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Ecology column

[*Ecology Column.* Send contributions to the column editor: Janice M. Glime, Department of Biological Sciences, Michigan Technological University, Houghton, Michigan 49931, U.S.A.]

A publication such as the *Bryological Times* can serve many purposes, foremost among them being communication. In a field where one rarely finds more than one expert (the bryologist) at a given institution, we must rely heavily on national and international communication to air our views and provide us with discussion. Since our international meetings are infrequent and cannot be attended by the majority of bryologists of the world, the *Bryological Times* can provide a venue for trying our ideas and getting feedback. I was pleased with the number of responses to my own statements regarding the stabilization of names. Now I know you read my column, and you feel free to disagree. I am pleased

to provide an avenue in which more of you can participate in world-wide discussions.

This isolation can be especially discouraging for our graduate students who yearn for peers who will evaluate and comment on their ideas and accomplishments. Sometimes they feel that there is no one, aside from the advisor, who cares. Peers working on higher plants seldom have sufficient knowledge of bryophytes to offer insightful criticisms or suggestions, and turn away, saying "I don't know anything about mosses." All too often, our graduate students have only their advisors to help shape their approaches and explorations. In this vein, I shall present here the hypotheses of

one of my own graduate students who is a hybrid biochemist and ecologist working on (and enjoying) the bryophytes. I encourage both the graduate students and the professional bryologists to deluge him with comments, questions, criticisms, suggestions, or encouragement, as you see fit. I hope that the graduate students in bryophyte ecology at other institutions will take advantage of this opportunity to have discussions with their peers and professional colleagues around the world by presenting their own ideas in this column, and that the field of bryology will advance more rapidly as we help each other grow.

Janice M. Glime

Chemical defence in bryophytes with high apparency

by Changliang Liao

It has been generally agreed that bryophytes are infrequently eaten (Hegnauer 1962; Pakarinen & Vitt 1974; Gerson 1982; Prins 1982; Longton 1984; Davidson 1988; Davidson et al. 1989; Asakawa 1990) by either vertebrate or invertebrate herbivores, although many invertebrates live, oviposit, or pupate in the shelter of bryophyte colonies (Glime 1978; Gerson 1982). Clymo and Hayward (1982) described that a "remarkable feature of *Sphagnum* is that almost nothing eats it." Therefore, it is interesting to ask why bryophytes are sel-

dom freely consumed by herbivores.

One reason for explaining herbivory might be the quality of plant material. Poor nutrient food is often considered as a factor that may deter herbivory, particularly when and where the availability of higher quality food presents herbivores with a choice. However, numerous studies have shown that bryophytes contain the same sugars as do higher plants (Hegnauer 1962; Huneck 1969; Margaritis & Kalaitzakis 1974) and the difference in protein content between bryophytes and higher plants is not

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significant (Prins 1982). Lipid levels are reasonably high (5% of dry weight) in the vegetative part of mosses; in spores alone they can be higher (30% of fresh wt) (Gellerman et al. 1972; Pakarinen & Vitt 1974). On the other hand, in most herbs the lipid contents lie in the range of 1-2 % (dry wt.) (Pakarinen & Vitt 1974). Therefore, it seems that bryophytes do not show any significant disadvantage in nutritive value.

Structural defence, such as spines, prickles, leaf pubescence, and/or cuticle, are commonly employed by higher plants as deterrents (Smith 1990). For bryophytes, however, this does not appear to be the case because bryophytes do not have these morphological modifications. The modifications bryophytes possess, like papillae, tomentum, hyaline cells, or thick cell walls, have not been explored at all for their defence functions. The natural substances, lignins, that occur widely and result in structural modification in vascular plants, are apparently not present in bryophytes (Miksche & Yasuda 1978; Markham 1988; Zinsmeister & Mues 1988), although it was assumed for a long time that there were compounds in bryophytes similar to the "vascular plant lignins." Therefore, bryophytes are non-lignified plants. Furthermore, Prins (1982) showed that the calcification levels of bryophytes are not as high as in vascular plants because the content of calcium in bryophytes is significantly lower than in dicotyledonous plants and there is no significant difference between bryophytes and monocotyledonous plants, suggesting that bryophytes would not seem to possess mechanical toughness as their defence function.

A remaining possibility is the presence of some chemical deterrent that would render plant tissue unpalatable, or toxic. It is now generally accepted that chemical armoring, i.e. secondary compounds including phenolics, terpenes, and nitrogen-containing compounds like alkaloids, is the most

significant type of defence a plant can possess (Harborne 1988). For many years, the adaptive significance of most plant secondary compounds was unknown (Taiz & Zeiger 1991). Beginning in the late 1960s, many secondary compounds were shown to have important ecological function in plants (Harborne 1982). Chief among these functions is protection against herbivory and infection by microbes. However, until the last 15 years the phytochemistry of bryophytes was completely neglected (Asakawa 1990). With the recent development of analytical instruments, a varied range of organic compounds were isolated and identified from the bryophytes. Zinsmeister & Mues (1988) considered bryophytes as a "remarkable reservoir" of secondary compounds. Many of these chemicals (secondary compounds) are supposed to be responsible for the chemical defences of bryophytes.

Bryophytes produce many phenolics and other related bio-active compounds (Markham & Porter 1978; Asakawa 1981, 1982, 1990; Markham 1988; Zinsmeister & Mues 1988; Davidson et al. 1989). Polyphenolics are effective deterrents to feeding by molluscs both in angiosperms (Valiela et al. 1979; Molgaard 1986) where they are known to poison slugs (Schaufelberger & Hostettmann 1983), and in algae (Geiselman & McConnell 1981; Steinberg 1984, 1985, 1988, 1989) where there is a significant correlation between polyphenolic content and the reproductive state of the plants (Ragan & Jensen 1978; Steinberg 1984; Johnson & Mann 1986). For instance, in order to look for an anti-herbivory role of polyphenolics in the bryophytes, we compared the food preference for gametophytes and capsules of *Funaria hygrometrica*. In the first 4 days, the slugs consumed 59% of the expanded, green capsules available. Within a week, 76% of the capsules were consumed. On the other hand, the leafy plants were rarely grazed by the slugs. Previous studies

showed that the average ash-free caloric value of immature capsules of the mosses is similar to or slightly lower than that of the leafy shoot (Forman 1968, 1969; Rastorfer 1976; Davidson et al. 1990). Thus, there appears to be no energetic advantage to be gained by eating the immature capsules. After analyzing the phenolic content (total phenolics of the capsules = 25 mg/g fresh weight, leafy shoot = 82 mg/g fresh wt), I found that the concentration of phenolics could be used to account for the different levels of herbivory.

One further question that arises is why plant species differ in their commitment to defence and hence in their susceptibility to herbivores. And, if plants have the potential to defend themselves effectively against herbivores, why do many species suffer a high level of herbivory? Feeny (1976) and Rhoades & Caies (1976) independently proposed an "apparency" theory stating that the type of defence and degree of defensive commitment evolved by plants are directly related to the risk of discovering of plant or individual plant tissue by herbivores. Quantitative defences, acting in a dosage-dependent fashion, are characteristic of "apparent" plants that are easy for herbivores to locate, whereas qualitative defences, acting in very sensitive-dosage, are characteristic of "unapparent" plants. However, Coley et al. (1985) suggested that both the nature and quantity of plant defences are determined by the food resource availability in the local habitat.

Therefore, we are conducting experiments in our laboratory, trying to improve the understanding of inter-relationships between the bryophytes and herbivores: 1) To determine the significant factor(s) controlling the antiherbivory of bryophytes; 2) To determine the role of secondary compounds in the antiherbivory of bryophytes.

Based upon principles observed in higher plants, we developed the following hypotheses:

1). PHENOLIC COMPOUNDS DETER BRYOPHYTE HERBIVORY WITH THE TENDENCY THAT GREATER CONCENTRATION OF PHENOLICS RESULTS IN GREATER DETERRENCE OF HERBIVORY. Phenolics are the best-documented defensive compounds both in terrestrial higher plants (Feeny 1970, 1976; Harborne 1979, 1988; Hedin 1983) and non-vascular plants, such as algae (Steinberg 1984, 1985, 1988, 1989; Targett et al. 1986; Hay & Fennell 1988; Winter & Estes 1992). It is also well-known that bryophytes have active metabolism of phenolic compounds, including a wide variety of flavonoids (Markham & Porter 1978; Markham 1988; Zinsmeister & Mues 1988). Their remarkable production of phenolics might be used for the purpose of chemical defence. This hypothesis is consistent with the prediction of the plant apparency model (Feeny 1976; Rhoades & Cates 1976).

2). BRYOPHYTES IN DIFFERENT HABITATS PRODUCE DIFFERENT LEVELS OF SECONDARY COMPOUNDS FOR CHEMICAL DEFENCE. BRYOPHYTES IN AQUATIC (BOG AND STREAM) HABITATS AND IN CONIFEROUS FORESTS SHOULD PRODUCE HIGHER CONCENTRATIONS OF SECONDARY COMPOUNDS THAN THOSE IN THE FIELD BECAUSE THEY HAVE MORE RISK TO BE EATEN. THE FIELD BRYOPHYTES SHOULD PRODUCE A LOWER LEVEL OF SECONDARY COMPOUNDS BECAUSE THEY ARE PROTECTED BY THE AVAILABILITY OF OTHER SUPERIOR FOOD RESOURCES THAT ARE EASIER TO LOCATE. For bryophytes, their "apparency" is relatively habitat dependent. In some habitats, like tundra ecosystems, bogs, streams, and boreal coniferous forests, they play a large role and they are obviously apparent plants to herbivores. In some other habitats, like fields and deciduous forests, however, the bryophytes are relatively "unapparent" because of the

abundance of other plant species. Evolutionary theory suggests that the production of defensive chemicals should be greatest in habitats in which selective pressures for their use are highest (Rhoades 1979). "Apparency" theory has never been applied to bryophytes in ecological studies. Based upon our results of feeding experiments so far, there is a significant feeding preference for unapparent bryophytes compared to apparent ones in the laboratory. One weakness for this theory is that the concept of "apparency" is not well-defined for bryophytes.

3). IN BRYOPHYTES, AS IN LICHENS, THE PRODUCTION OF SECONDARY COMPOUNDS IS POSITIVELY RELATED TO LEVELS OF CERTAIN ESSENTIAL ELEMENTS, SUCH AS NITROGEN (N) AND PHOSPHOROUS (P). Previous studies (Lawrey 1983) suggested that heavy loads of secondary compounds is positively related to the plant quality.

Any comments on these hypotheses are greatly appreciated.

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Bryologist Convicted of Illegal Collecting in New Zealand

Reproduced from the Australian Bryological Newsletter:

The December 1992 conviction in a New Zealand court of a visiting overseas botanist for making large collections of bryophytes in national parks and other reserves provides a cautionary tale. The collector in question was in New Zealand for four to

five weeks and collected heavily in the Auckland/Coromandel, Volcanic Plateau, and Fiordland regions. The bulk, if not all of the collections, were made from reserves and national parks. Some 900 collections in total were made, and at least some of them were made in quantities to provide 50 replicates.

The Department of Conservation (DoC) initially became aware of the collector's activities when he approached the Curator of the University of Waikato Herbarium, Cathy Beard, to request that a large quantity of bryophytes be dried, packaged, and mailed to him overseas. Cathy was immediately concerned about the massive quantity of material involved and the legal/conservation questions surrounding the collections (as well as her own legal culpability if she were held responsible for shipping the material out of New Zealand).

The collector was subsequently apprehended by a DoC officer in a Reserve near Te Anau, Southland, and a conviction was obtained in Invercargill district court for violation of the National Parks Act. A fine of \$1190 was imposed. According to all information available to me the collector made no attempt to obtain collection permits. Of further interest to a professional fraternity, he made no attempt to contact any professional or amateur bryologist in New Zealand prior to his arrival. Whether or not the collector intended to deposit any of the collections in a public New Zealand herbarium is unknown to me.

By an agreement between the collector, the Court, and the DoC, one replicate of each collection was allowed temporarily out of New Zealand in order for the collector to study/name the material. The material should arrive back in New Zealand before the end of 1993, and this is guaranteed by a court-imposed bond. After negotiations between all concerned parties it has been agreed that CHR is the most appropriate repository for the confiscated material.

The court conviction received a considerable amount of press exposure. The initial announcement was made by the Minister of Conservation and the case was reported on the "National Radio" network and in major newspapers (e. g. "The Press" in Christchurch and "NZ Herald" in Auckland, 23 December) throughout New Zealand and, I am told, in Sydney. There was considerable public comment about the "right" of professional/academic botanists to collect material for study on public lands; emotionally-laden terms such as "ravage" and "pillage" were used. No distinction was made between collectors with versus collectors without permits, between highly selective collection of single herbarium specimens versus collection of fifty replicates, nor between collections to be lodged in national public institutions versus those sent overseas. The entire incident reflected very poorly on the professional bryological/botanical fraternity.

I have subsequently had lengthy correspondence with the overseas collector, partly due to involvement in negotiations to ensure that the collections would be deposited in this public herbarium, and their research value be maintained. My initial harsh reactions have become somewhat softened by his explanation that he initiated his collecting trip to New Zealand by a spur-of-the-moment decision, precipitated by a series of tragedies involving both his family and personal friends. The entire episode has been for him, I believe, an extremely traumatic one.

As professional botanists we have special involvement in conservation issues. It is obvious that taxa cannot be conserved until they are recognized and their geographic/ecological limits understood; selective collection is necessary to achieve this documentation. As botanists, our professional interests and collection activities—whether or not sanctioned by the possession of a legal document—need to be weighed against the inherently de-

structive nature of collection.

In order to collect native plants from public land in New Zealand (including National Parks, Conservation Parks, Scenic and Scientific Reserves) it is necessary to have permission from DoC. The permit system is necessary to protect native plants from undue collector pressure. If you are planning to collect plants in New Zealand I recommend that you make an early application to: Director of Protected Species, Head Office, Department of Conservation, PO Box 10420, Wellington. If you leave your permit application until after your arrival in New Zealand, you can still contact DoC Head Office (04 471 0726) or, better still, the regional DoC Conservancy office (contactable through local conservation officers).

In a more general context, a useful document is a "Code of ethics for foreign collectors of biological samples", initially developed at the Botany 2000 Herbarium Curation Workshop held at Perth in October 1990. Among the 16 recommendations in the "Code" are that a foreign collector should: arrange to work with a local scientist(s) and institute(s); obtain official permission for all collections in National Parks or protected areas; leave a complete set of adequately labelled duplicates with the institute before departing the country; ensure that Types of species described as a result of the research are deposited in the National Museum or Herbarium of the country of origin; not exploit the natural resources of the host country...; collect no more material than is strictly necessary...; and inform the institute/appropriate organization of new localities of rare/endangered species found.

Allan Fife, Landcare Research New Zealand Ltd., P. O. Box 69, Lincoln, NEW ZEALAND.

Ethics in collecting bryophytes, and the risk for obstructing research

Recently, a visiting bryologist was convicted for making large collections of bryophytes in New Zealand. The regulations concerning the conservation and collection of bryophytes (or plants and animals in general) are quite different in different countries, depending on, i.a., differences in tradition and motives. It is clear that organisms must in many cases be protected from too heavy collection if they shall be able to survive. In some cases it is, however, evident that the motives for hindering collection by foreign researchers or amateurs are more political than based on scientifically sound arguments. Too rigid restrictions, such as a requirement to leave complete sets of duplicates of the collections within the country where the collections were made before leaving the country, can also be negative for the country itself. How many persons can identify bryophytes from an unknown area well enough to provide such a duplicate collection? I guess that, other conditions similar, more than one foreign researcher would choose to start with studies in a country with more reasonable rules than in one with rules which are more or less impossible to follow in practice.

This is clearly something which needs serious discussions also among bryologists. As a start, we are reproducing a note from the Australian Bryological Newsletter concerning this problem. In the next issue of The Bryological Times we hope to have the first contributions to the obviously needed debate regarding these questions. Any comments in this context are most welcome.

Lars Hedenäs

Computer programs

In the last issue of the Bryological Times the computer program FLORKART (Subal/May) was announced as available from IBIS. However, the developer would like to have control over its distribution, and the program is thus deleted from those available.

Jan-Peter Frahm, Universität Duisburg, FB 6, Bot., Postfach 101502, D-47048 Duisburg, Germany

Correction: E. W. Jones' herbarium

By mistake A. R Perrys name was omitted from the bottom of the article on E. W. Jones' Bryophyte Herbarium. The article was produced jointly by him and David Long. Jones' non-African bryophytes are at NMW where Dr. Perry is in charge of them so please write to him about them. His address is Department of Botany, National Museum of Wales, Cardiff, CF1 3NP, Wales, United Kingdom.

We apologise for this mistake.

The Editors

Membership in I. A. B.

The number of members is presently as follows:

	1993	1991
Africa	7	7
Asia	17	21
Australasia	26	26
Western Europe	236	239
Eastern Europe	79	23
Japan	41	39
China	30	29
North America	131	123
South America	8	8
non-paying members	0	90
Total	575	605

Membership has decreased slightly over the last two years due to the conversion of all members to payment status. As a result we have lost members from some eastern European countries. Overall, the Association is healthy - please encourage everyone to join us.

[Dale Vitt]

Awards 1994 (as approved - Tokyo, 1993)

The IAB business meeting in Tokyo decided to introduce two new awards to members of the IAB, the Sinske Hattori Prize and the Richard Spruce Award, in addition to the older Hedwig Medal and Stanley Greene Research Grant.

Hedwig Medal (silver medal). Awarded at each International Botanical Congress (every six years) to recognize outstanding lifetime contributions to Bryology by an I. A. B. member. Awards adjudicated by the Hedwig-Spruce committee (committee appointed by the president for two years terms. Three members of I. A. B. - not the president or secretary/treasurer. At the IBC meeting in Japan 1993 the medal was given posthumously to Sinske Hattori.

Richard Spruce Award (a plague and invitation to present the opening talk at the next biennial meeting). Awarded two times in six years at biennial meetings not held in association with the I. B. C. To recognize I. A. B. members who have made important contributions to Bryology, within the first 25 years of their career (dated from their first bryological publication). Awards adjudicated by the Hedwig-Spruce committee.

Sinske Hattori Prize (\$400 CDN - cash prize). Awarded every two years at a biennial meeting for the best paper or series of papers by a member of I. A. B. published within the previous two years in a journal or book. The first award period begins in Jan. 1, 1993, runs through Dec. 31, 1994 and will be presented at the 1995 biennial meeting. Awards adjudicated by a committee of four that are appointed for a two year term. The four will be chosen by nomination submitted by the membership and committee members.

Stanley Greene Research Grant (up to \$1500 CDN biennially or funds

available from the Greene fund - currently \$10,000). Awarded at each biennial meeting to support research in Bryology. Proposals are due January 15 of the year of each biennial meeting). Proposals adjudicated by the Greene Research Grant committee - two members appointed by the president (each for a six year term), plus the president and secretary/treasurer.

Dale Vitt

Estonian bryologists met at Jalase Village Reserve

From the 4th to 7th of May 1993, the majority of the Estonian bryologists, four persons, met in western Estonia at Jalase Village Reserve (c. 20 km²). Discussions were held and bryophytes collected. Of the 179 species collected, 24 are considered rare in Estonia and one species is new to Estonia. The reason for the species richness of the area is the great diversity of habitats (alvars, alvar forests, erratic boulders, abandoned fields etc.).

The Jalase Village Reserve is bryologically one of the most interesting areas in Estonia and we believe that it is necessary to establish a nature reserve to protect the bryophytes occurring there.

N. Ingerpuu and M. Leis, Institute of Botany and Ecology of Tartu University, Lai Str. 40, EE-2400 Tartu, Estonia.

New addresses:

Allan Fife, Landcare Research New Zealand Ltd., P. O. Box 69, Lincoln, New Zealand.

Elsa Nyholm, Botaniska Museet, Ö. Vallgatan 18, S-223 61 Lund, Sweden

The telephone number in Norway is changing this year. From 28 Oct. the following telephone and fax numbers will be new in Trondheim:

Lars Söderström +47 73596061 (ph.), +47 73596100 (fax)

K. L. Flatberg +47 73592248 (ph.), +47 73592249 (fax)

Catalogue of the hepatics in STR

News from the Herbaria. Send contributions to the column editor: A. R. Perry, Department of Botany, National Museum of Wales, Cardiff, CF1 3NP, Wales, United Kingdom

A "Catalogue of the Hepatics of the General Herbarium of Strasbourg" has recently been compiled. The work includes almost 1,400 specimens, with indications regarding origin and collector. So far, the specimens of the Nees herbarium are not included, but a catalogue of his herbarium will be presented later. The Catalogue of the Hepatics of the General Herbarium of Strasbourg is available for \$15 (including postage).

Dr. Françoise Dreger-Jauffret, Université Louis Pasteur, Institut Botanique de Strasbourg, Conservation des Herbiers, 28, rue Goethe, 67083 Strasbourg Cedex, France.

New institute of botany in Spain

In the past February, the "Instituto Asturiano de Taxonomía y Ecología Vegetal" (Asturian Institute of Vegetation Taxonomy and Ecology) was constituted. The main objective of the institute is to study the flora and vegetation of the northern part of the Iberian Peninsula. At the start, the institute has a herbarium with approximately 8,500 plants (bryophytes and vascular plants). The bryophyte herbarium contains about 5,750 specimens world-wide, including 20 types. Interesting specimens are duplicates of collections by Luisier, Mönkemeyer and Warnstorf. The vascular plant herbarium includes c. 2,750 specimens, mainly from the Iberian Peninsula. The library, mainly on bryophytes, includes interesting old literature (i.a., Hedwig, Schwaegrichen, Dillenius). Exchange, both of bryophytes (especially the Grimmiaceae) and

books - or copies, reprints - is desired. At present, J. Muñoz works with the genus *Grimmia*, and material belonging to this genus (world-wide) is welcome for revision or identification.

The research staff at the IATEV includes Jesús Muñoz (Bryology, President) and Jesús Valderrábano (Vegetation cartography, floristics of vascular plants).

Address: Instituto Asturiano de Taxonomía y Ecología Vegetal, Apdo 8, E-33120 Pravia, Spain. Phone +34-8-5822977

For Sale: Herbarium

The herbarium of E. & P. Hegewald is cited in BRYOPH. BIBL. 8 (1976): Bryological Herbaria (see page 31: Dortmund) and BRYOPH. BIBL. 30 (1985): Compendium of Bryology (see page 105: Niederzier).

The herbarium now contains about 12,000 specimens in total (own collections), including c. 4,000 specimens from Germany, 1,000 specimens from Scandinavia (mainly Finland), 500 specimens from other European countries, 5,000 specimens from Peru, 400 specimens from New Zealand and 1,000 specimens from Jamaica, Dominica, St. Lucia, Bali, Reunion, Seychelles, Tahiti, India, Mexico and U.S.A. (Texas, Alabama). Exchange specimens from all over the world. Hepatics are less well represented than mosses. The number of type specimens is c. 10.

Specimens from the herbarium are cited in many publications.

Anyone interested in further details about the herbarium or in the conditions for sale should write Dr. E. Hegewald, Grüner Weg 20, D-52382 Niederzier 4, Germany.

COLOPHON

Items for publication in *The Bryological Times* are to be sent to the Editors (preferably LH), except for those for the regular columns, which may go direct to the column editors.

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The Bryological Times, founded in 1980 by Stanley Wilton, Glasgow (1977-1989), is a newsletter of the *International Association of Bryologists*. It is distributed from Canberra (Australia), Edmonton (Canada), Eger (Hungary), Geneva (Switzerland), Hiroshima (Japan), Moscow (Russia), Praha (Czech republic), St. Louis (USA) and Trondheim (Norway).

Production

Lars Söderström, Trondheim

For details regarding membership of to *International Association of Bryologists* (currently US \$ 10.- per year) write to Dale H. Vitt, Department of Botany, University of Alberta, Edmonton, Alberta, Canada T6G 2E9.

Deadlines for material to the *Bryol. Times* will be January 15, March 15, May 15, July 15, September 15 and November 15 with the publication shortly afterwards. Shorter notes may be accepted later if there is still space.

DIARY

Send contributions to D. H. Vitt, University of Alberta, Department of Botany, Edmonton, Alberta, Canada T6G 2E9

1994

April (date not yet fixed). Sociedad Española de Briología: "XIV Reunión de Briología", including SEB General Meeting. The objective is to study the rich bryophyte flora of Liébana valley (Cantabria, north Spain). Further information from Jesús Muñoz, IATEV, Apdo 8, E-33120 Pravia, Spain. Phone +34-8-5822977.

April 30-May 1. Excursion to Gori (the Netherlands) with the Dutch Bryological and Lichenological Society to look at inland forests and heathland. Contact the secretary of DBLS, Dr. A. Aptroot, G. v. d. Veenstr. 107, NL-3762 XK Soest, the Netherlands. All DBLS excursions are open for non-members.

July 4-11. Australian Bryological Society Conference on "Australian Tropics". Lake Tinaroo (Atherton Tableland west of Cairns). Further information from Elisabeth Brown or Helen Ramsay, Nat. Herb. of New South Wales, Royal Botanical Gardens, Sydney N. S. W., Australia 2000. Fax (61) (02) 251 4403.

July 10-15 (tentative). Workshop on Chinese Bryophytes and Lichens. Place: Shengyang, China. Contact Officers: Cao Tong, Department of Plant Resources, Institute of Applied Ecology, Academia Sinica, Shenyang 110015, China and Lai Ming-Jou, Institute of Landscape Architecture, Tunghai University, P. O. Box 1-4, Sanchung, Taiwan 241.

July 18-28. The 1994 field meeting of the Dutch Bryologische en Lichenologische Werkgroep van de KNNV will be held in SW Carinthia, Austria. The meeting will be based at Weissbriach, c. 15 km W of Villach in the Gailtaler Alpen. Excursions will be extended to the Karnische Alpen, near the Italian border, and to the Kreuzeckgruppe of Hohe Tauern in the north. Further information from Leo Spier, Kon. Arthurpad 8, 3813 HD Amersfoort, The Netherlands, or Othmar Breuß, Naturhistorisches Museum Wien, Botan. Abt., Burgerring 7, Wien, Austria.

September 4-9. International Symposium: Endangered Bryophytes II, together with the meeting of the European Committee of Conservation of Bryophytes. Zürich. For information contact: E. Urmi, Inst. für Systematische Botanik, Zollikerstr. 107, CH-8008 Zürich. Phone: (41)1/385.44.41. Fax: (41) 1 385 42 04.

September 4-9. International Symposium: Endangered Bryophytes II, together with the meeting of the European Committee of Conservation of Bryophytes. Zürich. For information contact: E. Urmi, Inst. für Systematische Botanik, Zollikerstr. 107, CH-8008 Zürich. Phone: (41)1/385.44.41. Fax: (41) 1 385 42 04.

September 10-11. Excursion to Schonnen (the Netherlands) with the Dutch Bryological and Lichenological Society to look at coastal dunes. Contact Dr. A. Aptroot (address see 11-12 Sept. 1993)

October 2-8. VI Congreso Latinoamericano de Botanica to be held at Mar del Plata, Argentina. Further information from Celina M. Matteri, Museo Arg. Cs. Nat. B. Rivadavia, Av Angel Gallardo 470, C.C. 220, 1405 Buenos Aires, Argentina. Fax: (54) 1 9824494.