

Vanishing greenery in Kumaon Himalaya: Observations on bryoflora*

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Bryophytes form a striking part of the Himalayan vegetational complex contributing to the overall greenery of the region. However, these tiny plants are facing danger to their survival in a disturbed scenario where greater forces of man-made destruction are at work.

Causes of the rapidly dwindling bryoflora are pointed out. These include rapid urbanization, pollution and commercial exploitation. Red list liverwort taxa are categorized and discussed. Means to conserve bryophytic wealth are emphasized.

Key-words—Bryoflora, Ecology, Endangered taxa, Kumaon Himalaya.

INTRODUCTION

THE grandeur and charm of Kumaon Himalaya in yesteryears revolved around springs, streams, waterfalls and lakes. The majestic conifers, gnarled oaks, the weeping willows and blazing rhododendrons, the pretty rosaceous blooms, a dense, shrubby and herbaceous ground cover, the jewel-bright mossy slopes, a lush wall-mosaic of liverworts and mosses fringed with lichens, ferns and orchids were beautifully set in the background of rising peaks. However, the lush greenery is fast disappearing and the fragile mountain ecosystem is highly disturbed.

We write in defence of a green group of poikilohydric plants—the bryophytes. These flowerless, simplest and hardiest of all land plants with uniqueness of their beauty and life cycle, hold a special significance in the Himalayan vegetational complex. Builders of soil, early colonizers — they hold water and surface run off and act as “nutrient sinks”. They impart a many-hued greenery, a verdant cover to the bouldery tracts, rugged slopes, hillsides, rocky outcrops, overhangs and cliffs, limestone caves/caverns, hollows, water channels, forest floors and tree trunks. In cool, humid forests, banners of pendulous mosses hang from every tree; knotted limbs are padded and festooned with moss and there is a mossy mattress on the floor.

Even man-made habitats like buildings, gravel footpaths, road-cuttings, exposed hill slopes etc. are covered by these tiny plants (Pant & Tewari, 1989).

OBSERVATIONS

According to our field surveys in Kumaon Himalaya since 1979, the following factors appear to be responsible for the rapid declension of bryophytes in general and those of liverworts in particular.

Rapid urbanization

This process is directly linked with habitat destruction of bryophytes. Urbanization has led to the depletion of bryopopulation in the areas where once bryophytes were enjoying diversity. Naini Tal is an example of fast urbanization. The following factors are involved in urbanization:

- (a) Land clearance
- (b) Road construction
- (c) Faulty planning and haphazard growth of residential buildings, offices and hotels/motels
- (d) Deforestation

With regular cutting/felling of trees, the associated bryophytic habitats and their bryoflora are destroyed.

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Pollution

The pollution in the hills is due to various population stresses.

- (a) *Land pollution*—The facade is dotted with ugly pock marks of dirt, garbage, open drains, broken sewer lines which are not conducive for the bryophytes to thrive well and regenerate.
- (b) *Water pollution*—Most of the existing springs and streams are polluted with excessive human pressures which further mar the growth of bryophytes. The eutrophism of Bhim Tal lake has resulted in the elimination of floating forms like *Riccia fluitans* and *Ricciocarpus natans*.
- (c) *Atmospheric pollution*—Automobiles are held responsible for the atmospheric pollution which is indirectly injurious to the bryo-population.

Commercial exploitation of bryophytes

Exploitation of bryoflora is on an increase and huge quantities of liverworts/mosses are being regularly scraped off their habitats in the hills and supplied to the contractors in the plains. The beautiful Himalayan hanging forms (members of leafy Jungermanniales, Isobryales, Hookeriales and Hypnobryales) are being utilized in indoor gardening, beautification/decoration of expensive hotels/motels, cafes/restaurants/offices and apartments. Unfortunately, moss-draped hanging baskets, "pots" and "sticks" have become the status symbol of modern elite (Bisht, 1990).

Mosses as packing material

Mosses are widely exploited for packing/wrapping of fruits like apples and plums. The time has come when mosse should be replaced by a substitute like tissue paper.

RED LIST LIVERWORT TAXA

Monotypic endemics

Aitchisoniella himalayensis Kash. (Marchantiaceae Kash.; Targioniineae Schust.; Aitchisoniellaceae Schust.)

Present Status — Extremely rare.

The genus *Aitchisoniella* Kash. having its limited geographical range was collected by Kashyap (1914) from one locality in Mussoorie (2000m), whereas it was fairly common in Shimla, Kulu, Dulchipass (2000-2400 m). Over the years (despite repeated efforts by various workers) no one could collect this interesting thaloid liverwort from any of Kashyap's original localities. Nevertheless, Kanwal (1977) collected it after a lapse of four decades from Mukteshwar and Paharpani (2150-2200 m) in district Naini Tal. His listing treats it as rare. After trailing behind this plant over the last 10 years, we could

collect a few patches of fruiting material from muddy slopes in August 1988 and September 1991 from two sites at Orakhan (2000 m) and Mukteshwar (2150 m) in district Naini Tal. Since these sites are being now disturbed due to road constructions, the *Aitchisoniella* population is endangered.

Reproductive limitations

Habitat disturbances when coupled with reproductive limitations may have led to the disappearance of this Indian hepatic (Udar & Srivastava, 1983 b).

Paucity of specimens both in the herbarium and field, have put restrictions on taxonomical, cytological, biochemical and tissue culture studies and it is difficult to draw lines of marchantiaceous evolution.

Stephensoniella brevipedunculata Kash. (Marchantiaceae Kash.; Marchantiineae Schust.; Exorothecaceae Schust.)

Present status — Rare.

This genus was first described by Kashyap (1914) which had a very restricted distribution in Kumaon, Mussoorie, Shimla and Kulu (N.W. Himalaya) at an altitude of 1800-2100 m. (Kashyap, 1929; Mehra & Mehra, 1939). It was a common liverwort of Naini Tal till late seventies (Kanwal, 1977). During the last 16 years, *Stephensoniella* has gradually disappeared from the urban localities in and around Naini Tal. At present, this plant can be located only in some undisturbed sites near Sainik School and Khurpa Tal in Naini Tal proper. During 1985, patches of *Stephensoniella* were observed at Malaydaur (2450 m) on way to Pindari Glacier and in 1987 at Girigaon (2330 m) on way to Milam Glacier. In 1990, both sterile and fertile plants were seen in isolated patches on way to Namik Glacier (2500-2700 m) in district Pithoragarh.

Our field observations reveal that this delicate porose liverwort is to be labelled as endangered in Kumaon Himalaya.

Peculiar features of life cycle, i.e., male and female plants grow apart resulting in lesser chances of fertilization and thus a large number of individuals are deprived of reproduction.

Sauchia spongiosa Kash. (Marchantiaceae Kash.; Marchantiineae Schus; Cleveaceae Schust.)

Present status — Rare.

Kashyap established the genus *Sauchia*, based on collection from the higher ranges of Western Himalaya (2700-4350 m). In 1957, a few herbarium specimens were collected from Himachal Pradesh by Panjab University, Chandigarh team (unpublished). Thereafter, this endemic genus was not collected until 1988 when Drs S.D. Tewari and L.S. Bisht brought both sterile and copiously fruiting material of *Sauchia spongiosa* from Pindari Glacier (2900-4000 m). The population of *S. spongiosa*

in these high Himalayan localities is restricted to isolated patches mixed with other hepatics and mosses (Tewari *et al.*, 1988). More recently, during August 1990, *S. spongiosa* plants were again collected by S.D. Tewari from Namik Glacier (2800-3500 m).

Sewardiella tuberifera Kash. (Codoniaceae Kash.; Fossombroniaceae Schust.; Fossombroniaceae Schust.)

Present status — Endangered.

The discovery of this monotypic endemic Metzgeriale was based on the collections made by Kashyap (1915) from Mussoorie and Shimla. As observed by Pande *et al.* (1955) it was quite common in Naini Tal and environs. Over the years, it gradually disappeared from the original collection sites and thus became rarer. In recent years, single collections were made from Suyalbari (1100 m), Chaubatia (1820 m) and Dhakuri (2500 m) in Kumaon (Tewari & Pant, 1984; Pant, 1989).

ENDANGERED TAXA IN KUMAON HIMALAYA

- (1) *Athalamia pinguis* Falc. (Sauteriaceae Kash.; Marchantiaceae Schust.; Cleveaceae Schust.)

Present status — Rare.

This endemic taxon has a restricted distribution in Kumaon region. It was only known from some localities of district Naini Tal (1930-2100 m). Kanwal (1977) listed it as common in Naini Tal. During the last 12 years of our survey, we could locate this taxon from a few sites, viz., Khurpa Tal (1650 m), Naini Tal (2000 m), Mukteshwar (2280 m) and on way to Milam Glacier at Bugudiyar (2700 m).

- (2) *Athalamia pusilla* (St.) Kash.

Present status — Extremely rare.

It has limited distribution in the Western Himalaya (Kumaon, Kulu, etc.) and South India (Udar & Srivastava, 1983 a).

Once the species was known to be common in Kumaon on damp, muddy soil or shaded rocks (Kashyap, 1929). Kanwal (1977) had collected this taxon from muddy walls and rocks in shaded and moist places of Naini Tal, Khurpa Tal and Ratighat areas (1250-2250 m). Over the years, it has gradually disappeared from the original collection sites. Despite our repeated search, we could not collect even a single specimen from Kanwal's localities. However, only one collection-record of a few fruiting thalli from two localities, viz., Mukteshwar (2280 m) and Garampani (900 m) in Naini Tal District could be obtained.

- (3) *Cryptomitrium himalayense* Kash. (Rebouliaeeae Kash.; Marchantiaceae Schust.; Aytoniaceae Schust.)

Present status — Rare.

This taxon has a restricted distribution in NW Himalaya (Mussoorie, Shimla and Naini Tal). Until recently, one could observe a lush expansion of this delicate, sciaphilous liverwort in Naini Tal, Mukteshwar, Ramgarh, Paharpani (Kanwal, 1977) but now it is undoubtedly suffering the hazards of rapid urbanization particularly in and around Naini Tal. The luxuriance of *Cryptomitrium* has vanished from many exposed sites in Naini Tal (Pant, 1983) but this taxon is still surviving in small patches in some undisturbed protected sites of districts Almora, Naini Tal and Pithoragarh.

- (4) *Fossombronia himalayensis* Kash. (Fossombroniaceae Kash.; Fossombroniaceae Schust.; Fossombroniaceae Schust.)

Present status — Rare.

It is known to have been distributed in Western Himalaya and South India (Udar & Srivastava, 1983 a). The occurrence of this taxon was earlier reported by Pande *et al.* (1954) from Naini Tal only. Since then, it has also been collected from many other undisturbed sites/ localities in districts Almora, Naini Tal and Pithoragarh (Pant & Tewari, 1983; Tewari, 1984; Pant, 1989). Despite its wide occurrence in Kumaon region, the plant is rapidly losing its luxuriance particularly in and around Naini Tal. In some protected sites of Naini Tal, the further spread of this fragile species is almost negligible probably due to premature damage to sporophyte and nonavailability of required natural domain for proper growth and development.

- (5) *Metzgeria himalayensis* Kash. (Metzgeriaceae Kash.; Metzgeriaceae Schust.; Metzgeriaceae Schust.)

Present status — Extremely rare.

Metzgeria himalayensis is known to be distributed in Western Himalaya (Kulu, Dalhausie, Mussoorie), Palni Hills (Kodai Canal), Assam, Mount Abu and Mahabaleshwar (Udar & Srivastava, 1983 a). This taxon was reported for the first time from Dhobighat (2200 m) in Naini Tal (Pant & Tewari, 1983). Since then, no further specimen could be collected. The liverwort has nearly gone from Dhobighat and vicinity due to regular biotic disturbances such as mass scraping of epiphytic bryophytic layer by commercial exploiters. However, a few thalli of this rare taxon were collected from an undisturbed site of Ghorpatta (1800 m) in Pithoragarh District (Pant *et al.*, 1986).

TAXA WITH LIMITED ECOLOGICAL RANGE

These taxa may be very frequent elsewhere in the world, but in Kumaon they are disappearing from the scene with each passing year due to anthropogenic activities.

- (1) *Blasia pusilla* L. (Blasiaceae Kash.; Blasiineae Schust.; Blasiaceae Schust.)

Present status — Rare.

This monotype has a wide distribution in Northern Hemisphere. In India, it is known to be distributed in Kulu, Manali, Nagar, Kumaon, Garhwal and Gangotri Road (Udar & Srivastava, 1983 a). Fruiting plants are extremely rare in India. It reproduces only by means of copious gemmae production. During the course of our field trips to different parts of Kumaon, we could collect a few specimens near springs, streams and trails in shaded sites from Khati, Dwali on way to Pindari Glacier.

Natural spread of this taxon has become extremely limited due to rarity of male and female plants and destruction of bryophytic habitats.

- (2) *Calycularia crispula* Mitt. (Pelliaceae Kash.; Pelliineae Schust.; Allisoniaceae Schust.)

Present status — Rare.

In India, this thalloid Jungermanniale is distributed in Garhwal, Gaurikund, Kumaon, Dalhousie, Sandakphu-Khajiar road, Mungpoo (Darjeeling). In Kumaon region, we could collect sterile plants from Bajon near Khurpa Tal and fertile plants from Loharkhet, Dhakuri, Khati, Madari (on way to Pindari Glacier) as well as from Liti, Gogina, Namik (on way to Namik Glacier). The plants were found growing on humus-capped, shaded rocks, "pigeon holes" and rotten tree bases in dense forested areas. Due to fast clearing of forests, the natural habitats are being destroyed every year. Such fragile bryo-taxa are now available only in some undisturbed, remote areas of Kumaon Himalaya. Sporophyte development of this taxon has been observed exclusively in those plants which grow in the areas of frequent snowfall.

- (3) *Conocephalum conicum* (L.) Dum. (Marchantiaceae Kash.; Marchantiineae Schust.; Conocephalaceae Schust.)

Present status — Rare.

It is distributed mainly in Kumaon and Outer Himalaya up to Kashmir in the West and Middle Himalaya. In these areas it had a status of being very common in the past (Kashyap, 1929). Kanwal (1977) collected this taxon from Dhobighat (2000-2125 m) in Naini Tal and from Ranikhet (1650 m) in Almora. At present, this robust liverwort is losing its expansion from the well known site of Dhobighat where it grows on moist, loose, Kankar and slaty soil in association with other hepatics like *Wiesnerella*, *Dumortiera*, *Marchantia* and *Pellia*. The main cause of its depletion from this area is reckless collection by various excursion parties, other operational factors being biotic and natural disturbances (Pant, 1983). With each passing year we see the diminishing population of *Conocephalum* at Dhobighat. However, we have collected *C. conicum* from other undis-

turbed localities (Mukteshwar, Ranikhet, Jageshwar, Ghorpatta, on way to Pindari, Milam and Namik Glacier areas).

- (4) *Wiesnerella denudata* (Mitt.) St. (Marchantiaceae Kash.; Marchantiineae Schust.; Wiesnerellaceae Schust.)

Present status — Extremely rare.

This liverwort is known to occur both in Eastern and Western Himalaya (Udar & Srivastava, 1983a). Kanwal (1977) reported this taxon from Dhobighat, Ranikhet and Panuwanaula (Almora). Our field survey indicates that at present *Wiesnerella* population is vanishing rapidly from the biotically disturbed locality of Dhobighat. It has been observed that *Wiesnerella* thalli can be seen in traces with *Conocephalum conicum* patches.

- (5) *Preissia quadrata* (Scop.) Nees (Marchantiaceae Kash.; Marchantiineae Schust.; Marchantiaceae Schust.)

Present status — Rare.

This liverwort is distributed in Western Himalaya: [(Pangi, Lahul, Baralacha Pass, Kaghan Valley, Kinlung, Kashmir (collected only once since 1929 from Sonmarg, Kashmir)].

After a lapse of 56 years, it was collected by Tewari *et al.* (1988) from Kumaon Himalaya (Pindari range 3400-4000 m). We have again collected few isolated patches of both sterile and fertile plants from Milam and Namik Glacier areas where these plants were found rooted on moist soil of alpine marshy grounds. Our field survey indicates that in Kumaon Himalayan localities this liverwort is poorly represented and solely confined to high altitudes (3400-4000 m).

- (6) *Ricciocarpus natans* (L.) Corda. (Ricciaceae Kash.; Ricciineae Schust.; Ricciaceae Schust.)

Present status — Extremely rare.

It is distributed in Kashmir and Manipur (Udar & Srivastava, 1983a). From Kumaon region, it was collected by Bir (1970) and Pant and Tewari (1983) from the shallower margins of Bhim Tal (1371 m) and Naukuchia Tal (1219 m) lakes. There is an alarming reduction in its population with each passing year. Due to regular accumulation of sediments all around the lakes, the liverwort is losing its original habitats. Apart from these cited localities, we could also collect this plant from the paddy fields of Joshiura (1300m) in Naini Tal District. Recently, Dr. Jagdish Lal, B.S.I., Dehra Dun collected this taxon for the first time from Garhwal Himalaya (personal communication).

- (7) *Riccia curtisii* (Aust.) James. (Ricciaceae Kash.; Ricciineae Schust., Ricciaceae Schust.)

Present status — Extremely rare.

Pande and Ahmad (1944) collected a few thalli of this species only once from the sides of a lake in Mohanlalganj

(Lucknow). It was recollected after many years by Tewari and Pant (1983) from a single locality (Sunmanthapla Sal forest) at Chaurgalia (Foothills) on Haldwani-Tanakpur road. The spongy rosettes of this characteristic species were found growing on shady, moist, damp soil in close association with *Riccia fluitans* and a moss, *Physcomitrium*. Except this locality we could not collect even a single thallus of this taxon from elsewhere in Kumaon Himalaya. Due to limited spore production (spores permanently adherent in tetrads) and heavy biotic disturbances at Chaurgalia site, the liverwort is becoming rarer.

(8) *Metzgeria furcata* (L.) Dum. (Metzgeriaceae Kash.; Metzgeriineae Schust., Metzgeriaceae Schust.).

Present Status — Extremely rare.

Since its original discovery from India (Kashyap, 1932) it has never been redocumented (Udar & Srivastava, 1983 a). Very few thalli were collected by us from the moist bark of *Pinus roxburghii* tree in a dense mixed oak-conifer forest at Government House (2200 m), Naini Tal (Tewari, 1984). Due to fast clearing of forest trees and removal of bryophyte layer, the natural habitats of many of the interesting bryo-taxa have almost gone.

CONSERVATION

If we can change our callous attitude, then take a pledge and say - "This is Beautiful, This is our Heritage, We Care, We will not let it Go...."

To achieve this we will have to conserve and preserve all Red List taxa by declaring our best 'bryophyte sites' as 'Restricted Areas'.

New forest laws should be framed for the prevention of uncontrolled scraping and transportation of bryophytes from the hills. The Forest Department should be alerted about the importance of bryophyte layer in nature and its protection so that these plants are not treated as useless "green weeds".

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REFERENCES

- Bir, S.S. 1970. Thallose liverworts from Naini Tal, Western Himalayas. *Bryologist* **73**: 395-396.
- Bisht, L.S. 1990. Studies in Bryophytes of Kumaon Hills (Western Himalaya). *Ph. D. Thesis, Kumaon University, Naini Tal.*
- Kanwal, H.S. 1977. Marchantiales of district Naini Tal (Kumaon Hills) U.P., India. *Rev. Bryol. Lichenol.* **31**: 329-338.
- Kashyap, S.R. 1914. Notes on new and little known West Himalayan liverworts. *New Phytol.* **13**: 206-236.
- Kashyap, S.R. 1915. Morphological and biological notes on new and little known West Himalayan liverworts. III. *New Phytol.* **14**: 1-18.
- Kashyap, S.R. 1929. *Liverworts of the Western Himalayas and the Punjab Plain*. Part I, Lahore.
- Kashyap, S.R. 1932. *Liverworts of the Western Himalayas and the Punjab Plain*. II. Lahore.
- Mehra, P.N. & Mehra, H.L. 1939. Life history of *Stephensoniella brevipedunculata* Kash. *Proc. Indian Acad. Sci.* **9** (B): 287-315.
- Pande, S.K. & Ahmed, S. 1944. Liverworts of Lucknow and its neighbourhood. *Proc. 31st Ind. Sci. Cong.* **31**(3): 80.
- Pande, S.K., Mahabale, T.S., Raje, Y.B. & Srivastava, K.P. 1954. Studies in Indian Metzgeriineae. I. *Fossombronia himalayensis* Kash. *Phytomorphology* **4**: 365-378.
- Pande, S.K., Srivastava, K.P. & Misra, R.N. 1955. Studies in Indian Metzgeriineae-II *Sewardiella tuberifera* Kash. *Phytomorphology* **5**(1): 57-67.
- Pant, Giribala 1983. Threatened bryophytes of Naini Tal. In: S.K. Jain & R.R. Rao (eds) - *An Assessment of Threatened Plants of India* (Proceedings of Seminar, Sept. 14-17, 1981) Botanical Survey of India, Botanic Gardens, Howrah.
- Pant, Giribala 1989. Exploration of the bryophytic vegetation of districts Almora and Pithoragarh (Kumaon Himalaya). D.S.T. Project Report (1985-1989): 1-128, Kumaon University, Naini Tal.
- Pant, Giribala & Tewari, S.D. 1983. An assessment of bryophytic vegetation of Naini Tal and its environs. I. *J. Indian bot. Soc.* **62**: 268-275.
- Pant, Giribala & Tewari, S.D. 1989. Man-made disturbed habitats and their bryophytic associations of Naini Tal and environs, Western Himalaya. *Geophytology* **19**(2): 167-172.
- Pant, Giribala, Tewari, S.D., Pargaien, M.C. & Bisht, L.S. 1986. Bryological activities in North-West Himalaya-II. A bryophyte foray in the Askot region of district Pithoragarh (Kumaon Himalaya). *The Bryol. Times* **39**: 2-3.
- Tewari, S.D. 1984. Studies on Bryophytes of Kumaon Himalaya. *Ph.D. Thesis. Kumaon University, Naini Tal.*
- Tewari, S.D., Bisht, L.S. & Pant, Giribala 1988. Two long-lost thallose liverworts recollected from Pindari range (Western Himalaya). *Curr. Sci.* **57**(1): 41-43.
- Tewari, S.D. & Pant, Giribala 1983. *Riccia curtisii* (Aust.) James from Kumaon Himalayas. *Curr. Sci.* **52**(4): 164-165.
- Tewari, S.D. & Pant, Giribala 1984. Present distribution of two rare, monotypic endemic liver worts, *Stephensoniella brevipedunculata* Kash. and *Sewardiella tuberifera* Kash. in Naini Tal and environs. *Jour. Himalayan Research and Development* **3**(1): 48-50. Kumaon University, Naini Tal.
- Udar, R. & Srivastava, S.C. 1983a. Rare and endangered liverworts of India. In: S.K. Jain & R.R. Rao (eds)-*An Assessment of Threatened Plants of India* (Proceedings of Seminar, Sept. 14-17, 1981). Botanical Survey of India, Botanic Gardens, Howrah.
- Udar, R. & Srivastava, S.C. 1983b. Reproductive biology of some Indian liverworts. *Phytomorphology* **33**: 37-46.