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A BRYOPHYTE IN AN ANT GARDEN

By Jan-Peter Frahm

DURING FIELDWORK in the rain forests of NE Peru for the BRYOTROP project*, a bryaceous moss was collected growing in a so-called "ant garden". Ants' nests of this sort had been observed, from a bridge crossing a deep ravine, 1,100m a.s.l. at km 409 along the road from Moyobamba to Chachapoyas, Dep. San Martin, Prov. Rioja, in an area covered with nearly untouched rain forest. This view from the bridge allowed us to look at the top of the trees where two structures, in size and habit like large *Helianthus* flowers, were observed. Remembering Ernst Ule's description of "ant gardens" from the Amazon lowland forest, and supposing that the yellowish, central part of what looked like a *Helianthus* flower might consist of mosses, Dr. Rob Gradstein and the author tried to get one of the "ant gardens".

With some difficulties, caused by the steep slope, the tree was cut with machetes but it was caught by another tree as it fell. After cutting the second tree, the first fell ten meters deep into the river! The river was accessible only from the other side of the valley, by climbing down a steep, rocky slope. In this way the branch with the "ant garden" was cut off and brought to the bank where the picture was taken. (Fig. 1.).

The ant's nest consisted of a clump of soil (as in the nests of termites) about 15cm in diameter. It was densely covered by a bryaceous moss at the top and surrounded by *Peperomia* sp. with a single flowering orchid at the margins. Unfortunately the ants' nest with its many hundred inhabitants was destroyed before further examination could

be carried out by the attempt to pull it up to the bridge with a rope.

Ernst Ule (1901) first observed "ant gardens" ("Ameisengärten"), in the Amazon lowlands, near Pará and Manaos, where they were covered with species of *Peperomia*, *Anthurium*, *Codonanthe* or *Phyllocactus*. He described the nests as being as large as a walnut up to the size of a head and stated that 3 species of Araceae, 5 species of Bromeliaceae, 5 species of Gesneriaceae, 2 species of Piperaceae and one species each of Moraceae and Cactaceae were exclusively found on "ant gardens".

He also observed that ants were carrying seeds of these species, which they apparently planted in their nests and thus really cultivated the "gardens". However he did not take into account that these seeds were collected by the ants as food, perhaps seeds of these species having no elaiosomes. When the nests were enlarged, the first plants to grow on the nest were covered with soil and in this way they acted as a frame for the nest.

Ule did not mention bryophytes in the "ant gardens" and our observation seems to be the first record of a moss from such an unusual habitat. The specimen collected in Peru was identified by Dr. Dana Griffin, III as *Brachymerium columbicum* (De Not.) Broth. (*Osculatia columbica* De Not., *Bryum globosum* Mitt., *Neobryum costatum* R. S. Williams, *Acidodontium grubii* Bartr.), which has been described and reported from Colombia and Ecuador and here is reported as new to Peru. Because of special structures in the peristome, there has been uncertainty about its affinities and it has been described under several different names and has been placed in two monotypic genera.

Reference

Ule, E. 1901. Ameisengärten im Amazonas Gebiet. *Englers Bot. Jahrbücher*, 30, *Biebl.*, 68: 45-52.

Universität Duisburg, Fachbereich 6, Botanik, Postfach 101629, D-4100 Duisburg, F.R.G.

[* See *Bryol. Times*, 13:3, Ed.]



Fig. 1. *Brachymerium columbicum* surrounded by *Peperomia* sp. Knife c. 35cm long overall

PHOTOSYNTHESIS AND RESPIRATION *

By Janice M. Glime

NUMEROUS METHODS seem to be available for measuring photosynthesis and respiration, and one can easily extract arguments for each from a vast literature on vascular plants. However, these methods tend to be expensive and require specialized equipment. Dr. Takeshi Takaoki of the Botanical Institute, Faculty of Science, Hiroshima University, Hiroshima, Japan, has developed a simple, inexpensive method suitable for classroom and research use in the field or laboratory with small organisms such as bryophytes. He has introduced this device in previous papers (Takaoki, 1967, 1969, 1978), but some improvements are included here with a copy of his design (Figs. 1, 2).

The instrument operates on the principle of gas volume change as used in the classical manometers. A carbonate-bicarbonate - CO_2 buffer solution is used to maintain a constant CO_2 level. Thus oxygen increase (or decrease) can be measured. A solution of 20% KOH can be used for respiration studies to absorb the CO_2 produced.

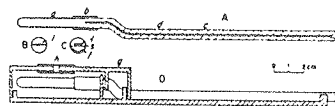


Fig. 1. The volumetric apparatus. A Longitudinal view of the volumeter; glass tube a, containing a leaf strip and carbonate-bicarbonate CO_2 -buffer solution¹, is connected with a rubber tube b to a capillary c filled with water having an air bubble d produced by a long injection needle. B. Cross section of tube a filled with 0.1M CO_2 -buffer solution having a leaf strip l (3cm in length) of aquatic or marine plants. C. Cross section of tube a for land plants; l, a leaf strip (3.5 x 30 mm); s, a brass net separator; f, a strip of filter paper Toyo No. 27 (3.5 x 40 mm) or layered three strips of Toyo No. 2 both soaked with 1M CO_2 -buffer solution. D. Five to seven volumeters were set on a mount e graduated in mm as shown in Fig. 2. Whole assembly was immersed in a thermostat water bath, running water, agitating water, or sea-water. A cover g with an air escape hole h was used to eliminate light exposure to reaction tube a.

Dr. Takaoki's device consists of a glass tube (Fig. 1a) connected by a rubber tube (1b) to a capillary tube (1c). The capillary tube is filled with water (which can be colored with a dye) and an air bubble. The

* A contribution to the Techniques Notebook Column, edited by Janice M. Glime.

For address: see *Bryol. Times*, 31:9.

air bubble is added by an injection needle and serves as the volume change marker.

The original design was suitable for aquatic plants, so tube a was filled with a 0.1 M CO_2 buffer solution in which the plant material was placed: recent modifications permit use of terrestrial plants. Filter paper is soaked in the buffer solution and placed on the upper surface of the glass tube. (The moisture will hold it in place.) The sample, with necessary water, is placed on the bottom of the tube. In cases where a greater light intensity is required, I would place the filter paper on the bottom of the tube and use a plastic mesh across the middle of the tube to serve as a shelf for the bryophyte.

The entire apparatus is sealed when the glass tube and capillary are connected by a rubber tube. The production or depletion of a gas (oxygen) is measured by the change in position of the air bubble. A 1mm inside diameter glass tube provides a sensitive measure for calculating changes at 2-minute intervals (a rate of < 6mm per min). The volume can be calculated as $v=kl$, where v is the volume (μl) of gas displaced, k is a constant dependent upon the diameter and adhesion, (inside volume is μl per mm capillary length), and l is the length (mm) travelled. Water adhering to the capillary walls during displacement contributes a smaller error which depends on the speed of movement. Dr. Takaoki found a positive error of 0.159%. This error was compensated by a negative error due to water pressure in the water bath (discussed below). His k value was 0.85 with the volume of water adhering ranging from 0.135 to 0.281 μl . A complete discussion of these factors will be found in his 1978 paper.

A constant temperature can be maintained by submerging the apparatus in a water bath. One must, however, recognize that water absorbs 95% of the red light in one metre, so this factor must be considered as a variable related to water depth above the plant. Likewise, glass absorbs far more ultraviolet radiation than does plastic, so these variables must be considered when materials are chosen.

As shown in Fig. 2, Dr. Takaoki places seven volumetric tubes into a single rack to obtain six replicates, the seventh serving as a thermobarometer without plant material. Volume displacement in the thermobarometer is subtracted from changes in the other tubes to correct for temperature and pressure changes during the experiment.

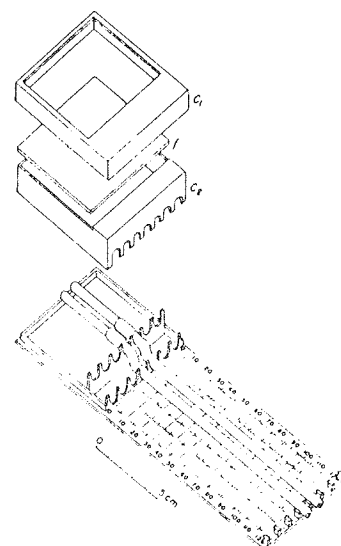


Fig. 2. Apparatus for outdoor measurement. Cover g, light filter of wire gauze f, and cover c₁ are successively placed over the reaction chamber to decrease exposure to sunlight.

The design improvements include use of a box-shaped reaction chamber to house the glass tubes. These chambers are made of black plastic with a glass cover. For dark studies a black plastic lid is placed over the glass. A rule is marked beside each capillary tube to facilitate reading volume changes. Finally, the starting position air bubble can be adjusted by putting a screw clamp on a short rubber tube connected to the reaction chamber on one end and closed at the other end. Adjustment of the screw can push air into or remove air from the capillary tube, thus moving the meniscus. Care must be taken not to draw any colored capillary fluid into the reaction vessel.

A light filter of wire gauze can be inserted in the reaction chamber to reduce the light intensity. White cloth gauze, or white paper, can be used if they are protected from water. Such filters can be varied by using several thicknesses and sealing them in clear (colorless) contact paper.

Several cautions are necessary for the experiments themselves. Traditionally "light" and "dark" bottles have been used for measurement of photosynthesis with the oxygen absorbed in the dark serving as the measure of oxygen lost to respiration in the light. We know now that this is not the case for C_3 plants, i.e. plants such as bryophytes which have photorespiration which occurs in the light at rates as

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Photosynthesis and respiration (contd. from last page.)

high as three times the rate of dark respiration. Furthermore, photorespiration can continue for at least 40 minutes in the dark before baseline (dark) respiration is reached. If gross photosynthesis is to be measured, a rough estimate of photorespiration can be obtained in the first 30 seconds after the plant is put in the dark (Harris and Piccinin, 1977).

A second timing problem arises when the light is turned on. Plants which have been in the dark can have a burst of photosynthesis when first illuminated. In some cases this is due to stored nutrients or readily-available CO₂ which were not depleted in the dark. Other timing phenomena result from an endogenous rhythm. Such phenomena are not generally known for bryophytes and any researcher should be aware of their possibilities.

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Dept. of Biological Sciences,
Michigan Technological University,
Houghton, Michigan 49931,
U.S.A.

Personalia

JOHN A. CHRISTY has been appointed Cryptogamic Collections Manager, under the direction of Dr. Martyn J. Dibben, at the Milwaukee Public Museum. In addition to regular herbarium duties, he will continue biosystematic studies in the moss genus *Limbella*. His address will be:-

Section for Botany, Milwaukee, Public Museum, 800, West Wells Street, Milwaukee, WI 53233, U.S.A.

ACCUMULATION OF MERCURY IN THE AQUATIC LIVERWORT

Jungermannia vulcanicola Steph.*

By Ken'ichi Satake

OVER THE LAST 20 YEARS, studies of aquatic bryophytes living in rivers, lakes, ponds, springs and in the effluents from mines, have revealed many examples of high accumulations of heavy metals (e.g., Cu, Zn, Pb and Cd) (Shacklette, 1965; Whitehead and Brooks, 1969; McLean and Jones, 1975; Welsh and Denny, 1980; Say et al., 1981; Whitton et al., 1982; Say and Whitton, 1983; Wear and Whitton, 1983a, b; Wear et al., 1983). However, in spite of the abundance of data on heavy metals in the shoots of aquatic bryophytes, there is virtually no information about mercury or the possible accumulation of this element in these plants. Moreover, most of the data on heavy metals in the shoots of bryophytes have been restricted to the total analysis; only few studies having been done on the localization of heavy metals at the sub-cellular level. The demonstration of Pb accumulation in the nuclei of *Rhytidia leleuphus squarrosus* (Skaar et al., 1973; Gullvåg et al., 1974) is a notable exception. No direct evidence has been presented for the chemical form of accumulated heavy metals in bryophytes.

Satake et al., (1983, 1984a, b, c) employed newly-developed analytical techniques such as energy dispersive X-ray fluorescence spectrometry (EDXRF), X-ray photoelectron spectroscopy (XPS), inductively coupled plasma (ICP) and electron microscopy with X-ray microanalysis (XMA) on the studies of aquatic bryophytes. Using such instrumentation, they discovered that the aquatic liverwort *Jungermannia vulcanicola* Steph. accumulates mercury, and they presented data on its localization within the cell and on the chemical form of the element.

Initially Satake analyzed the elemental composition of plants, including aquatic bryophytes collected from lakes, ponds, rivers and streams, using EDXRF which permitted non-destructive multi-element simultaneous analysis (Satake et al., 1981; Satake and Uehiro, 1982). The most notable result from this survey was the discovery of the mercury accumulating liverwort *Jungermannia vulcanicola* in the water of Kashiranashigawa stream having pH 4.2-4.6 (Satake et al., 1983). *J. vulcanicola* is an

acidophilic liverwort living in acid water at pH 1.9-4.6 (Amakawa, 1956, 1960; Hattori, 1958; Watanabe, 1961; Våta, 1974; Satake et al., 1984c). [Kashiranashigawa stream is an acid stream about 2-4m wide, 0.1-0.4 m deep, and about 800m in length, flowing into Lake Usoriko (Osoresanko). The water of Kashiranashigawa stream originates mainly from cold springs with a pH of 4.2 and containing 55 mg/l SO₄ and about 0.6 µg/l of mercury (Satake et al., 1983).]

The hemispherical colonies of *J. vulcanicola* were sampled from up-, mid-, and down-stream sites. Mercury in the shoots was determined using EDXRF and a Zeeman effect mercury analyzer. The results showed a high level of Hg in the shoots of *J. vulcanicola* from upstream sites (max. about 1.3% in the basal part of the shoots). Mercury was not detected in samples from downstream sites where the mercury content in the stream water was less than the detection limit of cold vapour atomic absorption spectrometry for mercury analysis.

From bulk analyses it is impossible to be certain about the accumulation of heavy metals actually within the tissues of bryophytes. Possible contamination from adherent organic or inorganic particles can never be ruled out completely. However, a critical examination of shoots of *J. vulcanicola* by XMA attached to a scanning electron microscope showed accumulations of considerable amounts of mercury (more than 0.5% on a dry weight basis) at the randomly-selected points of the shoot clearly free from attached amorphous particles and diatoms (Satake et al., 1983). Furthermore, a survey of sections (80-150 nm thick) from a stem of *J. vulcanicola* (3-4 cm from the apex of the shoot containing about 6,000 µg/g of Hg) by transmission electron microscopy coupled with XMA showed that electron-dense amorphous particles, ranging from 0.01 µm - 0.1 µm - 0.2 µm in diameter contained high levels of mercury and sulphur. It seems reasonable to conclude that they were mercuric sulphide (HgS). Such particles were distributed through the cell wall but were not found at the plasmalemma or within chloroplasts (Satake and Miyasaka, 1984a). Examination of the same material by X-ray photoelectron spectroscopy (XPS) also showed accumulations of mer-

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

Mercury in *Jungermannia vulcanicola* (continued from last page)

cury as mercury-sulphur compounds. It is noteworthy that mercury-sulphur compounds are highly insoluble in water, and as such, are non-toxic to living organisms (Satake et al., 1983).

These results on *J. vulcanicola* suggest that deposition of insoluble sulphides in the cell wall is one mechanism by which bryophytes may accumulate and, at the same time, detoxify heavy metals. Further studies on the mechanism of mercury-sulphur compound formation in relation to the physiological characteristics of *J. vulcanicola* are now being undertaken, together with investigations on other heavy metals accumulated by other aquatic bryophytes.

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Personal Recollections of the IAB Meeting in Budapest, 1985.

by

C.J. Miles and A.J. Davidson

BEFORE OUR ARRIVAL our image of Hungary was very limited. We knew that it was the home of goulash, bulls' blood wine, and was the country that inspired the music of Bartok and Liszt; but we knew little else about it. We therefore eagerly anticipated a visit to a country with a culture so different from any that we had experienced before.

We travelled by train and arrived at the splendid Keleti Pályandvar on time, but a little weary, so we were pleased to find that the instructions sent to participants by Professors T. Pócs and T. Simon made it easy to find our accommodation.

At the Schönherz Zoltán youth hostel we were welcomed by Dr. M. Rajczy, who organized our rooms and handed us further instructions about the conference, including the programme of events and useful information about travel and places of interest in Hungary. We soon learnt our first words of Hungarian - Sor and Bor - i.e. Beer and Wine!

The following morning delegates staying at the youth hostel were met by Dr. K. Bato who guided us to the Eötvös Loránd University where the Conference was to be held. As delegates assembled to register in the Gólyavár Congress Hall of the University, before the first session, there was much renewing of old friendships and initiations of new ones.

Well over 100 people were present when proceedings began with a welcoming speech from the head of the Faculty of Science of the University. Unfortunately Dr. H. Inoue, President of IAB, was unable to attend, but Dr. S. R. Gradstein, Honorary Secretary of our Association, spoke on behalf of the IAB. While thanking the organizing committee, and particularly Professors T. Pócs and T. Simon for all their hard work preparing for the Conference, he also acknowledged the much appreciated support given by the Hungarian Academy of Science. He concluded by reminding us of Dr. George Scott's remarks in Sydney* where he said that bryophyte ecology was like a pile of bricks with little mortar. Dr. Gradstein

* See *J. Hattori Bot. Lab.*, 52, 173, Ed.

expressed the hope that the Conference would go a little way towards correcting this.

Professor P. Richards, one of the pioneers of studies in bryophyte ecology, as honorary chairman of the Conference, gave us a brief historical résumé of studies in the subject. He concluded by saying that today such studies were more numerous and wide-ranging than ever before as evidenced by this Conference, the first to be devoted wholly to the ecology of bryophytes. He then declared the meeting open.

During the following 3 days a total of 66 papers were presented. These were divided between 6 sessions varying in length from 7 to 16 papers. Time was therefore limited and thanks are due to the speakers and the chairmen of the sessions who kept very well to the tight time schedules. English was the official language of the Conference and we have nothing but admiration for those speakers who had to present their data in a foreign language, even in their own country! There were speakers from 24 different countries with even more nations represented amongst the participants. With such a wealth of talent and data, only a few of the many items that fired our imagination can be mentioned.

We were amazed by Dr. van Zanten's incredible experiments, using a KLM airways Boeing 747 with a modified wing tip which enabled him to test the survival of spores at high altitudes. Professor Ando showed a collection of beautiful photographs of Japanese moss gardens and it appears that in Japan you can actually purchase mosses propagated specifically for use in horticulture. Dr. Mäkinen told us about an intriguing use of moss balls to monitor air pollution in and around Helsinki, while Dr. Haji Mohamed showed some fascinating slides of bryophyte habitats in limestone scenery in Malaya. Dr. E. Simon talked about a remarkable basidiomycete which is parasitic on *Sphagnum*. The prize for the greatest number of presentations surely must go to Dr. D.M. Bergstrom who gave at least 4 papers, both for herself and for her colleagues.* An informal and friendly atmosphere prevailed throughout the 3 days. Refreshments were always available close at hand, and everyone was especially grateful to Drs. Biro, Bato and Simon, who not only contributed to the Conference, but also acted as "coffee ladies". Our hosts were always prepared to guide

us to restaurants or to help sort out other problems. A series of photographs were taken throughout the talks and these soon appeared for sale at very reasonable prices.

Three days of trips followed the Conference. To the south of Budapest is the region called the Kislánnság, an area of low-lying saline plains and sand dunes between the Danube and the Tisza rivers, which was visited on the first day. The weather was rather cold and cloudy when we arrived at Kecske-mét, which has the headquarters of the National Park. In its information centre we were told about the various regions of the park and shown a film about it. We moved on to Bugac, to be greeted at the 'Juniperus' field station by members of the Department of Plant Taxonomy and Ecology of the Eötvös Loránd University. After refreshments of peaches, pears and Perlinka (a potent fruit brandy!), we heard about some of the work in progress before walking around the dunes and seeing such plants as *Ephedra distachya*, *Achillea ochroleuca*, *Echinops ruthenicus* and, among the bryophytes, *Barbula convoluta*, *Pleurochaete squarrosa*, *Tortella inclinata* and *Tortula ruraliformis*.

After a short bus ride, an excellent lunch was provided at the Bugac restaurant which suddenly appeared amongst the trees. Soup was followed by a large meat dish and sweet pancakes accompanied by more fruit brandy, free-flowing wine and traditional music. After this there was some debate as to the next move. About half of the participants, perhaps with an eye on the darkening sky and the promise of more wine, were reluctant to continue to the saline lake and alkaline steppes, but the remainder were determined to complete the programme and set off in one of the buses. After passing the mobile dunes (which did not appear to be moving as fast as in the film we had seen) we reached the track leading to the site. The sky by now had turned a horrid colour and within 500 metres of the bus a torrential squall hit us. Only about a third of the party was prepared for such adverse conditions, notably Dr. M. Proctor, down to his Wellington boots! However, our hosts had thoughtfully brought along massive waterproof capes. By the time we reached the site of interest it was more of a lake than a saline steppe! Dr. M. Rajczy remained enthusiastic throughout, but after about ten minutes the rumble of thunder heralded yet another torrential downpour, and when the hardy Scotsman beat a retreat to the bus, the rest were close behind. Later the reports of frivolity amongst those who stayed at the

restaurant did nothing to dry out our enthusiasm!

The following morning some of us were out early for a short guided tour of Budapest, thankful that the sun was shining again. We were shown the fishermen's bastion, the Church of St. Mathias, the parliament building, Margaret's island, St. Steven's Cathedral and, perhaps most impressive of all, Hosock tere, or the heros' square with its magnificent bronze statues of the fearsome chiefs who conquered the area.

Our guide, Anna Marie, remained with us for the journey up to Szentendre during which we passed 2 Roman amphitheatres reminding us that Budapest occupies a site inhabited for thousands of years. Szentendre itself is an old settlement with narrow streets, a community of Serbian merchants, as was evident from the churches, and a museum containing the ceramic work of Kovács Margit. Lunch in the town was another huge and enjoyable meal including turkey stuffed with spinach, followed by cheeseballs in a sweet sauce. Anna Marie explained, as we rolled back to the bus, that Hungarians like to see a guest unable to eat all that is offered, rather than to leave an empty plate!

After lunch we crossed the river and travelled to Vác-rátót, where the Institute of Ecology and Botany of the Hungarian Academy of Science is located. Here we were reunited with the rest of the party and we were greeted by Professor A. Berczik, Director of the Institute. Tours were arranged around the garden or the laboratories. We chose the garden which contained mature landscaped areas said to be in the English romantic style. A buffet with tasty sausages, cheese and custard cream cakes and wine was enjoyed by all. The highlight of the evening was a breathtaking performance of traditional Hungarian folk music and dance by the famous Teká ensemble, accompanied by Béla Halmos. The sounds produced by a large variety of instruments, such as bagpipe, cithern, dulcimar, hit gordon hurdy gurdy and by voice were truly astonishing, and soon all of us were tapping our feet and clapping. The dancer gave energetic demonstrations of czárdós and verbunk dances and encouraged us all to try some steps. Noteworthy was Dr. Scott's flamboyant dancing, ably aided by a trio of local women!

On the final day we travelled south to the Lake Balaton region. Because our bus broke down we could not visit the first

* A full list of the speakers and lectures will be published separately. Ed.

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Recollections of Budapest (continued from last page)

site, and so went directly to Felső hegy. Here we climbed a hill through turkey oak and sessile oak forest to look at the relict *Genisto pilosae-Quercetum* association. The association was poor in bryophytes, but *Atrichum undulatum*, *Dicranella heteromalla*, *Dicranum scoparium*, *Leucobryum glaucum* and *Polytrichum piliferum* were noted.

Our picnic lunch had saved time as we headed for the next site, Péter hegy, a steep hill of dolomite and limestone above the village of Arács. This site was much richer botanically and we walked up through a *Cotino-Quercetum* association where plants of *Cephalanthera domasognium* and a number of earth star fungi were seen. We also saw the habitat and plant community conditions of a heliophyte moss community, as described by Biró and Debreczy during the paper reading session. A noteworthy species seen at this site was the liverwort *Mannia fragrans*, though most found the fragrance hard to detect. Despite the steepness of the hill we were impressed by the determination of Dr. Grolle, with the help of his assistant, to see the sites for himself. This determination was shown on all occasions that we were in the field.

From Péter hegy we went to Tihany where there is a 17th century church built on the site of an 11th century abbey, perched on a hill overlooking lake Balaton. We walked along the peninsula and down below the Ovar hill to look at the surroundings of caves once inhabited by monks. Here was one of the moister areas we had seen which had a good growth of *Thamnobryum alopecurum*, *Anomodon longifolius* and *Plagiomnium rostratum* amongst others. The day ended with an evening farewell party in a restaurant overlooking lake Balaton. Another sumptuous meal was provided, together with music.

After 6 days of intensive, if relaxed, bryology, the time had come for saying farewell. Everyone had enjoyed the hospitality of our Hungarian hosts and greatly appreciated all the hard work which went into making things run so well and our stay so memorable. Professors T. Pócs and T. Simon and Drs. M. Rajczy, Z. Tuba and G. Biró deserve a special word of thanks for all their help. We are also very appreciative for the help, advice and hard work of all the other people who contributed to making our visit to Hungary so memorable. We now know rather more about a nation of very friendly and affable European people.

Dept. of Botany, The University, Reading RG6 2AS, Berkshire, U.K.

A Report of the Fourth Meeting of CEBWG

by A.J. Harrington

THE FOURTH MEETING of the Central and East European Bryological Working Group (CEBWG) was held in Eger, Hungary, 12-14 August, 1985. On Monday 12th, some 50 participants from 13 countries assembled in the Zoology Department of the Ho Chi Minh Teachers' Training College where the meeting was opened by the Rector of the College in a short address of welcome. Dr. S.W. Greene conveyed greetings on behalf of IAB and then presented a paper entitled "Some aspects of bryological documentation" which was succeeded by two sessions on taxonomy with the following papers:-

- R. Grolle: News on hepatics in amber.
- I. Duell: Cluster-analysis of 8 European *Didymodon*-taxa.
- R. Duell: Taxonomy and distribution of the Central European *Zygodon*-taxa.
- R. Mues: New results on the flavonoid chemistry and chemotaxonomy of Hepaticae and Anthocerotae.
- H. Ando (Read by H. Kanda): *Hypnum cupressiforme* Hedw. and its close allies in Europe.
- J. Duda, T. Herben and I. Novotny (Read by I. Novotny): Strategies in bryofloristic research: a simulation study using real data.
- M. Rajczy: Numerical taxonomy of the genus *Schistidium* in Europe.

The afternoon was occupied by two sessions on bryogeography, one dealing with Europe and Asia, the other with Africa and Antarctica. The following papers were presented:-

- G. Nordhorn-Richter: Bryogeographic aspects of the Rhineland (NRW) Germany.
- J. Váňa and Z. Soldán (Read by Z. Soldán): Some new and phytogeographically-interesting bryophytes from Central Siberia.
- T. Olasz: A bryophyte flora of the Chasagt Chajchan Mts. (Mongolia).
- R. Ochrya and T. Pócs (Read by T. Pócs): East African bryophytes. XI. Dr. L. Péntek's collection from Mozambique.
- S. Orbán: Studies on African Calymperaceae. IV. Distribution of the African species of *Syrhophodon*.
- H. Kanda: The moss flora in the King George Island, South Shetland Islands.

In the evening the staff of the Botany Department entertained participants and guests to a welcoming party in the Ceremonial

Hall of the College, where the splendour of the surroundings was matched by the excellence of the food and wines.

Four sessions dealing with various aspects of ecology had been scheduled for Tuesday 13th, but some reorganisation proved necessary when it became apparent that a number of speakers had not arrived. In the event the papers detailed below were read, after which Dr. Váňa closed the proceedings.

- Gy. Biró and Zs. Debreczy (Read by Zs. Debreczy): Habitat and plant community conditions of a heliophyte, drought- and warmth-resistant moss microcommunity and microrespirometric tests of its species.
- S. Huneck: Some new results on the chemistry of liverworts.
- T. Simon and G. Szerényi (Read by T. Simon): The values of soil parameters (humus, pH, free carbonate, potassium, phosphorus, N-compounds) of moss cushions in acidic sands (Somogy, Hungary).
- B.F. van Tooren: The influence of the bryophyte layer on the microclimate in chalk grasslands.
- H.J. During: Life span, mortality and establishment of bryophytes in two contrasting habitats.
- J.-P. Frahm: The ecological significance of the costal anatomy in the genus *Campylopus*.

Two exhibits were displayed during the coffee-break: *Thuidium* sp. in Dominican amber (c. 20 million years old) by R. Grolle and some living thalloid hepatics (including *Bucegia romani-ca*) from Romania by M. Siegel.

The afternoon being free, participants had the opportunity of visiting the magnificent 18th century library of the College, as well as the astronomical observatory and camera obscura. A somewhat reduced party was then conducted on a short tour of Eger, finishing at the fortress with its fine picture gallery.

On Wednesday 14th the group visited two localities at the northern end of the Zemplén Mountains, an area described in some detail by Boros (1968) in his well-known book *Bryogeographie und Bryoflora Ungarns*. The first of these was the spectacular castle-hill at Füzér, where interest centred on the forest and rocky (andesite) slopes below the ruins of the castle. The site is notable for the occurrence of the fern *Woodsia ilvensis* and the Mediterranean-Atlantic moss, *Leptodon smithii*. Among the species seen were *Lophocolea minor*, *Homalothecium lutescens*, *Leucodon sciuroides*, *Mnium stellare*, *Rhytidium rugosum* and *Thuidium abietinum*. [continued over]

Fourth CEBWG Meeting (contd. from last page).

It was only a short drive to the second locality, Kőkapu, two-three kilometres south-west of Pálháza. Here the party divided, some members setting off to visit a nearby site noted for the presence of several species of *Sphagnum*, others preferring to examine beech forest and andesite rock faces close to the road. An interesting bryophyte flora included *Porcella arboris-vitae*, *Anomodon attenuatus*, *Leucodon sciuroides*, *Neckera complanata*, *Platygyrium repens* and *Rhynchostegiella tenella*. After a late lunch in the local restaurant, and a group photograph, the party journeyed to Tokaj (Tokay) where the meeting was brought to a bibulous conclusion in the celebrated wine cellars.

It is a pleasure to thank all of our Hungarian colleagues who contributed to the success of the meeting, but particularly Prof. Simon and Dr. Tuba for their guidance during the field excursion, the staff of the Botany Department of the Ho Chi Minh Teachers' Training College for their hospitality, and, above all, Dr. Orbán for his excellent organisation.

British Museum (Natural History), Cromwell Road, London SW7 5BD.

BRYOLOGICAL METHODS WORKSHOP

THE INTERNATIONAL ASSOCIATION of Bryologists will hold a pre-Congress bryological methods workshop in Mainz, Germany, 17-23 July, 1987.* The Workshop is planned as a practicum in which participants will share techniques in various fields of bryology. Workshops will include axenic culture, callus culture, *Sphagnum* culture, identification of protonema types, SEM and TEM preparation, fluorescence, detection of cations in cells, X-ray fluorescence, computer data handling, paleobryology, electrophoresis, chemosystematics, isozyme markers, serological methods, gene sequencing, herbarium methods, microclimate measurement, sampling, ecophysiology of growth and photosynthesis, experimental ecology, uses in teaching, illustration methods, photography. Participants are encouraged to bring items of equipment for demonstration. The schedule is:

17 July	Registration
18 July	Workshops
19 July	Excursion or ecological field trip
20-22 July	Workshops
23 July	Half day field trip for ecological sampling; departure for Berlin.



JÖRG CRAMER (1931 - 1985)

THE WELL-KNOWN PUBLISHER, Jörg Cramer, founder of the "Wissenschaftlicher Verlag für Botanik J. Cramer" in Braunschweig, West Germany, died of heart failure on 4th June, 1985, at the age of 53. He had an international reputation as a publisher of botanical books and periodicals, especially in the field of cryptogamic botany, and at the time of his death his catalogue contained over 2,000 titles, including a considerable number of bryological works.

Jörg Cramer was born on 1st December, 1931, in Bad Langensalza, Thüringen, where he attended school. In 1950 he moved to Braunschweig, where he received an education in the retail trade business. Subsequently, he worked for a few years in the publishing firm of his uncle, Julius Beltz in Weinheim and with the antiquarian booksellers, Schierenberg-Junk in Lochem, The Netherlands, where he got his training as a publisher and bookseller in the field of natural history. In the mid-fifties he saw fit to establish his own firm by resurrecting the famous name "H.R. Engelmann Verlag" from Leipzig - publisher of Hedwigia, *Die Natürlichen Pflanzenfamilien*, *Das Pflanzenreich*, etc. - which had ceased its activities at the end of the second world war.

Workshop registration must be sent to the Chairman, Dr. Janice Glime, Dept. Biological Sciences, Michigan Technological University, Houghton, MI 49931, U.S.A. Housing registration must be sent to Dr. Elmar Hartmann, Inst. für Allgemeine Botanik der Universität, Saarstrasse 21, 6500 Mainz, West Germany. Dr. Hans Rudolph, Universität Kiel and Dr. Zennoske Iwatsuki, Hiroshima University, are also serving on the workshop organizing committee.

[* A preliminary announcement about this Workshop was published in *Bryol. Times*, 26:6. Ed.]

Appropriately, Cramer's first publishing projects were a republication of Engler's *Das Pflanzenreich* (1958-1960, 105 volumes) and the *Annales Mycologici*, as well as the re-establishment of the cryptogamic journal *Hedwigia*, launched as *Nova Hedwigia* in 1959, with the help of the cryptogamists at the Berlin Botanical Museum.

In the beginning, his main interest was the re-edition of classical books (series *Historiae Naturalis Classicae*), but later his interest shifted to publishing new scientific works in botany. For this purpose, he established numerous new series including the various *Bibliothecas* for the major groups of cryptogams and the *Dissertationes Botanicae*. Many doctors' dissertations in the field of plant systematics and plant ecology thus found their way on to the market.

In bryology his main series were the *Index Hepaticarum* (1963 - to date), the *Bryophytorum Bibliotheca* (1974 - to date) and the *Journals Nova Hedwigia* and *Herzogia*. He helped to establish, for the International Association of Bryologists, the series *Advances in Bryology* (1981 - to date) which has successfully appeared in 2 volumes so far, the first one being sold out already. "The bryological market is small but dependable" is what he used to say and who would know better?

With his wife Helena Cramer and a few part-time assistants, he ran the business very much as a one-man job, and it is astonishing to see how much was achieved in such a short time. Jörg Cramer combined outstanding craftsmanship and intelligence with a very warm, jovial character. He had a genuine interest in, and appreciation for, personal contacts with the authors and scientific advisers of his publications and through these numerous personal contacts he developed an intimate knowledge of the field. I will long remember my visits to his hospitable home in Lehre, where much more time was spent on conversations concerning botanists he had known and their work than on actual business. He and his wife were great entertainers, and time would pass quickly as one enjoyed his numerous witty stories, her home-made cakes and a good glass of alcoholic beverage.

In his short life, Jörg Cramer achieved an amazing amount for botany and bryology. Those who knew him well remember him as an excellent craftsman and a marvellous human being.

S.R. Gradstein, Institute of Systematic Botany, Heidelberglaan 2, 3584 CS Utrecht, The Netherlands.

CEBWG, LEIPZIG

26-29/30 August, 1986.

5th Meeting of Bryologists
from Socialist Countries

THE 5TH MEETING of the Central and East European Bryological Working Group will be held in Leipzig under the joint sponsorship of the Biologische Gesellschaft der DDR und der Universität, Leipzig.

The programme will include 2 days of lectures on the taxonomy, cytology, ecology and distribution of bryophytes, and 2 day field excursions to the southern part of the DDR to visit calcareous and acidic habitats.

All interested in attending this meeting are asked to contact the organizer, Dr. R. Fritsch, Zentralinstitut für Genetik und Kulturpflanzenforschung, der Akademie der Wissenschaften der DDR, DDR - 4325 Gatersleben, DDR, for further particulars.

Recent Publications

Briolatina, No. 6: 1-8, 1985.

Bryologist, 88, No.1, pp. 1-64, 1985.

Bull. Brit. Bryol. Soc., No.46, 1-30, 1985.

Buxbaumiella, No.17: 2-60, 1985.

Crypt. Bryol. Lichen., 6 (Fasc. 2): 95-203, 1985.

Journal of Bryology, 13(3): 319-460, 1985.

Lindbergia, 10 (3): 133-195, 1984.

Muscillanea, No.4: 1-42, 1985.

Taxon, 34(3): 393-571, 1985.

DIARY

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

Oct. 4 - 6. First Blomquist bryological Foray, Roan Mtn. State Park, Tennessee. For details see Bryol. Times, 31: 6.

Oct. 31 - 3 Nov. WGMBE. Mont-Rigi. 3rd Meeting of lectures and field work in Hautes Fagnes region and in the Eifel. Further particulars from: Prof. Dr. R. Schumacker, Directeur, Université de Liège, Station Scientifique des Hautes Fagnes, B-4898 Mont-Rigi, Robertville, Belgium. See Bryol. Times, 32:4.

Nov. 2 - 3. BBS. Taxonomic Workshop, Gilbert White Museum, Selborne, Hants. Local Sec.: Dr. J.E. Chatfield, The Gilbert White Museum, The Wakes, Selborne, Alton, Hants GU34 3JH. For details, see Bull. BBS, 46: 16-17.

1986

Jan. 31 - 3 Feb. Cass, New Zealand. 3rd Annual bryological field meeting. See Bryol. Times, 33:3.

April 2-9. BBS. East Dereham, Norfolk. Spring field meeting. Local Sec.: Mr. R. Stevenson, 111 Wootton Road, King's Lynn, PE30 4DJ. Preliminary details in Bull. BBS, 46: 17.

July 23 - 5 Aug. BBS. West of Scotland. Summer field meeting. 1st week, Fort William; 2nd week, Gairlock, Wester Ross. Local Secs.: Mr. G.P. Rothero (for Fort William)

Benmore Centre, by Dunoon, Argyll, Scotland and Mr.D.G. Long (for Gairlock), Royal Botanic Garden, Edinburgh EH3 5LR. Preliminary details in Bull. BBS, 46:17.

Aug. 26-29/30. CEBWG Leipzig, DDR. For preliminary announcement see this page.

Sept. BBS. Paper-reading meeting and AGM. University of Leeds. Local Sec.: Prof. D.J. Cove, Dept. of Genetics, University of Leeds, LS2 9JT.

Nov. BBS. Workshop. University of Reading. Preliminary details in Bull. BBS, 46:17.

1987

April 6-13. BBS. Penzance, Cornwall. Spring field meeting. Local Sec.: Mrs. J. A. Paton, Fair Rising, Wagg Lane, Probus, Truro, Cornwall TR2 4JU. Preliminary details in Bull. BBS, 47.

July BBS. West of Ireland. Summer field meeting. 1st week Achill I.; 2nd week Westport. Local Sec.: Dr.D. M. Synnott, National Botanic Gardens, Glasnevin, Dublin 9, Ireland. Preliminary details in Bull. BBS, 46:17 - 18.

July 24 - 1 Aug. XIVth IBC Berlin (West). Preceded by IAPT Nomenclature Sessions, July 20 - 24. For preliminary notice see Bryol. Times, 23:9. Congress Address: XIV IBC. Bot. Garden and Museum, Königen-Luise-Strasse 6-8, D-1000, Berlin (West) 33, Germany.

July 17 - 23. IAB. Mainz. Bryological Methods Workshop. For further information, see this issue, p. 7.

THE INTERNATIONAL ASSOCIATION OF BRYOLOGISTS publishes The Bryological Times every two months, and the Advances in Bryology every two years. Material for The Bryological Times can be sent at any time, but submission dates for the Advances should be discussed with its Editor, Dr. Norton G. Miller (Albany) U.S.A. The Editors do not accept responsibility for the views of authors.

For details regarding membership of the International Association of Bryologists (currently U.S. \$ 8.00 p.a.), write to the Honorary Secretary, Dr. S.R. Gradstein, Instituut voor Systematische Plantkunde, Heidelberglaan 2, 3584 CS Utrecht, The Netherlands.

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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 1st November 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.