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## Auxin in Mosses: effects and occurrence\*

by  
Martin Bopp

SINCE THE EARLY NINETEEN FIFTIES it has been well known that auxin has several effects on moss development. These include growth inhibition, inhibition of bud development, torsion of the young stem and reduction of leaf, size and number (Bopp 1953, Kofler 1959). At that time it was far from clear, whether such effects could be regarded as hormone-specific growth regulation or were merely the manifestation of a general inhibition of growth brought about by the high concentration of auxin used in the experiments. However, the subsequent studies by Johri and co-workers have established beyond reasonable doubt that auxin is involved in a highly characteristic manner in the development of the protonema of mosses.

Protonemata of *Funaria hygrometrica* cultivated in Erlenmeyer flasks in a suspension of Knop solution without shaking, remain in the chloronema stage. With the addition of low concentrations of NAA, the protonemata differentiate into caulonema (Johri and Desai 1973). The strength of this effect depends on the cell density in the inoculum. The lower the original cell density, the lower the auxin concentration necessary. At cell densities below 0.1 mg protonema/ml of solution, caulonemata appear spontaneously. These density effects stem from the release of IAA oxidases from the protonema which degrades the IAA in the Knop solution. The oxidases have the highest activity in the medium when the cell density is highest (Sharma et al. 1979). Thus for caulonemal

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Footnote.\* A contribution to the Research and Development column edited by R. Mues and J.G. Duckett. For addresses, see Bryol. Times, 31:9.

## BRYOLOGY IN THE DEMOCRATIC PEOPLES REPUBLIC OF KOREA

By  
Siegfried Huneck, Ho Dzun Hoang  
and Jong Ho Kim

ACCORDING TO AN AGREEMENT between the Academics of the German Democratic Republic and the Democratic Peoples Republic of Korea (DPRK) one of us (SH) had the opportunity of spending one month (September-October 1986) in North Korea in the "country of the morning calm". The purpose of the visit was to give some lectures on phytochemistry at the Institute of Botany of the Academy of Sciences of the DPRK in Pyongyang and to meet the bryologists of this institute, Dr. Hoang and Dr. Kim. Because so little is known about bryology in Korea outside of the country, we decided to write a short article on this subject for the Bryological Times.

The book "Taxonomic list of plants from Korea. Vol. I." (Printing House of Sciences and Encyclopedia, Pyongyang 1983) lists 187 species of liverworts, 3 species of Anthocerotae and 450 species of mosses. Since

then numerous further species have been found and now about 220 liverworts and 583 mosses are known for the territory of Korea, rather high numbers for such a small country.

The reason for these high numbers is that (a) the Korean peninsula did not suffer from an ice age like Central Europe, and (b) the country is up to 30% mountainous. Because of its position between 34° and 43° North latitude, the climate is temperate with an average temperature of 8-12° C and an average precipitation of 1,120 mm. The Korean flora also has elements from north-east China, far-east Siberia and the northern part of Japan; a small region in the southernmost part is subtropical.

Bryotaxonomy in the DPRK is only done by Dr. Hoang, who is especially interested in mosses and Dr. Kim, who works with liverworts. The herbarium

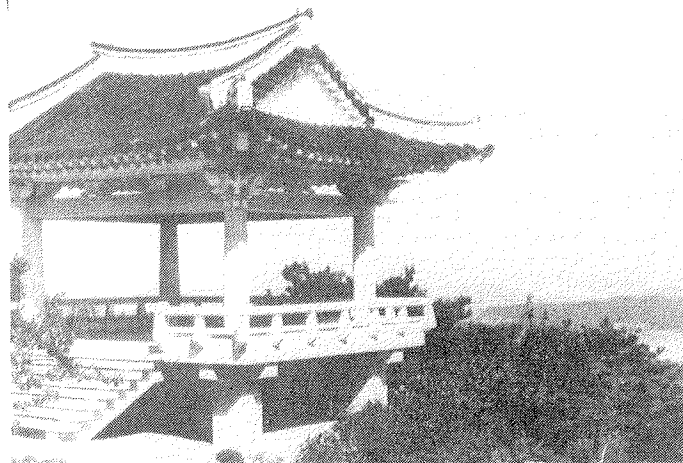


Figure 1. The summit of Rjongaksan.

## Bryology in the DPRK

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of the institute of Botany of the Academy of Sciences in Pyongyang contains about 10,000 specimens of bryophytes and is very interested in the exchange of samples. The Korean scientists would also be very grateful to colleagues in other countries for providing them with reprints or other modern literature on bryophytes.

A monograph about the sporophytic plants of Korea, including the bryophytes, is in press and a volume containing the bryophytes is planned as part of the "Flora Coreana". Furthermore lists of bryophytes of special localities (Mt. Paekdusan, Mt. Kumgangsan, Chailbong and Chilbosan) have been published in the journals "Saengmulhak" (Biology) and "Kwahagwon Tongbo" (Bulletin of the Academy of Sciences of the DPRK) during the last few years. These journals are issued by the Science and Encyclopedia Publishing House in Pyongyang and are with the English summaries and English lists of contents, respectively.

It was a great pleasure for one of us (SH) to take part in some excursions in the countryside, with Dr. Hoang and the Head of the Department of natural products of the Botanical Institute, Dr. Dzae Duk U. The first excursion took us to Mt. Rjongak, about 15 km north of the capital. From the summit of this mountain (Fig. 1), we had an excellent view of the golden-yellow ripe rice fields below us and Pyongyang in the distance.

Another excursion took us to Kaesong, 200 km south of Pyongyang, the former capital of the "United Kingdom of Koryo". Kaesong is well known for the cultivation of ginseng (*Panax quinquefolia*) the roots of which yield a famous "tonic". Near Bakjon, about 20 km northeast of Kaesong we collected *Jamesoniella autumnalis*, *Macvicaria ulophylla*, *Lophocolea minor*, *Porella vernicosa*, *P. grandiloba*, *Fullania davurica*, *F. tamarisci*, and *F. taradakensis*. A further highlight was the visit to Mt. Myohyang, about 120 km north of Pyongyang, where we stayed for 5 days. The Myohyangsan (san=mountain) is of granite and in the very steep and narrow valleys small rivers run down over numerous beautiful waterfalls. The slopes of the mountains are covered by species-rich mixed forests and especially the moist, north-exposed sides of the valleys are very rich in bryo-

phytes. On soil below the paths grew *Marchantia polymorpha*, *Pellia endiviaefolia*, *P. neesiana*, the pale green *Conocephalum japonicum* and *C. conicum*, the latter differing distinctly in its smell from European plants. The granite boulders were covered with *Jungermannia subulata*, *Porella setigera*, *Lejeunea japonica*, *L. parva*, and *Frullania* species, and on the bark of deciduous trees grew *Frullania muscicola*. The sunny rocks were covered with *Grimmia apocarpa* and *Hedwigia ciliata*. On soil and rotten trunks we found *Dicranum japonicum*, *Climacium japonicum*, *Atrichum undulatum*, and *Pogonatum inflexum*, while on coniferous trees above 1,000 m *Leucodon pendulum* and *Neckera pennata* were frequent.

On the way to the highest mountain of Myohyangsan, Mt. Bobwhangbong (1,390 m a.s.) we arrived after 4 strenuous hours at the small Buddhist temple Nunginam (1,000 m a.s.) from where we had a marvellous view down to the forests which were in full autumn colour; especially *Acer pseudo-sieboldianum* was shining a deep red colour. Immediately above us was the summit of Mt. Bobwhangbong with nearly vertical slopes. Unfortunately we could not climb to the summit because we had lost too much time collecting plants. After a nice picnic at this memorable place we went downwards, which proved to be equally as difficult as the way up!

One of us (SH) thanks the Academies of Sciences of the FDR and the DPRK for funding the journey to Korea and for organizing the excursions. He is especially grateful to Drs. U and Hoang for their guidance and continuous help. Last but not least we thank Dr. R. Grolle, Dr. S. Hattori and Dr. M. Mizutani for identifying the collected liverworts. S. Huneck. Institute of Plant Biochemistry of the Academy of Sciences of the GDR, Halle/Saale, Weinberg, 4050, GDR. H. D. Hoang and J. H. Kim. Institute of Botany of the Academy of Sciences and the DPRK, Pyongyang, DPRK.

## Membership of IAB

THE FOLLOWING LIST for the period 16th February 1987 - 30th May 1987, updates those already published. The last list appeared in *Bryol. Times*, 42:6.

## New Members

- Bates, J. W. Imperial College at Silwood Park, Ascot, Berkshire, SL5 7PY England, U.K.
- Becker, Hans. Fachrichtung 15.1 Universität des Saarlandes, 66 Saarbrücken, Germany B.R.D.
- Bisang, Irene. Systematisch-Geobotanisches Institut der Universität und Botanischer Garten, Altenbergrain 21, CH-3031 Bern, Switzerland.
- Cronberg, Nils. Lilla Södergatan 20 D, S-223 53 Lund, Sweden.
- Harrison, Leslie J. FB 14 Universität des Saarlandes, Pharmakognosie und Anat. Phytochemie, D-6600 Saarbrücken, Germany, B.R.D.
- Kack, Cynthia. Botany Department, University of Iowa, Iowa City, IA 52242 U.S.A.
- Ligrone, Roberto. Technische Hochschule, Institut f. Botanik, FB Biologie, 10 Schnittspahnstr. 3-5 D-6100 Darmstadt, Germany, B.R.D.
- Yücel, Erain. Anadolu Üniversitesi, Fen Edebiyat Fakültesi Biyoloji, Bölümü, Eskisehir, Turkey.

## Change of Address

- Bhatla, Satish C. Department of Botany, University of Delhi, Delhi 110 007, India.
- Hattaway, Robert A. Northeastern Illinois University, 55-00 N St. Louis Avenue, Chicago, Ill 60625-4699 U.S.A.
- Schäfer-Verwimp, Alfons. Rua Frederico Guarinon, 520, 05-713 São Paulo, Brazil.
- Timme, Steve L. Department of Biology, P.O. Box 5284, University of North Alabama, Florence, AL 35632 - 0001, U.S.A.

## BRYOLOGICAL BOOK OF RECORDS

More on Mosses and Stamps

by S. W. Greene

Unfortunately due to the amount of photo reduction the identity of the mosses on the stamps illustrated in *Bryol. Times*, 42:6

was hardly legible. They were *Sphagnum palustre* (left-hand stamp) and *Amblystegium serpens* (right-hand stamp).

## COURSES AT HELSINKI

GRADUATE AND UNDERGRADUATE students in botany in more than 80 colleges and universities in 37 states of the U.S.A. have an unusual opportunity for a study year abroad. The University of Helsinki is affiliated with the ISEP exchange program under which a student may study in a foreign university at fees similar to those he or she would pay in his or her home institution. The Botany Department of Helsinki offers a variety of courses in bryophytes: *Sphagnum* (Dr. P. Isoviita); mosses (Prof. T. Koponen) and liverworts (Dr. S. Piippo). This program is supported by one of the finest herbaria in the world, and there is a large and active cadre of graduate and undergraduate students in that specialty (see *Bryol. Times* 43: 1-4. Similarly the lichenology program includes a course taught by Prof. T. Ahti; there is available one of the premier lichen herbaria and a large and active group of students. Research in both these subjects is encouraged, with ample space and equipment provided.

As an American who has spent over two years in the bryophyte herbarium at Helsinki, I can testify that these programs are among the best that I have seen. English is adequate as a language for nearly all communication, and the courses are so laboratory orientated that an English speaking person can prosper. I strongly recommend that students, interested in bryophytes and lichens, consider studying in Helsinki under the International Student Exchange Program, 1242 35th St., N.W., Washington, D.C. 20057.- Daniel H. Norris. Botanical Museum, University of Helsinki, Unioninkatu 44, SF-00170 Helsinki 17, Finland.

## ADDRESS

## LISTS AVAILABLE

IN ADDITION TO THE SOFTWARE-SERVICE (*Bryol. Times*, 42:5-6), the address files of bryologists and bryological herbaria of the world, compiled by D. H. Vitt for the "Compendium of Bryology" (1985), and offered on disks for Apple II, is now available also for IBM and compatibles WordStar or (formatted) ASCII-file. In the case of ASCII-files please indicate whether the print commands for boldface and underlined should be omitted or retained. Free disks can be obtained from J.-P. Frahm, Universität Duisburg, Fachbereich 6, Botanik, Postfach 101629, 4100 Duisburg, Federal Republic of Germany.

INTERNATIONAL SYMPOSIUM OF  
BRYOPHYTE ECOLOGY

EDINBURGH, JULY 1988

The British Bryological Society and the British Ecological Society are jointly organizing an International Symposium on Bryophyte Ecology to be held at the University of Edinburgh from 19 - 21 July 1988. It will be followed by a field meeting at Beaully, Invernesshire, from 23 - 30 July, organized by Mr. David Long. The symposium will consist of four sessions of invited papers relevant to currently active areas of research plus poster sessions and sessions of contributed papers. The invited speakers and their topics are listed below.

## Session 1. Bryophyte production and decomposition

Tundra ecosystems. S. Russell  
Temperate ecosystems. D. H. Vitt (Edmonton, Alberta)  
Tropical ecosystems. J.-P. Frahm (Duisburg)  
Physiological basis of bryophyte production. M.C.F. Proctor (Exeter)

## Session 2. Interaction between bryophytes and other organisms

Bryophytes and nutrient cycling. D. H. Brown (Bristol) and J. W. Bates (London)  
Bryophyte interactions with other plants. H. J. During and B. van Tooren (Utrecht)  
Entomophily in the Splachnaceae. A. Koponen (Helsinki)  
Bryophyte herbivory. A. J. Davidson (Reading)

## Session 3. Population biology

Reproductive strategies in mosses. R. E. Longton (Reading)  
Genetic structure of hepatic species. M. E. Newton (Manchester)  
Bryophytes and ecological niche theory. N. G. Slack (Troy, New York)  
Bryophytes and plant strategy theory. J. P. Grime (Sheffield)

## Session 4. Bryophytes in man-modified ecosystems

Bryophytes and heavy metal accumulation. G. Tyler (Lund)  
Responses of bryophytes to mineral deposition. J. A. Lee (Manchester)  
Influence of man on the European bryoflora and vegetation. J. H. Dickson (Glasgow)  
Effects of forest disturbance on tropical bryophytes. D. H. Norris (Arcata, California)

Offers of posters and contributed papers should be sent as soon as possible, and not later than 31 March 1988, to the Programme Secretary, Dr. R. E. Longton, Department of Botany, The University, Reading RG6 2AS, UK. Details of accommodation and related matters are available from the Local Secretary, Dr. P. J. Lightowers, ITE, Penicuik, Midlothian EH26 0QB, Scotland.

## AETFAT CONGRESS

Hamburg, West Germany.

4-10 Sept. 1988

AETFAT (Association for the Taxonomic Study of the Flora of Tropical Africa) Congress, Symposium V, will be on African Lichenology and Bryology. Convener: D. Wessels. Members who wish to contribute to Symposium V are requested to contact Dr. Robert E. Magill, Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, for papers or posters dealing with bryology and Dr. D. Wessels, University of the North, X1106, Sovenga, 0727, South Africa, for papers or posters dealing with Lichenology. Those interested in membership or Congress information should write to the Secretariat, Institut für Allgemeine Botanik, Ohnhorststr. 18, D-2000 Hamburg 52, West Germany - Allemagne Federale.

Auxin in Mosses (contd. from page 1.)

production more external auxin molecules per cell are necessary. Non auxins ( $\beta$ -NAA), cytokinins or gibberellins do not induce caulonemal differentiation (Johri 1978).

The results of the suspension culture studies were confirmed by Lehnert and Bopp (1983) and extended to experiments on a solid agar substrate at low irradiance (ca.  $1\text{Wm}^{-2}$ =LLI). Here protonema grow only as chloronema but, once treated with IAA, the formation of oblique cell walls characteristic of caulonema, starts immediately. Optimal effects occur at  $10^{-7}$  to  $10^{-8}$  mol IAA/l (Lehnert and Bopp 1983). Caulonemata are the exclusive site for bud induction by cytokinins in *Funaria hygrometrica* and LLI protonema can react to cytokinin only when pretreated with auxin (Lehnert and Bopp 1983). Therefore in LLI the number of buds induced by kinetin can be used to quantify the auxin effect. The subsequent effects of the two hormones was called a "sequential interaction" by Bopp (1979).

The effects of IAA have been reproduced with 2,4-D,  $\beta$ -NAA and precursors of IAA found in higher plants. The main biosynthetic pathway of IAA in higher plants is tryptophan, indole-3-pyruvic acid, indole-3-acetaldehyde and IAA (Fig. 1). Intermediates of 3 other pathways are indole aceto-nitrile, tryptamine and indole-3-acetamide. The latter is an intermediate of the auxin formation in crown gall tumors, where the genes for this pathway have been identified (Schröder et al. 1985). In mosses, tryptamine and indole aceto-nitrile do not induce caulonema. This suggests that the pathways via tryptamine and indole aceto-nitrile do not seem to exist in bryophytes. If the two other pathways are working the enzymes necessary for the transformation of the precursors must be present. In a cell-free system prepared from *Funaria hygrometrica* protonema,  $^3\text{H}$ -tryptophen is metabolized into IAA via the indole-pyruvate pathway (Jayaswal and Johri 1985).

Further evidence for the involvement of internal auxins in mosses derives from experiments with auxin antagonists. Caulonema reverts to chloronema when treated with parachlorophenoxyisobutyric acid (PCIB), an antagonist to auxin in mosses (Sood and Hackenberg 1979, Bopp 1980). In the presence of PCIB cell diameters become smaller and all further cross walls are

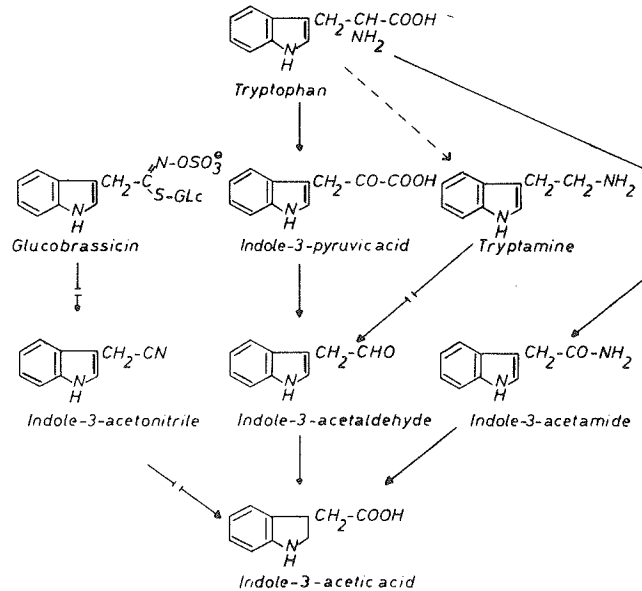


Figure 1. Pathways of auxin synthesis. The likely pathways in mosses are indicated with uninterrupted lines (after Lehnert and Bopp 1983).

transverse. The number of chloroplasts increases and elongation is retarded. These experiments show that endogenous auxin must be present and active.

The participation of internal auxins has also been demonstrated by experiments with mutants. The first mutants of *Funaria hygrometrica* were obtained by Hatanaka-Ernst (1966). In a series of mutants, she found one (Fu 219) which consisted only of chloronema. This mutant develops normally in the presence of  $0.5/\mu\text{M}$  IAA. Since 1977 Cove and co-workers have produced numerous mutants of *Physcomitrella patens*, including several with altered sensitivity to auxin/cytokinin (Fig. 2; Cove et al. 1980, Cove and Ashton 1984, Bopp and Kessler unpublished data). The response of the category 4 mutant may serve as the example for categories 4-7. It resembles Fu 219 in *F. hygrometrica* with small protonemata, consisting of chloronema and only a few caulonema-like filaments. These mutants are unaffected by exogenous cytokinin alone. However normal caulonema production is restored by treatment with  $\beta$ -NAA ( $125-25\text{ nM}$ ). Then the mutant reacts exactly as the wild type of *Funaria hygrometrica* in LLI conditions. It becomes sensitive to exogenous cytokinin. To explain the behaviour of this category of mutants, Cove

and Ashton (1984) suggest that a block in the synthetic pathway prevents the synthesis of endogenous auxin.

In contrast, experiments with "auxin-resistant" mutants of *Funaria hygrometrica* (NAR) indicate a different cause. Five mutants were selected on a substrate with a high concentration of NAA ( $5-50/\mu\text{M}$ ). The most clearly defined mutant, NAR 2, behaves as a type 4 mutant of *P. patens*. Normal development can be restored by a supplement of about  $1/\mu\text{M}$  IAA,  $\beta$ -NAA or 2,4 D. The precursors indicated in Fig.1 induce the formation of caulonema. Only tryptamine has no significant effect similar to that observed in the wild type (Bhatla and Bopp 1985). Therefore, a block in the biosynthetic pathway between tryptophan and IAA cannot be the reason for auxin deficiency. Furthermore the same experiments exclude the possibility of reduced sensitivity.

A comparison of the activity of auxin oxidases in the soluble and particulate protein fraction of the wild type and the NAR 2 (calculated per g fresh weight) gives significantly (up to 20 times) higher values in the mutant than in the wild type. The differences in mean quantities of the oxidases which change during growth are smaller than these in activity but the mutant always contains

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higher IAA oxidase activity. In contrast to auxin oxidases peroxidase activity in the mutant is always much lower than in the wild type (Bhatla and Bopp 1985).

Thus, in NAR 2 (and probably in the other deficient mutants also) auxin degradation seems to be specifically stimulated by oxidase. This might be expected from the selection of the mutants using high auxin treatment: only these with an efficient degradation system can tolerate high auxin concentrations in the medium.

For a considerable period nothing was known about internal auxins in mosses (Cove and Ashton 1984). However, in the last few years, three reports have demonstrated unequivocally that IAA is a natural constituent of the moss protonema. Ashton et al. (1985) found 2.1 ng g<sup>-1</sup> fresh weight (fw) or 75 ng g<sup>-1</sup> dry weight (dw) IAA in *P. patens* using gas-chromatography and ion monitoring mass spectrometry. Jayaswal and Johri (1985) found between 1.9 and 5.0 ng g<sup>-1</sup> protonema cells (=fw) with an indole-pyrene fluorometric assay.

Both results show that IAA is present in concentrations sufficient to induce the transition from chloronema to caulonema. In cultures of *F. hygrometrica* E. Weiler (Osnabrück, personal communication) has an-

alyzed IAA content with an enzyme immuno assay (Bopp and Bhatla 1985). The concentrations for the wild type grown in HLI conditions was about 0.4 n mol g<sup>-1</sup> fw (or 70 ng g<sup>-1</sup> fw), which may be about 10 times higher as in the two preceding papers; in LLI about 0.15 n mol g<sup>-1</sup> was found (depending on the age of the protonema) and the mutant NAR 2 contained 0.12 n mol g<sup>-1</sup> fw (in HLI). These figures should be viewed with caution since amounts of auxin can vary according to the method of extraction and the sensitivity of the test. For example Markmann-Mulisch (1985) found between 1.1 and 18.5 ng g<sup>-1</sup> dw of IAA in protonema of *Polytrichum formosum* depending on the extraction method. More significant than absolute amounts are values for protonemata in different conditions of in the mutants. At LLI the IAA content of the wild type is about one third of that at HLI. At HLI the mutant contains the same amount as the LLI wild type. This result is in agreement with the values expected from the auxin treatments.

It thus seems clear that endogenous auxin (in the range of 10<sup>-9</sup> mol/g fresh weight) is responsible for the transition from chloronema to caulonema. Any situation which lowers the endogenous auxin content e.g. PCIB treatment, low light intensities, culture in a suspension and mutants with blocked biosynthetic pathways or with high rates of degradation (only the latter has

been demonstrated to date) must result in the suppression of caulonema formation.

A further important aspect to our understanding of the endogenous regulation of differentiation by auxin comes from the following observation. When the apical cell of a caulonema is killed, all cells lose their caulonemal character (Knoop 1976, 1984). This indicates that a signal from the apical cell maintains the caulonema status in all cells of the filament. This signal is almost certainly auxin. In fact auxin is transported from the tip to the base of a rhizoid or caulonema filament in a strong polar manner (Larpen-Gourgaud 1974; Bopp and Knoop 1974; Rose and Bopp 1983). The transport mechanism includes a pH dependent passive auxin influx (Rose et al. 1983 a, b). Details of this mechanism seem to be different from those described in higher plants, but far more experimental data are needed.

Regarding the mechanism of auxin action the first step appears to be the binding of the hormone to a membrane-bound receptor (Venis 1985). The nature of an auxin receptor in mosses is completely unknown. In the only investigation to date Lomax-Reichert et al. (1982) found that auxin binding was barely detectable in total membrane preparations of auxin-resistant and wild tupe *Physcomitrella patens*.

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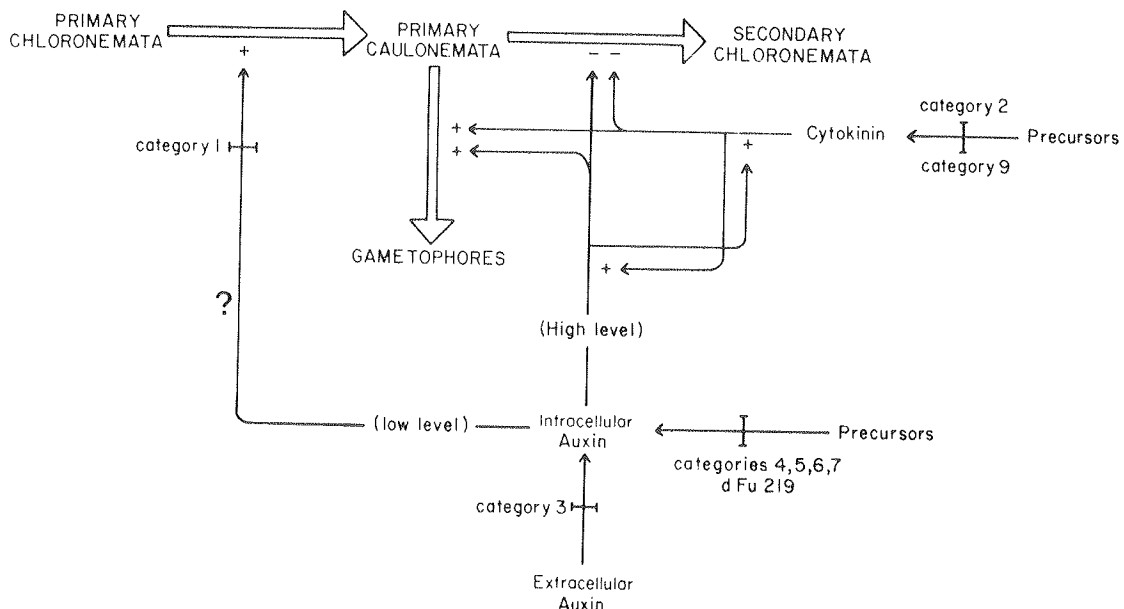


Figure 2. 9 categories of auxin/cytokinin sensitive mutants of *Physcomitrella patens* (modified from Cove and Ashton 1984).

Auxins in Mosses [continued  
 from page 5.]

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- Botanisches Institut der Universität Heidelberg, Im Neuenheimer Feld 360, D-6900 Heidelberg. Fed. Rep. of Germany.

## Personalia

DR. GUY R. BRASSARD has accepted a position as Executive Director of the Association of Canadian Universities for Northern Studies for two years. He will be on leave from Memorial University of Newfoundland, St. John's, and based in Ottawa, Ontario. He will continue his research on bryophytes of northern and eastern Canada. Dr. Brassard's new address is: c/o A.C.U. N.S., 130 Albert Street, #1915, Ottawa, Ontario, Canada K1P 5G4. Material destined for the Bryophyte Herbarium at Memorial University (NFLD) should continue to be sent to St. John's.

DR. D. Y. JOSHI, Department of Botany, Abasaheb Garware College (Research Centre, Pune -411 004, India, has had his research project on the bryophyte flora of the tropical rain forests of the Andaman and Nicobar Islands approved by the Department of Science and Technology, Government of India. The aim of the project is to explore bryophytes on various islands of the Andaman and Nicobar Group.

DR. MING-JOU LAI, P.O. Box 19 - 004, Taipai, Taiwan 24199, ROC or P.O. Box 834, Tunghai University, Taichung, Taiwan, 40704, ROC, spent two months (June 14 to August 15) at the Botanical Museum, University of Helsinki, Finland, on a scholarship from the Academy of Finland.

DR. JETTE LEWINSKY, Botanical Museum, University of Copenhagen, will be working as a visiting research fellow in the Department of Botany, University of Melbourne, Parkville, Victoria 3052, Australia, for one year from mid-November 1987. Her work will be concentrated on a taxonomic revision of the genus *Zygodon* for Australasia.

## INDEX MUSCORUM, 1963-1973

by

M.R. Crosby and R.E. Magill

The nomenclatural information for the "missing years" of the *Index muscorum*, 1963 through 1973 inclusive, is being compiled and edited at the Missouri Botanical Garden. Publication is planned for 1989. Like the two-year supplements that have been appearing regularly in *Taxon* beginning with 1974, the information in the eleven-year supplement will be purely nomenclatural rather than taxonomic and nomenclatural as in the *Index muscorum*. As with the two-year supplements, we are attempting to verify each record for the supplement, including all cross-referenced basionyms and other needed citations. Unlike *Index muscorum*, we are attempting to catalog names at all ranks for mosses, including formae and those above genera.

The MOST portion of the TROPICOS botanical database system is being used for this work. The basic information is nearly all in MOST, and citations are being verified. We would greatly appreciate readers of the *Bryological Times* sending us references to publications, or better still, xerographic copies or reprints of publications containing nomenclatural information published anytime between 1 January 1963 and the present. As a guide to what we have in the data base the entries are based, for the most part, on the titles that appeared in the *Recent literature on mosses series* in *The Bryologist* for the years 1973 to the present. Thus, any reference containing nomenclatural information not in those lists would be welcomed.

In order to make the supplements to the *Index muscorum* more easily managed, we now plan to merge all of the two-year supplements into the eleven-year supplement to produce a twenty-five-year supplement covering the years 1963 through 1987. Since the information is all comput-

## Change of Address

As and from 1 October 1988, Prof. Dr. Fred J.A. Daniels, formerly of the Department of Plant Ecology, Lange Nieuwstraat 106, 3512 PN Utrecht, The Netherlands, has moved to the Botanisches Institut und Botanischer Garten, Schlossgarten 3, D-4400 Münster, Bundesrepublik Deutschland. Tel.: 49-(0) 251 - 833824, 833810 (Institut) 933827 (private).

erized and in a data base format, titles of publications and names of authors are being coded, resulting in uniformly spelled or abbreviated entries, unlike the *Index muscorum*.

The number of entries to appear in the twenty-five-year supplement is about 6,500 and this should grow to approximately 7,000 when all needed cross-referenced names have been coded for inclusion. Since virtually all of the citations for the twenty-five-year supplement will have been verified against their original place of publication, the quality of the data will be very high, representing over eight percent of the entries in the index to moss names.

In addition to the index to plant names, MOST contains a great deal of distributional information about mosses and a bibliography of some 3,800 literature citations for moss literature. Readers interested in knowing more about the system and about ways that they might make use of it are encouraged to write to the authors.

Missouri Botanical Garden,  
PO Box 299, St. Louis,  
Missouri 63166-0299, U.S.A.

Publication of Bryophyte/  
Lichen/Fungi/Algae  
Monographs  
in *Flora Neotropica*

THE ORGANIZATION FOR FLORA NEOTROPICA (OFN) aims to publish a complete Flora of Tropical America. Since 1967 over 45 volumes have appeared and many more are in preparation. Monographs published thus far deal primarily with angiosperms, some with fungi. To facilitate the publication of treatments of small neotropical groups of non-vascular cryptogams (bryophytes, lichens, fungi, algae) *Flora Neotropica* has begun issuing special volumes devoted to each of these groups. Each special volume will consist of at least 100 printed pages and contain one to several taxonomic treatments. Authors may purchase reprints of their articles and will receive a complimentary copy of the entire volume.

Publication of the special volumes will be co-ordinated by S. Rob Gradstein, (University of Utrecht, Deputy Director of Cryptogams of the OFN, Institute of Systematic Botany, P.O. Box 80.102, 3508 TC Utrecht, The Netherlands, who will be pleased to supply further information on request.

## Index Muscorum

## Special Offer

For a strictly limited period of time, until 15 January 1988, the International Association for Plant Taxonomy is offering for sale full 5-vol. sets of *Index muscorum* at US\$120 per set plus postage. The normal advertised price is US\$345 per set, incl. postage.

Orders should be sent directly to IAPT, Institute of Systematic Botany, Heidelberglaan 2, 3584 CS Utrecht, The Netherlands.

## Recent Publications

- Australas. Bryol. News*, 16:1-11, 1987.  
*Bryolog. Beit.*, 7: 5-117, 1987.  
*Bryologist*, 89(4):253-327, 1987.  
*Bryophyt. Bibl.*, 34:5-112, 1987.  
*Bull. B.B.S.*, 50: 1-28, 1987.  
*Buxbaumiella*, 20: 3-48, 1987.  
*Crypt. Bryol. Lichén.*, 8(2):95-188, 1987; 8(3):189-290, 1987.  
*Evansia*, 4(1):1-16, 1987; 4(2):17-32, 1987.  
*J. Bryol.*, 14(3):415-624, 1987.  
*J. Hattori Bot. Lab.*, 62:1-486, 1987.  
*Lindbergia*, 12(2-3):73-176, 1987; 13(1-2): 1-104, 1987.  
*Nova Hedwigia*, 45(1-2):1-281, 1987.  
*Novit. Syst. Plant. non Vasc.*, 24: 3-239, 1987.  
*Proc. Bryol. Soc. Jap.*, 4(7):109-122, 1987; 4(8):123-136, 1987.  
*Taxon*, 36(2): 339-558, 1987; 36(3): 559-703, 1987.  
[*Bryomania*, Issue 8½, 1987.]

FRAHM, J.-P. & W. FREY 1987.  
*Moosflora*, 2nd revised edition, 525pp with 108 plates UTB 1250, Stuttgart (Ulmer). Price DM29.80 paperback; DM68 hardcover.

Four years after publication, the first edition of this German bryophyte-flora was sold out. The second edition is more or less a reprint of the first. It includes some corrections, typographic changes and additions as well as species in the meantime reported new to Germany. These are treated in an appendix. The book was produced as part of a series of University textbooks to reduce the price for students and at c. \$15 for 525 pages (paperback) is very cheap. However, for libraries or people who do not like a paperback that does not remain open on the desk, part of the new edition is available with hardcovers at more than double the price.



## SOCIETY NEWS

THE BRYOLOGICAL SOCIETY OF JAPAN (BSJ) elected new officers for Sept. 1987- Aug. 1989 at the General Meeting in Yamagata, 22 August 1987. They are:

President ....H. Ando  
(Elisabeth University of Music)  
Secretary ....Z. Iwatzuki  
(Hiroshima University)  
Treasurer ...M. Higuchi  
(Hiroshima University)  
Auditor .....N. Kitagawa  
(Nara University of Education)  
Editor .....H. Deguchi  
(Kochi University)  
Associate Editors ...  
J. Hasegawa (Kyoto University) and  
T. Furuki (Hiroshima University)

The secretariat of BSJ was moved from the National Science Museum, Tokyo to Hiroshima University. All communications to BSJ from 1 September, 1987, onwards should be addressed to: Secretary, Bryological Society of Japan, Botanical Institute, Faculty of Science, Hiroshima University, Higashi-senda-machi, Hiroshima 730, Japan.

Hironori Deguchi, Department of Biology, Faculty of Science, Kochi University, Akebono-cho, Kochi-shi, Kochi 780, Japan.

## EDITOR'S ADDRESS

The editor is pleased to announce that for the foreseeable future his address, for all professional correspondence, remains unaltered, viz: The University of Reading, Department of Botany, London Road, Reading, Berkshire, RG1 5AQ, U.K. (Telex 847813 RULIB).

THE INTERNATIONAL ASSOCIATION OF BRYOLOGISTS publishes The Bryological Times every two months, the Bulletin of Bryology twice a year, and the Advances in Bryology irregularly. Material for the Bryological Times can be sent at any time, but submission dates for the Bulletin and the Advances should be discussed with the Editors, Dr. Diana G. Horton (University of Iowa) U.S.A. and Dr. Norton G. Miller (Albany) U.S.A. respectively. The Editors do not accept responsibility for the views of the authors.

For details regarding membership of the International Association of Bryologists (currently U.S. \$8.00 p.a.), write to the Honorary Secretary, Dr. Dale H. Vitt, Department of Botany, University of Alberta, Edmonton, Alberta, Canada, T6G 2E9.

THE BRYOLOGICAL TIMES is published in Reading (U.K.) and distributed from Beijing (China), Eger (Hungary), Reading (U.K.), St. Louis (U.S.A.), Tokyo (Japan) and Utrecht (The Netherlands). All correspondence concerning mailing to: Rob Kruijt, Institute of Systematic Botany, Heidelberglaan 2, 3584 CS Utrecht, The Netherlands.

ITEMS FOR THE NEXT ISSUE to be with the Editor, Dr. S. W. Greene, Department of Botany, The University of Reading, London Road, Reading RG1 5AQ, Berkshire, England (Telex 847813 RULIB) by the 1st December, at the latest. Items for the regular columns should be sent direct to the column editors, whose names and addresses will be found in Bryol. Times, 31:9, 1985.

## DIARY

For explanation of acronyms, see Bryol. Times, 31:7-8, 1985.

### 1987

- Nov. 8. VWGB. Field trip to Herselt/Westerlo (Prov. of Antwerpen). Meet at Herselt Church at 09.30 hours.
- Nov. BBS. Taxonomic Workshop. University of Manchester. Local Sec.: Dr. S.R. Edwards, The Herbarium, Manchester Museum, The University, Manchester M13 9PL. For preliminary details see Bull. BBS., 49:28.
- November. John Child Memorial Foray to northern part of South Island, New Zealand. Further details from: Ms Gail Franho, Cawthorn Institute, P.C. Box 175, Nelson, New Zealand.

### 1988

- April 6-13. BBS. Spring Field Meeting, Cirencester. Local Sec.: Miss K.A. Hearn, The National Trust, Spitalgate Lane Cirencester, Gloucestershire GL7 2DE, U.K.
- July 19-23. Joint BBS - British Ecological Society Meeting, Edinburgh. International Symposium on bryophyte ecology. For outline programme see this issue page 3. Local Sec.: Dr. P.J. Lightowlers, Institute of Terrestrial Ecology Bush Estate, Penicuik, Midlothian, Scotland EH26 0QB.
- July 24-30. BBS. Summer field Meeting, Aigas Field Centre, Beaulieu, Invernesshire. Local Sec.: Dr. P.J. Lightowlers. Participants at the BBS ecological symposium (see July 19-23) will be most welcome.
- Aug. 5-7. BSJ. 17th Annual Meeting, Sanda City, ca. 25km N of Kobe City, with paper-reading sessions and field study. Further information from Dr.

N. Kitagawa, Biological Laboratory, Nara University of Education, Takabatake-cho, Nara 630, Japan.

Aug. 7-11. ABLS Annual Meeting in conjunction with AIBS meeting, University of California, Davis, U.S.A.

Aug. 7-12. NBS Annual Meeting and Excursions, Kitee, Pajarinhovi Travel Centre, Finland. Further details from Dr. Matti Haapasaari, Kuopio Museum of Natural History, Myhkyrinkatu 22, 70100 Kuopio, Finland.

Aug. 31-2 Sept. Phytochemical Society of Europe. Saarbrücken. International Symposium on the chemistry and chemical taxonomy of bryophytes. Further information from Prof. H.D. Zinsmeister or Dr. R. Mues Fachrichtung Botanik der Universität der Saarlandes, D-6600 Saarbrücken 11, B.R.D. (See Bryol. Times, 43:11).

Sept. 4-10 AETFAT Congress, Hamburg, F.R.D. Symposium on African bryology and lichenology. See preliminary notice in this issue p.3.

Sept. 12. 6th CEBWG Meeting, Liblice (Village near Mělník) Czechoslovakia. For preliminary announcement of this 4-5 day meeting, see Bryol. Times, 40:10.

Sept. 17-18. BBS. A.G.M. and paper reading meeting, Liverpool, Local Sec.: Dr. J. Edmondson, County Museums Dept., William Brown St., Liverpool L3 8EN, U.K.

### 1989

Aug. 6-10. ABLS Annual Meeting in conjunction with AIBS Meeting, Univ. of Toronto, Canada.

### 1990

Aug. 12-18. Helsinki, Symposium on SE Asian bryophytes. See preliminary announcement in Bryol. Times, 41:4.