Chandra; 200646 C, 200654 A, 200708 A, 200709 C (LWG).

**27. *Plagiochasma pterospermum*** Mass Mem. Acad. Agric. Varona 73: 46 (1897).

**Synonym:** *Plagiochasma articulatum* Kashyap, New Phyt. Vol XIII, P. 320 (1914).

**Ecology and distribution:** On soil, Valley of Flowers, on way to Hemkund, 3343-3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling), western Himalaya (Kumaon Hills, Ladakh, Leh), South India (Ootacamund, Nilgiris, Bombay, Panchgani); Nepal.

**Specimens examined:** India, Valley of Flowers, 20.10.1964, leg. S. Chandra; 200787 B (LWG); on way to Hemkund, 20.10.1964, leg. S. Chandra; 200907 A (LWG).

**28. *Reboulia hemispherica*** (L.) Raddi. Opusc. Scient. di Bologna 11, P. 357 (1818).

**Ecology and distribution:** On soil, Govindghat, Valley of Flowers, on way to Hemkund, 1823-3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling), western Himalaya (Mussoorie, Dhanolti, Kausani, Dalhousie, Simla, Pangl, Kulu, Spiti, Lahul, Kyelong), South India (Chennai, Nilgiris, Tinnevely Hills, Kanghan Valley); Asia, Europe, West Indies, Africa, Formosa, Sumatra, Java, Borneo, Australia, South America, Mexico, Bermuda.

**Specimens examined:** India, Govindghat, 18.10.1964, leg. S. Chandra; 200647 A, 200650 A, 200656 A (LWG); Valley of Flowers, 20.10.1964, leg. S. Chandra; 200729 C, 200778 A (LWG); on way to Hemkund, 20.10.1964, leg. S. Chandra; 200921 A (LWG).

**Family: Conocephalaceae**

**29. *Conocephalum conicum*** (L.) Necker, Elem. Bot. III. p. 344 (1759).

**Ecology and distribution:** On soil, on way to Ghangaria, Valley of Flowers, on way to Hemkund, 3343-3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling), western Himalaya (Kumaon Hills, Kashmir), China, Japan, Korea, Tibet, Europe, North Africa, North America, Siberia.

**Specimens examined:** India, on way to Ghangaria, 18.10.1964, leg. S. Chandra; 200661 B, 200710 A (LWG); Valley of Flowers, 20.10.1964, leg. S. Chandra; 200751 A, 200757 A, 200761 A, 200768 A, 200785 A, 200793 A, 200794 D, 200799 A, 200806 A, 200809 B, 200835 A, 200837 A (LWG); on way to Hemkund, 20.10.1964, leg. S. Chandra; 200842 B, 200866 A, 200873 C, 200876 B, 200878 A, 200898 C, 200903 A, 200904 E, 200905 B, 200915 A (LWG).

**Family: Marchantiaceae**

**30. *Dumortiera hirsuta*** (Sw.) Nees in Reinw. Bl. & Nees., Nov. Acta. Leop. Carol. VII P. 410 (1824)

**Ecology and distribution:** On soil, on way to Ghangaria, 3510m.

**Range of distribution:** Eastern Himalaya (Darjeeling, Meghalaya), western Himalaya (Kumaon Hills, Pangl, Lahul), South India, central India (Pachmarhi); Nepal, West Indies, Mexico, Central America, South America, Borneo, China, Japan, Malaysia, Philippines, New Caledonia, Samoa.

**Specimens examined:** India, on way to Ghangaria, 18.10.1964, leg. S. Chandra; 200661 A, 200672 A, 200688 A, 200689 A, 200690 A, 200694 A, 200696 A (LWG).

**DISCUSSION**

During the present study it has been observed that terricolous forms are more than epiphytic and out of 80 species investigated from the area, mosses viz. *Pogonatum urnigerum*, *Racomitrium crispulum*, *Sanionia uncinata* and *Anomodon rugelii* were more frequent in occurrence. Among leafy liverworts



*Blepharostoma trichophyllum* and *Bazzania imbricata*, and thalloid liverworts *Apometzgeria pubescens* and *Conocephalum conicum* have been frequently found in the area. Among the mosses, family Bryaceae seems to be more dominant in the region with 7 species, followed by Mniaceae with 6 and Thuidiaceae with 4 species. On the other hand some families e.g. Fabroniaceae, Entodontaceae, Sematophyllaceae and Leucodontaceae are represented by merely single taxon. As far as the leafy liverworts are concerned, families Plagiochilaceae and Lophoziaceae exhibit maximum number of species, i.e. 5 each distributed in the region, while Geocalycaceae and Lepidoziaceae are represented by 3 species each. Family Aytoniaceae is represented by a maximum of 3 species among thalloid liverworts, however, Cleveaceae, Marchantiaceae and Conocephalaceae are represented by single taxon each. Genus *Plagiochila* has maximum number of 5 species, followed by *Anastrophyllum* with 3 species. Three species of mosses and 7 species of liverworts have been found new to western Himalaya.

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