

Bryological activities in north-west Himalaya

III A field excursion to the Pindari Glacier region of District Almora (Kumaun Himalaya)

by

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A 12 day excursion was undertaken from 10 - 22 September 1985 to the famous Pindari glacier of the Almora district in the Kumaun Himalaya to explore the bryo-flora of that region*. It is one of the most easily accessible Himalayan glaciers and has always attracted a large number of naturalists and mountaineers. During the rainy season of 1982, the first author had trekked up to Pindari and made random moss collections (Tewari *et al.*, 1982) but a thorough bryo-exploration was needed.

The Pindari valley is situated in the Northern mountainous region of district Amora (Kumaun Himalaya) between longitudes 79° 13' - 80° 2' E

and 30° - 30° 15' N (Fig. 1). It occupies an area of 339.39 km² of Uttar Pradesh Himalaya and is drained by the Pindar river that emerges from the glacier. There are several tributaries of this river like the Kafni, Sunderdhunga, Kailganga and Attagadh. The river, in its initial course, flows through sedimentary rocks but further to the south it meanders through quartz schists. Granite is found in abundance in this area (Walton, 1911). Close to the glacier is an open undulating meadow, and to the East a lofty moraine made up of gravel and blocks of snow embedded in ice which project from the glacier. The soil is rocky in nature, but in forest sites it is humus-enriched. The climate of the valley is varied depending upon its aspect as the snow-line fluctuates between 1300 m and 5000 m (Walton, 1905) and precipitation between 150 and 175 cm (Sharma, 1983).

We journeyed by bus from Naini Tal to Kapkot (1400 m; Fig. 1) through undulating, forested, hilly terrain dominated by pure and mixed forests of *Pinus roxburghii* and *Quercus* spp. At places the forest landscape was dissected by terrace cultivation.

From Kapkot the remainder of the journey was by foot, 60 km to Pindari. Two porters accompanied

IAB: the next two years

The *International Association of Bryologists* has come a long way since its beginning in 1969. There are now about 550 members from over 40 countries. The Association meets biennially, and in 1989 about 50 bryologists gathered at the Missouri Botanical Garden in St. Louis, Missouri to listen to presentations on the subject of Tropical Bryology and to participate in the discussions. During this meeting, the Executive met and formulated several important policies that were ratified by the persons in attendance. What follows is a report on these and other significant happenings of the Association.

The sad and untimely passing during the summer of 1989 of our President and Editor of *The Bryological Times*, Stanley Greene, left a large void to be filled. In St. Louis, Timo Koponen was ratified as the President of the Association and S. Rob Gradstein has agreed to begin the editorship of *The Times*, assisted by Guido van Reenen and Paula Greene. *The Times* will be issued six times a year. Volume three of the *Advances in Bryology* was published early in 1989, and the editor, Norton Miller, is presently arranging articles for Volume four. The *Glossary of Bryological Terms*, edited by Robert Magill, is ready for publication and will be issued early in 1990.

Volume 11 of *Index Hepaticarum*, edited by Patricia Geissler,

* During the last three years, a major part of this collection has been duly identified.

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us. At the bryophyte-rich gorge of Kharbagarh (1300 m) we collected a large number of thalloid and leafy liverworts: *Asterella wallichiana* (Lehm.) Grolle, *Conocephalum conicum* (L.) Dum., *Cyathodium tuberosum* Kash., *Dumortiera hirsuta* (Sw.) Nees, *Marchantia palmata* Nees, *Reboulia hemisphaerica* (L.) Raddi, *Riccia* sp., *Aneura pinguis* (L.) Dum., *Pellia endiviaefolia* (Dicks.) Dum. and *Chiloscyphus polyanthus* (L.) Cord. Close to the boundary of this gorge around a sulphur-spring we collected *Splachnobryum procerrimum* Dix. and *Hydrogonium consanguineum* (Thwait. & Mitt.) Hilp. Substrate and water samples were taken for analytical study. From Kharbagarh, we followed a track to Loharkhet through sub-tropical terrain and on the way collected acidophilous forms such as *Jungermannia confertissima* Nees, *Bryum* sp., *Campylopus fragilis* (Brid.) B.S.G. and *Scopelophila gedeani* (Lac.) Nog. on exposed limonite outcrops along the roadsides. Around us were terraced fields with standing crops of rice, maize and millets such as *Eleusine coracana* and *Setaria italica* (L.) P. Beauv., locally called "Madua" and "Kauni" respectively. In these fields we found common liverworts like *Riccia* sp., *Anthoceros* sp. and copiously fruiting male and female thalli of *Cyathodium tuberosum*. At places, moist seepage areas were covered by lush growth of liverwort-moss associations. Prominent among these were communities of *Conocephalum*, *Marchantia*, *Aneura*, *Pellia*, *Chiloscyphus*, *Anthoceros*, *Anomobryum*, *Eurhynchium*, *Hydrogonium*, and *Plagiomnium*. In contrast, exposed rocks presented a dry barren appearance with only scanty colonization by *Grimmia donniana* Sm., *Macromitrium* sp. and *Frullania nepalensis* (Spreng.) L. et L. in places.

From Loharkhet we ascended a serpentine path through dense, mixed



Fig.1 The route to Pindari glacier

temperate oak forest with its 'characteristic, green fresh look'. Bryophytes were collected en-masse from this area. There was a great variety of epiphytic as well as forest-floor species. Almost all the trees and shrubs were densely covered with liverworts and mosses. *Quercus leucotrichophora* appeared to be the most species-rich oak, its trunks covered with a mixed liverwort-moss felt. As a rule bryophytes were more abundant on the tree bases gradually

diminishing towards the top. *Apometzgeria pubescens* (Schrank) Kuwah., *Frullania pyriformis* St., *Lejeunea tuberculata* Steph., *Porella densifolia* sub sp. *appendiculata* (Steph.) Hatt., *Ptychanthus striatus* (L. et L.) Nees, *Anomodon rugelii* (C. Müll.) Keissl., *Cryptoleptodon flexuosus* (Haarv.) Ren. & Card., *Entodon plicatus* C. Müll., *Erythrodonium julaceum* (Schwaegr.) Par., *Floribundaria floribunda* (Doz. & Molk.) Fleisch., *Herpetineuron*

toocoeae (Sull. & Lesq.) Card., *Homaliodendron montagnanum* (C. Müll.) Fleisch., *Leucodon secundus* (Harv.) Mitt., *Macromitrium moorcroftii* (Hook. & Grev.) Schwaegr., *Meteoriopsis formosana* Nog., *M. reclinata* (C. Müll.) Fleisch., *Meteorium buchananii* (Brid.) Broth., *Thamnobryum subseriatum* (Hook.) Nog. & Iwats., and *Thuidium tamariscellum* (C. Müll.) Bosch. & Lac. were all recognized in the field. The rotten logs, stumps and fallen twigs on the humus-laden forest floor were covered with rich hepatic-moss mixtures, the most prominent being a fruiting population of *Calycularia crispula* Mitt. Other conspicuous species were *Riccardia sikkimensis* (St.) Pande et. Srivast., *Chandonanthus hirtellus* (Web.) Mitt., *Lepidozia reptans* (L.) Dum., *Lophocolea bidentata* (L.) Dum., cushions of *Leucobryum nilghiriense* C. Müll. and *Octoblepharum albidum* Hedw. and tufts of *Fissidens* sp. The moist, shaded road-side track yielded magnificent mats of *Lophocolea bidentata* together with *Bazzania praerupta* (Reinw. et al.) Trev., *Plagiochila chinensis* St. and *Scapania* sp. A little below the Dhakuri top (2500 m) we collected some sterile patches of a rare, endemic monotypic liverwort, *Sewardiella tuberifera* Kash. The near-by open meadows were also examined and a dominant population of *Bryum pseudotriquetrum* (Hedw.) Gaertn. was noticed along with associates like *Conocephalum conicum*, *Aneura pinguis*, *Riccardia multifida* (L.) Gray and *Scapania* sp.

After an arduous climb of 1 km we reached the top of the Dhakuri pass (2900 m) to be rewarded with the enthralling spectacle of an Himalayan panorama of snow-clad peaks and the Sunderdhunga and Pindari glaciers. The strong icy-cold winds encouraged us not to prolong our sojourn at this lovely spot.

The area around Dhakuri is covered in oak-conifer forest and was

found to support a great variety of bryophytes. The richest of all were the fern-bryophyte laden tree-trunks and branches, even of shrubs and saplings. Large cushions of *Dicranum scoparium* together with pendant colonies of many hanging mosses such as *Cryptoleptodon flexuosus*, *Floribundaria floribunda*, *Meteoriopsis reclinata*, *Meteorium buchananii* and *Papillaria fuscescens* (Hook.) Jaeg. embellished the trunks of *Quercus*, *Cedrus* and *Cupressus* spp. Bryophytes were also collected from some specialized habitats such as "knot holes", fruiting bodies of wood-decaying fungi and from old humified animal dung. A nearby marshy-meadow attracted attention where aquatic bryophytes such as *Aneura pinguis*, *Bazzania* sp., *Scapania* sp., *Bryum pseudotriquetrum*, *Cratoneuron filicinum* (Hedw.) Spruce and *Drepanocladus uncinatus* (Hedw.) Warnst. were the chief colonizers.

From Dhakuri we had to descend 400 m to the next stop at Khati. We again passed through dense temperate oak-conifer (*Cedrus deodara*, *Cupressus torulosa*) forest, its bryo-flora being more or less the same as observed at Dhakuri. Some interesting forms were collected e.g. *Metzgeria leptoneura* Spruce, *Porella macroloba* St., *Tritomaria exsecta* (Schmid.) Schiffn., *Bartramia pomiformis* Hedw., *Bryoerythrophyllum* sp., *Macromitrium hymenostomum* Mont., *Ptychomitrium rhacomitrioides* Dix. and *Syrphopodon spiculosus* Hook. & Grev. Around natural water sources, *Conocephalum conicum*, *Dumortiera hirsuta*, *Marchantia palmata*, *M. polymorpha*, *Eurhynchium riparioides*, *Plagiomnium integrum* and *Philonotis fontana* associations were prominent.

After covering a distance of 8 km, we could see the tiny village of Khati (2600 m) situated on the banks of the river Pindari surrounded by terraced cultivation. Cultivated pota-

to fields yielded fruiting material of *Riccia* sp., *Anthoceros erectus* Kash., *Notothylas levieri* Schiffn., *Entosthodon wallichii* Mitt. and *Physcomitrium eurystomum* Sendtn. The hill-tops around Khati were also explored and collections of *Bryum capillare* Hedw., *Campylopus umbellatus* (W. Arn.) Par., *Grimmia* sp., *Hypnum cupressiforme* Hedw., *Mnium lycopodioides* Schwaegr., *Pogonatum microstomum* (Schwaegr.) Brid. and *Racomitrium crispulum* (Hook. f. et Wils.) Hook. were made.

When we reached Khati, the local people came flocking to meet us and asked why we were collecting these plants locally called "muk" which they use as bedding, packing, plugging and stuffing materials.

From Khati onwards we took the route along the Pindari river to Dwali (3000 m). This gorge was thickly forested with a cool, temperate vegetation dominated by *Rhododendron arboreum*, *Quercus floribunda*, *Cedrus deodara* and *Cupressus torulosa* associations. The trees were covered with epiphytic ferns, mosses and leafy liverworts. Conspicuous amongst them were pendant species of *Frullania*, *Ptychanthus*, *Cryptoleptodon*, *Floribundaria*, *Meteoriopsis*, *Meteorium*, *Papillaria* and *Leucodon*: wefts of species of *Anomodon*, *Brachythecium*, *Entodon* and *Thuidium*: mats of species of *Lophocolea*, *Radula* and *Plagiothecium*: turfs of *Herbertus* sp. and *Dicranum* sp. and dendroid fans of species of *Homaliodendron*, *Neckera*, *Pterobryopsis* and *Thamnobryum*. The moist, shaded boulders were covered with a luxuriant growth of intermingled liverworts and mosses including *Frullania squarrosa* Nees, *Lejeunea nepalensis* Steph., *Lophocolea bidentata*, *Plagiochila* sp., *Ptychanthus striatus*, *Radula complanata*, *Anomodon minor*, *Brachythecium buchananii*, *Bryum retusifolium* Card. & Vard., *Hyophila involuta* (Hook.) Jaeg., *Macrothamnium sub-*

macrocarpum, *Mnium lycopodioides*, *Pohlia elongata* Hedw., *Rhodobryum roseum* (Hedw.) Limpr., *Thamnobryum subseriatum* and *Thuidium tamariscellum*.

In contrast, the exposed granite rocks and boulders strewn all along the banks of the Pindari river were studded with small cushions of *Grimmia* sp. and extensive patches of *Racomitrium* sp. While passing through this dense "mossy" forest between Khati and Dwali near Malayadaur, we came across a green fertile patch of the rare endemic *Stephensoniella brevipedunculata* Kash. on moist soil. Other noteworthy collections from this area included the rare liverwort *Blasia pusilla* L. and *Bartramia halleriana* Hedw., the latter a new moss record for Western Himalaya. Near Dwali rest house, exposed dripping hillside rocks were covered with a profuse growth of *Dumortiera hirsuta*, *Marchantia palmata*, *Pellia endiviaefolia*, *Chiloscyphus polyanthus*, *Bryum* sp., *Eurhynchium riparioides* with *Hydrogonium consanguineum* forming a conspicuous part of the scenery.

The vegetation of Dwali was very profuse and the temperate *Cupressus torulosa*, *Cedrus deodara*, *Taxus baccata*, *Rhododendron arboreum* and *Ilex diphyrena* were locally dominant. The meeting place of the Kafni and Pindari gorges is a rocky mountainous region.

Beyond Dwali we ascended to an altitude of 3200 m. The sub-alpine flora along the way to Furkia formed a very dense herb-rich vegetation with a sprinkling of evergreen trees and conifers such as *Rhododendron campanulatum*, *Lonicera alpigena* and *Taxus baccata*. The trees were draped with epiphytic bryophytes and ferns. On the way to Furkia, up to the timber line, the following interesting species of bryophytes collected were: *Conocephalum conicum*, *Cryptomitrium himalayense* Kash., *Reboulia hemisphaerica*, *Tar-*

gionia hypophylla L., *Wiesnerella denudata* (Mitt.) St., *Bazzania praerupta*, *Herbertus* sp., *Plagiochila* spp., *Porella macroloba*, *Scapania undulata* (L.) Dum., *Actinohuidium hookeri* (Mitt.) Broth., *Bryoerythrophyllum wallichii* (Mitt.) Chen, *Bryum pseudotriquetrum*, *Encalypta ciliata* Hedw., *Grimmia donniana* Sm., *Homaliodendron ligulaefolium* (Mitt.) Fleisch., *H. sphaerocarpum* Nog., *Hylocomium* sp. and *Racomitrium himalayenum* (Mitt.) Jaeg. It was interesting to note that luxuriant bryophytes prevailed up to the timber line where increase in elevation resulted in a gradual depletion of the bryo-vegetation.

Above the timber line we saw a curious liverwort in perfect fruiting condition that was later identified as the extremely rare monotypic *Sauchia spongiosa* Kash. This was the first record of this species from the Kumaun Himalaya since its original discovery by Kashyap (1916) from high altitudes (2700-4350 m) of the middle and main Himalayas (Tewari et al., 1987). As we proceeded higher up it became extremely cold and snow patches were visible all around. The exposed granitic rocks/boulders lying along the path were covered with *Grimmia* and *Racomitrium* species.

The next phase of the exploration was confined to Furkia and the Pindar valley adjoining the Pindari glacier (up to an elevation of 4000 m). Furkia and its environs has a sub-alpine vegetation mostly characterized by a paucity of trees although there were stunted species of *Rhododendron campanulatum* and *Betula utilis*. Exposed boulders of an open undulating meadow were vegetated by several xerophytic mosses such as *Bryoerythrophyllum wallichii*, *Distichium capillaceum* (Hedw.) B.S.G., *Ditrichium heteromallum* (Hedw.) Britt., *Encalypta ciliata*, *Grimmia alpicola* Hedw., *Hyophila spathulata* (Harv.) Jaeg., *Racomitrium himalayenum*, *Syntrichia princeps* (De Not.)

Mitt. and *Tortella fragilis* (Hook. & Wils.) Limpr. Two species of *Bryum* grew near-by, on gravelly alpine moranic soil. Both were found firmly embedded in the sandy soil, the only visible parts being reddish-brown, pendant capsules of *B. bicolor* Dicks. and the shoot tips of *B. paradoxum* var. *reflexifolium* (Ochi) Ochi. Amongst alpine aquatic bryophytes, *Aneura pinguis*, *Marchantia polymorpha*, *Chiloscyphus polyanthus*, *Bryum pseudotriquetrum*, *Cratoneuron commutatum* (Hedw.) Roth., *Drepanocladus uncinatus*, *Eurhynchium riparioides*, *Fissidens grandifrons*, *Rhizomnium horikawae* (Nog.) Kop. and *Philonotis fontana* were the taxa most frequently observed. Another prize specimen was *Preissia quadrata* (Scop.) Nees! The large fertile patches of this thalloid liverwort were found growing on moist alpine soil and rock associated with *Jungermannia* sp., *Lophocolea cuspidata* (Nees) Limpr., *Brachymenium bryoides* Schwaegr., *Brachythecium buchananii*, *Bryum capillare* and *Hyophila involuta*. This is the first collection of this taxon from the Kumaun Himalaya. Previously it had been collected only once by Kashyap (1929) from Sonmarg, Kashmir. Some epiphytic mosses were also collected from semi-erect or prostrate plants of *Juniperus* and *Rhododendron*. Another thrilling collection was some more *Sauchia spongiosa*!

On the return journey from Furkia we camped at Dwali to explore the Kafni glacier, the final locality of our collection trip. We passed through the magnificent Kafni gorge along the banks of the river Kafni. The thick, cold-temperate mixed forest of *Cedrus deodara*, *Abies webbiana*, *Taxus baccata* with intermixed oaks, maples, walnuts and chestnuts had a splendid grandeur but the bryophytic vegetation was more or less the same as observed between Dwali and Furkia. The alpine meadows near the Kafni

glacier had the same bryo-flora as found in the Pindar Valley. However, interesting plants collected from this region and subsequently identified were *Riccia* sp., *Fossombronia* sp., *Jungermannia* sp., *Bryum alpinum* With., *Gymnosomiella vernicosa* (Hook.) Fleisch., *Grimmia alpicola*, *Pogonatum alpinum* (Hedw.) Röhl. and *Racomitrium crispulum*. We spent the night at Dwali rest house and started homewards in the early hours of the 20th Sept., reaching Naini Tal on the 22nd September. The toil and sweat, the thrills and the joys of the trip to Pindari and its environs were now far behind us.

Acknowledgements

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IAB: the next two years, continued

is in press and Volume 12 will be issued in 1990. The fourth *Supplement to Index Hepaticarum*, edited by John Engel, has just appeared in *Taxon*. The coverage of 1982-1983 is in its final editing. The 25 year update of *Index Muscorum*, edited by Marshall Crosby, will be soon be published in *Regnum Vegetabile*. A new, third edition of the *Compendium of Bryology*, edited by S. Rob Gradstein, Zen Iwatsuki, and Dale Vitt, will be issued in 1993 at the meeting in Tokyo, Japan. Barbara Murray and Jan-Peter Frahm are currently arranging a list of electronic mail addresses of all bryologists; it will be issued in *The Times* and will become part of the *Compendium*.

We have arranged with Gebrueder Borntraeger Verlagsbuchhandlung, Johannes-strasse 3A, D-7000 Stuttgart 1, Federal Republic of Germany, for all IAB members to receive a 25% discount on the following publications:

- *Advances in Bryology*, Volumes 2 and 3;
- All volumes of *Bryophytorum Bibliotheca*;
- *The Conspectus of Bryological Taxonomic Literature*, Parts 1 and 2.

As well, subscription to *Nova Hedwigia* is offered to IAB members at a 25% discount. Please send your orders directly to the publisher at the above address, mentioning that you are a current IAB member.

The next meeting of the Society will be held with the British Bryological Society in Exeter, U.K., between July 12 and 23, 1991. This meeting will be the site of the First International Symposium on the "Biology of Sphagnum", while the theme of the associated IAB meeting will be "Experimental Bryology". A selection of the papers presented during the Sphagnum symposium will form the basis for Volume 5 of

the *Advances in Bryology*. In 1993, the Association will meet as part of the International Botanical Congress in Tokyo, Japan. The executive are considering proposals for a 1995 meeting site; these include Mexico City, Mexico and Beijing, China.

Meetings being sponsored by IAB in 1990 include the CEBWG meeting in Kirovsk, U.S.S.R. (26-30, June); the Congress of East Asiatic Bryology in Helsinki, Finland (12-19, August); and the Endangered Bryophytes in Europe Symposium in Uppsala, Sweden (24-28, September).

Several new projects have begun and standing committees have been appointed, including The Committee on Tropical Bryology, chaired by Benito Tan, (with membership of I. Sastre, T. Pócs, and H. Mohammad). Patricia Eckel is presently designing a logo for the Association, which we hope to present to the membership early in 1990. *Flora Africanum*, headed by Robert Magill and Tomas Pócs will publish a *Guide to Contributors* in 1990. A standing committee on Endangered Bryophytes was formed, co-chaired (pro tem) by Richard Andrus and Tomas Hallingbäck. The committee will be involved in formulating world lists of endangered species for use by the International Union for the Conservation of Nature.

The Association has established an Endowment Fund that will be used to furnish small grants to members. The Executive is presently formulating guidelines for grant applications. The Association will call for applications in time for the first presentations at the Exeter meeting in 1991. We expect for this first competition that there will be about \$800-\$1000 (US) available. An announcement will be made in a future *Bryological Times*.

Consequences of the movement of the secretariat of IAPT (International Association for Plant Taxonomy) to Berlin after the Berlin Botani-

cal Congress has caused some concern among members of IAB. Our finances are now completely separate from those of IAPT, but we have arranged with IAPT for continued association. This relationship results in the ability to publish the *Bulletin of Bryology* in the journal *Taxon*. In past years, members of IAPT were considered members of IAB as well (if they so wished) with no further dues required, and in return IAPT furnished many services for us in Utrecht. These services must now be paid for by our Association. While IAPT does reimburse us some of the dues they collect (about \$5/per member US), the amount is not comparable to what regular members pay. To bring about parity, the Executive has recommended that current IAPT members begin to pay dues to IAB of \$5.00 (US) per year. Additionally, the Executive recommended that dues be increased to \$10.00 (US) per year for all non-IAPT members. This takes effect January 1, 1990. We now have a postal giro account in The Netherlands, for the convenience of our European members. I might add that for all members who must pay a large bank fee for transfer of funds, please consider sending small amounts (yearly dues) in US or Canadian cash.

Our Association is running smoothly and we hope it is serving its members well. The Executive is extremely interested in having input from all of our members and will welcome any comments. Please send comments, questions, or concerns to myself or our new president.

Dale H. Vitt, Secretary

The IAB tropical bryology conference (St. Louis 1989)

by

Angela Newton

The Conference on Tropical Bryology of the International Association of Bryologists (31 July-3 August 1989) was hosted by the Missouri Botanical Garden and organised by Bruce Allen and Robert Magill. It was a truly international meeting, with representatives from at least 17 countries and with nearly two thirds of the 53 participants from outside the United States.

The majority of the sessions were held in the Schoenberg Auditorium in the Ridgeway Centre of the Missouri Botanical Garden, with contributed paper sessions held in the Wohl Centre of Washington University. The audio-visual facilities of the Schoenberg Auditorium were excellent, but unfortunately the small screen and poor lighting in the Wohl Centre resulted in many of the slides there being faint or indecipherable. The long breaks after lunch provided ample opportunity for leisurely strolls to appreciate the well-laid out Garden, and for visits to the Herbarium and Library. The two evening banquets, held in the Ridgeway Centre and the Library, featured good food and a convivial atmosphere, especially following the free bar on the second evening!

The participants were welcomed by the Director, Peter Raven, who gave a brief history of the Garden and a summary of work under way. In particular he emphasised the support of the Garden for bryology, that loans are encouraged (including those of unsorted collections for floristic studies) and that there is a co-operative program for graduate study with four neighbouring Universities. Alan Harrington then spoke briefly in memory of our late

President, Stanley Greene, who was a founder of the I.A.B. and of the *Bryological Times*, an editor and a major contributor. He was a co-worker with high expectations of others, and above all he is remembered by many as a loyal friend and a good social companion.

Nearly a third of the papers dealt with floristics, covering most areas of the moist tropics, and giving an interesting survey of the special problems and rewards associated with work in tropical countries. Many of the papers discussed aspects of the biology and ecology of the organisms in addition to the distribution of taxa.

T. Koponen (University of Helsinki) reported on the progress of the Bryophyte Flora of Western Melanesia, which is now more than half finished. A hepatic check list has been produced and a moss checklist is in preparation. Many new records for the area have been added but 300 names have been reduced to synonymy. The moss flora shows a closer relationship to Indonesia, the Philippines and continental Asia than to Australia. Endemism is higher in liverworts (40%) than mosses (18%), and is found mostly above 1700m. Since the area appears to have emerged recently, 10 mya, these endemics may be relatively young.

T. Pocs (Agricultural University, Morogoro, Tanzania) emphasised the value of different approaches in extending the knowledge of the bryoflora of a region such as East Africa. Much new information has been obtained by exploring under-collected areas, taking new routes on well known mountains, and by looking at specialised habitats. This

information is particularly important for phytogeographical and evolutionary studies. Interesting observations were made on the specialised epiphytic vegetation along the Rift Valley. Differences in geological age and climate could not adequately explain the striking differences in the composition of the flora. An alternative explanation given was that alkaline dust blown from nearby soda lakes during the dry season has resulted in the development of an alkaline tolerant vegetation. This was borne out by measurements on the magnesium and potassium content of the soils and bryophytes in the region.

D. Griffin (University of Florida Museum) in an interesting account of the paramo vegetation of South America tackled two major questions - when did the paramo become available for colonisation, and what were the sources of the colonising elements? Pollen stratigraphy from high altitude lake beds indicates that paramo vegetation appeared rather suddenly 1-3 mya in the Lower Pleistocene, when there was a dramatic increase in the pollen of the Poaceae and the Asteraceae. In Venezuela paramo occupies only 1% of the land area but contributes 39% of the 700 moss species known. All the largest genera are acrocarpous, as are 72% of the species, a pattern similar to that seen in other open areas and in contrast to that seen in forest areas where about 50% of the species would be acrocarps. Paramo elements may have come from open wet patches at lower elevations. The most important elements in the paramo flora are Neotropical (37%), Andean (26%) and Cosmopolitan (18%).

P. Redfearn (South-West Missouri State University) described the moss flora of the four tropical areas in China. Three vegetation types present are evergreen rain forest, semi-evergreen broadleaved forest and evergreen bamboo. The flora has

most affinity with other Asian regions. In a later paper **R. Hu** (East China Normal University, Shanghai) described the seven floristic districts of China and listed many of the families and genera present.

B. Tan (Harvard University) discussed the affinities of hepatics in the Philippines, Borneo and New Guinea, which are similar to those known for mosses, but whereas in the large, actively evolving moss genera many species are shared between the three areas, in similar hepatic genera few of the species are shared. This may be due to poor dispersability of spores and reliance on asexual reproduction in the hepatics, or to differences in taxonomic concepts between the two groups.

Z. Iwatsuki (Hiroshima University) spoke on the flora of New Caledonia, using *Fissidens* and *Frullania* as examples. Endemism appears high (although much lower than that known for phanerogams) but it is expected that revisions will decrease this significantly. Differences in endemism between these genera were attributed to differences in sexuality and spore size.

R. Gradstein (University of Utrecht) discussed the bryoflora of the Guianas and included some superb slides of Mt Roraima. Studies of the number and distribution of species found per tree sampled showed that a large proportion (75%) of the local epiphyte flora of the mixed lowland rain forest could be found on five trees, and that the base of the canopy contained the largest number of species. Floristic variation was found between the different types of rain forest. The largest element of the flora is widespread lowland neotropical (90%) and the remainder are Caribbean, North Amazonian and Guayana Highlands elements. The few disjuncts are likely to be artificial and due to lack of collecting. The area is of particular importance for its large areas of

undisturbed rain forest and the availability of good field stations.

Several papers dealt with the systematics and evolution of major families or genera. Some cladistic methodology was included, and again there was a tendency to include aspects of the ecology and biology of the living plants.

H. Robinson (Smithsonian Institution) dealt with the functional evolution of the Leucobryaceae. The Leucobryaceae was defined as consisting of eight genera, with *Exodictyon* and *Leucophanes* excluded. The evolution of the Leucobryaceae was considered to consist of four functional stages - stratification of the leaf, shift from soil to epiphytic habitats, increased reliance on vegetative reproduction and increase in numbers of chlorocysts. The leucocysts in *Leucophanes* were held to be not homologous with those in the Leucobryaceae (as defined) in that in the latter the contained air was considered to be internally generated. This provoked many questions about the physiological and taxonomic significance of air bubbles in leucocysts. The use of "reasonably" paraphyletic groups was defended on the basis that we still know very little about the process of evolution, although use of "extremely" paraphyletic groups was rejected. However, on the pseudocladogram shown the basal position of *Leucobryum* was "undefined" rather than paraphyletic, in that there were no synapomorphies shared by some portion of *Leucobryum* and the rest of the family.

D. Vitt (University of Alberta) discussed the evolution of drought tolerant epiphytes on angiosperms, using *Macromitrium* as an example of a very successful genus that has managed to climb out of the slime! In general, tropical epiphytic bryophytes were considered to be more derived than those from higher

latitudes, having adapted to a highly unstable, stressful environment with high light levels and incidence of drought, and rapid succession. Pseudo-autoicy (or phylloidioicy) was seen as an adaptation to epiphytism, providing a mechanism to increase outbreeding and thereby evolutionary rate, although this hypothesis provoked some lively discussion later. Comparison of patristic distances for Australasian species of *Macromitrium* indicates that canopy species are more derived than other species.

J.-P. Frahm (University of Duisberg) raised the question of whether *Campylopus* could be considered a modern and successful genus (despite still inhabiting the slime). In a highly informative presentation he discussed many aspects of the structure, ecology, reproductive biology and phytogeography of the genus. The genus is very large (600-1000 spp) with a wide latitudinal, altitudinal and habitat range (although mostly on acidic substrates). Anatomical data is taxonomically important, with the costa showing a wide range of structures that can be accounted for by just a few types of cell division. Experimental evidence, using an IRGA, indicates that the plants are unable to tolerate high temperatures, which is reflected in their temperate and montane distribution. Analysis of the continuity of climate through geological ages was used to estimate the age of species. Approximately 60% of speciation was thought to have occurred in the Tertiary, 30% in the Cretaceous and 10% in the Triassic, so although very successful, the genus cannot be considered modern.

R. Pursell (Pennsylvania State University) gave an account of *Fissidens* in the Neotropics. The basic leaf structure and features used in classification were reviewed, and new characters in the costa structure and peristome sculpturing were

mentioned. These were later described in detail by **M. Bruggeman-Nannenga** (University of Utrecht). No segregate genera are now recognised, but several subgenera and numerous sections are used. The use of only one main suite of characters (leaf structure) was questioned later, and the possible significance of branching patterns was raised.

B. Allen (Missouri Botanical Garden) discussed his revision of the epiphyllous neotropical genus *Crossomitrium*. The genus has been variously classified on the basis of its sporophyte morphology but is now placed in the Hookeriaceae on the basis of its vegetative features.

Three papers concerned aspects of bryogeography.

W. Buck (New York Botanical Garden) spoke on the biogeography of the Greater Antillean mosses. Vicariance biogeography holds that the distribution of organisms is due to vicariance events (the separation of groups of organisms by rising sea levels, mountain building, plate tectonics etc.) rather than dispersal. The tectonic history of the Caribbean has been used to explain the distribution of many groups of organisms, but is complicated and still under dispute. There is evidence that sea levels have been both higher and lower than those presently seen, so that at times the islands have been submerged and at others much larger and drier. This evidence, together with the ease of dispersability of mosses and the affiliations of the taxa, may indicate that the ecological history of the islands is more important than tectonics in determining moss distribution in this area.

B. Mishler (Duke University) described the various distribution patterns shown by the 23 Mexican species of *Tortula*, which reflect to a large extent those recognised for angiosperms. Five species show disjunction between the Andes and

the very recent Mexican volcanoes. Aspects of the biosystematics of the *T. ruralis* complex were presented, including the behaviour of taxonomic characters in culture. Finally it was demonstrated that asexual species can be just as distinct morphologically as sexual species, despite the absence of gene flow to hold the species together, a finding that poses problems for the prevailing biological species concept.

R. Schuster (University of Massachusetts) discussed the origins of the Neotropical Hepaticae. He emphasised that evolutionary rates of mosses and hepatics may not be the same, and that any biogeographical comparisons at the species level may not be valid unless the group has been thoroughly revised. He then summarised the geological history of the continent, which has been isolated for a very long time, separating from Africa about 90 mya and from the W Antarctic 60 mya. There has been some connection with N America in the Cretaceous, and a separation between the northern and southern parts of S America, probably until the Andes arose in the Tertiary. However, the many endemics and strange taxa in the area may have required more time than this to evolve. He noted that many areas with high levels of tectonic activity (the "ring of fire" round the Pacific) are much more interesting and have many more unusual taxa than older stable areas and concluded that rates of evolution are not constant and may be stimulated by disturbance and tectonic instability.

The contributed papers addressed several topics in addition to those already mentioned, including ecology, fossil bryophytes, anatomy and development, and regional progress reports.

M. Ignatov (Main Botanical Garden Herbarium, Moscow.) reported some new fossil finds from the Upper

Permian (ca. 250 mya) of the North Russian Platform. They represent 12 genera, including 8 recently established, and can be related to modern Dicranales, Pottiales, Funariales, Leucobryales and Hypnobryales. In fossils of *Protosphagnum*, *Intia*, *Uskatia* and some related genera described by Neuburg the leaves attach to the stem by the costa only, a feature not known previously in any fossil or recent mosses. In *Rhiznigerites neubergae* Meyer rhizoids appear both on stems just below the leaf insertion and on secondary axes completely lacking leaves.

A. Harrington (British Museum (Natural History)) described the flora and vegetation zones of Nigeria. The bryophyte flora is relatively poor since much of the country is dry lowland and little is undisturbed, but there are still unexplored wet forest and highland areas that need work. Traditional agricultural practices (shifting cultivation, tree crops) allow some forest bryophytes to persist, and a National Park has been established recently in a key area. P. Geissler (Conservatoire et Jardin Botanique, Geneva) spoke briefly on the flora of Paraguay and the status of *Marchesinia*, which has now been reduced to 5 species, including the widespread and weedy *M. brachiata*. J. Snider (University of Cincinnati) discussed the eastern North American distribution of *Tetradontium brownianum*, which now appears to be more widespread than was previously thought. Masking tape was used to collect very small sterile plants from virtually inaccessible parts of overhanging rocks, which made it possible to find the plants with much greater ease.

C. Delgadillo (Universidad Nacional Autonoma de Mexico) reported on progress in Mexico, where there has been a marked increase in bryological publications in recent years. H. Miller (University of

Central Florida) in an account of the progress of Pacific Bryology gave a poetic and stirring oration on the urgent necessity for conservation "as the growl of chainsaws spreads across the land."

E. De Luna (Duke University) showed very convincing anatomical evidence that the Hedwigiaceae are acrocarpous, with the archegonia terminating the main apex and further vegetative growth occurring from lateral innovations, while A. Newton (Duke University) discussed the leaf sequences found along developing shoots and the structural components that contribute to the complicated morphology of *Pireella* (Pterobryaceae).

J. Glime (Michigan Technological University) spoke about an ecological study using herbarium material (of *Frullania* from Papua New Guinea) to provide data on altitudinal distribution and the distribution of sister species. The problem of taxonomic concepts and the lack of ecological data for many collections raised a number of questions. J. Enroth (University of Helsinki) described a similar study in which herbarium material was used to find floristic discontinuities in the vertical distribution of the moss flora of Papua New Guinea. The resulting zonation was very similar to that known from other tropical areas.

I. Sastre (Universidad Catolica, Puerto Rico) compared the bryoflora of two different areas of Puerto Rico (SW facing palm brake and NW facing lowland tropical forest) using frequency data collected at regular intervals along transects. This simple and straight-forward technique revealed differences in the species distributions and in the frequencies for each species between the two areas.

The organisers are to be complimented for such an interesting and pleasant meeting, and for the varied range of topics presented under the heading of "Tropical

Bryology". Several general themes appear to have emerged from the meeting. In particular, interactions between many of the topics studied were very apparent, so that floristic data contributed to studies of biogeography, evolution, reproductive biology and ecology and in turn gained from these subjects. The great age of bryophytes, in comparison to angiosperms, was highlighted by the discussion of vicariance events that resulted in the formation of bryophyte species but angiosperm families. It was also generally recognised that ecological and systematic techniques used must be acceptable to specialists in fields outside bryology. Many of the papers emphasised the extent of the destruction of the area under study, with the concurrent loss of essential and irreplaceable information, so that it is imperative that we do all we can to promote conservation in the tropics.

Duke University
Department of Botany
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New Exsiccata

Bryophyta Vogesiaca Exsiccata
fasc. 7-8, nrs.151-200

Campylopodex exsiccata fasc. 7,
nrs.151-175

Available on exchange basis from
Dr. J.-P.Frahm, Universität Duisburg,
Fachbereich 6, Botanik, Postfach
101503, 4100 Duisburg,
F.R.Germany.

Bryophyta Neotropica Exsiccata
fasc.IV, nrs. 151-200.

Available on contribution or
exchange basis (tropical materials
only) from Dr. S.R.Gradstein,
Institute of Systematic Botany,
Heidelberglaan 2, 3584 CS Utrecht,
The Netherlands.

Deaths

Dr. Vera Danilova Aleksandrova, formerly of the Laboratory of Geography and Cartography of Vegetation, The Komarov Botanical Institute, Leningrad, died on 14 January 1989.

Professor Akira Noguchi of Kumamoto University, Japan, died on 24 September 1988. In him Japanese botany has lost one of its most distinguished leaders. He suffered a cerebral haemorrhage in June 1988 in his home and was in hospital for three months. In August he was much improved but subsequently developed pneumonia which caused his death. - All his bryophyte collections are deposited in NICH, and a considerable number of duplicates are in the herbarium of Kumamoto University, Kumamoto. A list of his publications will appear in the Journal of the Hattori Botanical Laboratory. - Prof. Noguchi had been devoting his time to the preparation for publication of his *Moss Flora of Japan*. Part 2 of this work was published in December 1988 by the Hattori Botanical Laboratory. Parts 3-5 (supplemented by Z. Iwatsuki) will eventually be published also by the Hattori Botanical Laboratory. - Z. Iwatsuki, Botanical Institute, Faculty of Science, Hiroshima University, Higashi-senda-machi, Hiroshima 730, Japan.

Announcements

New editor for Techniques column
In the previous issue of *The Bryological Times* we announced that a new editor was being sought for the Techniques column, following the appointment of Janice Glime as editor of the new column on Ecology.

We are pleased to announce that Dr. Malcolm L. Sargent from the University of Illinois at Urbana Champaign has agreed to take up this position. Dr. Sargent is particularly keen to publish articles on techniques relating to biochemistry, physiology, culturing, genetics, development, anatomy, etc. In addition he would welcome contributions on techniques in ecology and systematics if publication in the Techniques column would be desirable.

Please send contributions for the Techniques column to Dr. Malcolm L. Sargent, School of Life Sciences, University of Illinois at Urbana Champaign, 505 South Goodwin Avenue, Urbana, Ill. 61801, USA.

New Bryological Journals

ACTA BRYOLOGICA ASIATICA

The journal is designed to be a venue for short scientific notes or brief technical articles regarding Asiatic bryophytes and lichens. Topics concerning taxonomy, phyto-geography, biology, morphology, chemistry and genetics of Asiatic bryophytes and lichens are welcome.

Manuscripts submitted for consideration can be written in Chinese or English, and must have an English summary. The total length of the manuscript must not exceed 15 typed pages. Manuscripts must be sent to either the publisher, Dr. Ming-Jou Lai, P.O.Box 19-004, Taipei, Taiwan 24199, or to the editor, Dr Benito C. Tan, Farlow Herbarium, Harvard University, Cambridge, Mass, U.S.A..

The journal is to appear twice a year; the first issue will be published in June 1990. Subscriptions to this new Asian journal are solicited. Subscription is US\$ 10/year, to be paid in cheque or money order

payable to the Asian Bryological and Lichenological club, P.O.Box 19-004, Taipei, Taiwan 24199.

TROPICAL BRYOLOGY

Although bryophyte diversity is much higher in the tropics than in temperate or polar regions, knowledge of tropical bryophytes is still poor. To promote this neglected field of science, this non-profit journal has been set up as a forum for all aspects of tropical bryology. Its editors are Dr J.-P. Frahm, Universität Duisburg, Fachbereich 6, Botanik, Postfach 101503, D-4100 Duisburg, BRD, and Dr S.R. Gradstein, Institute of Systematic Botany, Heidelberglaan 2, 3584 CS, Utrecht, The Netherlands.

Tropical Bryology only accepts manuscripts on diskettes after review and acceptance for publication and thus differs essentially from the present bryological journals. The final manuscript will not be rewritten and therefore there will be no need for proofreading by the author. The textfile (ASCII or wordprocessor file) will be directly processed into the style and format of the journal by desktop publishing. Thus, publication of articles will be possible in less than three months (depending on contributions available). A further advantage of this new journal is the low subscription price, with special rates for subscribers from tropical countries. The subscription price is US\$ 5 per 100 pages incl. postage (for subscribers from tropical countries) or US\$ 10 (for subscribers from all other countries). Please send orders for subscription to Dr J.-P. Frahm at the above address.

Book Reviews

R. E. Longton. 1988. *The biology of polar bryophytes and lichens*. Cambridge, Cambridge University Press, 391pp., 118 figs., 39 tables., 245 x 170 mm, hardback. Price £55 excluding postage.

Polar vegetation is often dominated by bryophytes and lichens and knowledge of the biology of these plants seems crucial therefore for a general understanding of the nature of polar ecosystems. *The biology of polar bryophytes and lichens* by Dr. R. E. Longton of the University of Reading, is a broad synthesis of the subject based on the author's 25 years of field experience in the Arctic and the Antarctic, and on his assessment of the literature, almost 800 references being cited. There are eight chapters which focus on general characteristics of the polar environment, on polar cryptogamic vegetation and its classification, on the ecophysiology, growth, reproduction and evolution of polar bryophytes and lichens and on the possible role of these plants in polar ecosystems.

The polar regions harbour a diversity of vegetation types and little agreement seems to exist about their classification, especially of that in the Arctic. In order to clarify the vegetational subdivision of the area, the author recognizes four life zones: mild-, cool-, cold- and frigid-polar, which are applicable to both the Arctic and the Antarctic. While these subdivisions seem to be both logical and natural, I would have liked for these terms to have been used more consistently in the text.

It appears that much work has been done on the physiological basis of the remarkable capacity of bryophytes and lichens to survive cold and arid conditions, and much space is devoted to a discussion of these topics. However, much less seems to

be known about the possible role of bryophytes and lichens in polar ecosystems. Although it has been well established that plants of both groups are important for fixing nitrogen in polar environments, and as food sources for lemming, reindeer and caribou, their functioning in the energy flow and nutrient cycling of the ecosystems remains poorly understood and current knowledge of these aspects appears to be still largely speculative.

The author of *The biology of polar bryophytes and lichens* is to be congratulated on a very nice and well-presented book. The subject seems to be very thoroughly treated to the current level of knowledge and the book will be the standard work of reference on the subject for years to come. We certainly need many more books of this kind on the world's bryophytes and lichens and the vegetation types they produce.

S R. Gradstein, Utrecht

Greene, S.W. and Harington, A.J. *The conspectus of bryological taxonomic literature. Part 1, Index to Monographs and Regional Reviews, Bryophytorum Bibliotheca* 35, 1988, 272 pp. *Part 2, Guide to National and Regional Literature, Bryophytorum Bibliotheca* 37, 1989, 321 pp. J. Cramer, Berlin and Stuttgart, price DM 120 for each volume with a 25% reduction for members of IAB.

This work documents the most useful literature relevant to the identification of bryophytes throughout the world. The first volume is arranged alphabetically by taxon: it gives an annotated index of

monographs, revisions and comparable works that deal with bryophyte orders, families and genera either at world level, or throughout a major geographical region. The second volume is arranged on a geographical basis and lists floras, checklists and bibliographies at a national or state level. The objective, as the authors state, is that "the two volumes will complement one another and will allow the identification of unknown material to be attempted via a national or state flora or handbook on the one hand, or a regional or worldwide monograph on the other".

Emphasis throughout is on the 50 years up to 1986, but the more important earlier works are also included. The references are set out in full, complete with diacritical marks where appropriate. An important and useful feature is that both bibliographic dates and actual dates are given, where they differ. On a conservative estimate Parts 1 and 2 contain approximately 2000 and 1200 entries respectively.

There is no doubt that this work will become an invaluable, and indeed indispensable aid to those engaged in identification work, or in dealing with taxonomic or floristic studies on mosses, liverworts or hornworts. Its publication is a tribute to the bryological vision and zeal of the senior author, the late Dr. Stanley Greene.

R.E. Longton, Reading

Diary

For explanation of acronyms, see
The Bryological Times 31: 7-8 [1985]

1990**April 4-11**

BBS, spring field meeting, Lancaster. Loc. Sec.: Mr. Martin Wigginton, Nature Conservancy Council, 70 Castlegate, Grantham, Lincolnshire, UK.

June 26-30

CEBWG meeting Kirovks, USSR. Further information from Dr. N.A. Konstantinova, Polar-Alpine Bot. Garden - Institute Kola Branch, Kirovsk, Murmansk Oblast, USSR.

July 1-7

IV International congress of systematic and evolutionary biology. University of Maryland, College Park, Maryland, USA.

August

BBS, summer field meeting, Ulster: Antrim, Derry and Donegal. Loc. Sec.: Dr. Keith Lewis, Biomedical Library, Queens University, Belfast City Hospital, Lisburn Road, Belfast, BT9 7AB. *First few days in the Cushendall/Cushendun area in the heart of the glens; the remainder of the first week in Castlerock/Limavady in the County Derry. The second week in north Donegal, headquarters Donfanaghy.*

August 12-19

Helsinki. Congress of East Asiatic bryology. See *Bryol. Times* 50: 5. Further information from Prof. T. Koponen, Department of Botany, University of Helsinki, Unioninkatu 44, SF-00170 Helsinki, Finland.

September

Annual general meeting and paper reading meeting, Cambridge. Loc. Sec.: Dr. Philip Stanley, 48 Glisson Road, Cambridge CB1 2HF. *Special meeting in honour of Professor Paul Richards and Dr Eu. tace Jones.*

Colofon

The Bryological Times, founded in 1980 by Stanley Wilson Greene (1928-1989), is the bimonthly newsletter of the INTERNATIONAL ASSOCIATION OF BRYOLOGISTS. It is published in Edmonton (Canada) and distributed from Edmonton, St. Louis (USA), Beijing (China), Tokyo (Japan) and Eger (Hungary).

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