The Relationship between Taxonomy and Chemical Data*

By Rudiger Mues

DURING THE LAST TWENTY YEARS, the number of papers on the "Chemistry of bryophytes" has been increasing rapidly, as shown by the graph of citations in this field of research given by Huneck (1983). Today there may even appear a flood of papers on chemical constituents of bryophytes and so it becomes more and more difficult for taxonomists to evaluate these data. Several review articles are available summarizing the results, only the most recent being cited here: Markham & Porter (1978); Zinsmeister & Mues (1980); Spencer (1979, 1980); Asakawa (1982a) and Huneck (1983). In these reviews the compounds are mainly arranged into several compound classes but the taxonomist, who is not so familiar with natural products, may hardly be able to use them for the solution of his special problems.

Likewise, most of the individual papers, written mainly by chemists or pharmacologists with or without collaboration from botanists, e.g. Markham et al. (1976a); Campbell et al. (1979); Mues (1980) and Asakawa (1982b) describe the isolation and identification of new compounds. As has already happened for several decades with conifers, discussion is more often than not limited to their chemical and pharmaceutical properties with little or no mention of their possible systematic significance.

As in the case of all new fields of research, classical systematists and taxonomists have at first been sceptical about attempts to introduce new characters. However, more and more papers are now a consequence of cooperation between phytochemists and taxonomists, e.g. Kopena & Nilsson (1978); Asakawa et al. (1981); Tocque et al. (1981); Graggstein et al. (1981) and Mues et al. (1982). From such collaboration the phytochemist is immediately made aware of the most important and urgent problems and obtains appropriate and correctly determined plant material to start his investigations. The taxonomist, well informed of the nature of phytochemical analyses, is thus readily able to assimilate these new data.

The unequivocal condition of chemotaxonomy is that a compound must represent a stable character. This means that the biosynthesis of such a compound must be genetically controlled and is not altered by environmental conditions. The following discussion considers some of the factors which must be taken into account when using chemical data for taxonomic purposes.

1. Compound Class

Organic chemical plant constituents are classified into primary and secondary plant products. Proteins, carbohydrates and lipids are primary products; terpenoids, flavonoids, alkaloids and others are considered as secondary products. In general primary products are virtually ubiquitous within any particular group of plants. So far only a limited number of primary plant products, often with modified structures, have been used as marker substances in bryophyte taxonomy. These have been most valuable for distinguishing between specific and sub-specific ranks, e.g. Lewis (1970); Christie et al. (1981); Kozak & Sweeney (1977); Kozak & Sweeney (1978) and Kozak & Sweeney (1981b). On the other hand, secondary plant products, because of their discontinuous distribution among groups, have proved to be more useful for chemotaxonomic purposes at several levels in the taxonomic hierarchy. To date, in bryophytes, terpenoids and phenolics have been used most widely as chemotaxonomic markers.

Chromosome Banding in Bryophytes *

By M.E. Newton

THAT CHROMOSOMES are not uniform throughout their length is well known. Centromeres and nuclear organizers provide obvious evidence of this, as does differential condensation relating to the presence of heterochromatin, as well as euchromatin. However, where centromeres do not appear as primary constrictions, as in bryophytes, these features are difficult to locate accurately because to do so would necessitate the correlation of observations made during prophase and anaphase of mitosis with chromosome dimensions determined at metaphase. Moreover, the cytological markers which they provide are often inadequate for comparative purposes in bryophytes, and are particularly so in liverworts.

These problems may now be largely overcome by the use of modern chromosome banding techniques developed during the last fifteen years. Each chromosome identifies, as similarly stained segments or bands, regions of the chromosomes which have some feature of their sub-structure in common. They serve as highly efficient probes of variation in the conformation and molecular composition of chromatin at the light microscope level. As a result, chromosome banding has changed the whole course of higher plant and animal cytology, including its medical aspects, and has been shown to be particularly effective in bryophyte studies. It is, therefore, surprising that bryologists have been slow to adopt techniques which other cytologists use routinely. Part of the reason is perhaps due to misunderstanding; two of the three techniques listed by Ramsay (1983) are essentially identical and the third is not a banding technique but is generally recognized. There is also a belief that many bryophyte chromosomes are too small to make...
2. Taxonomy & Chemical data (contd. from p.1)

2. Plant Material

The most important feature of phytorhiza is that taxonomic work is that it can be correctly identified. Especially with difficult genera such as Pteris, Plagiobrya, Frullania, Bryum, Campylypus, Sphagnum or other plants by bryophytes, because of their dependence on moisture. In the case of bryophytes normally the whole plant is used for chemical studies. If possible, fresh plant material should be extracted, especially for the analysis of certain terpenoids. Yet it is often impracticable to keep the plants fresh so that one has to work with dried plants. These should be air-dried at room temperature in a dark room for at least several days: drying plants in an oven may cause the decomposition of heat-labile compounds.

Whenever possible comparisons should be made to confirm whether the compound pattern of fresh and dried plants. Cultivation of the species under chemical investigations is desirable, but it is still very difficult to grow bryophytes under natural conditions. Once cultivated plants have changed morphologically, which is often the case under laboratory or greenhouse conditions, the compound pattern may change too so that results are not to results on chemical constituents from "greenhouse plants" are not comparable with results from plants from natural habitats.

A compound or a compound pattern is only acceptable as a chemotaxonomic character when it is qualitatively, and possibly quantitatively, stable. This means that the pattern in the plant should not depend on seasonal, ecological, geographical or other environmental conditions. To determine stability it is necessary to check as many samples as possible from a wide range of environments.

When using herbarium specimens, the age of a collection has to be taken into account. The compound pattern of old herbarium specimens should be compared with that of recently-collected plants: suitable compounds should be known for at least a couple of years. In the case of flavonoids 100-year-old herbarium specimens showed the same pattern as freshly collected plants (Mues, 1984).

Furthermore, it is important to know whether the conditions under which the material was obtained, i.e. whether it was pure gametophytic, or rich in sporophytic material, or sporophytic alone. Some bryophytes exhibit changes in compound pattern when entering into the reproductive phase, e.g. 

When the foregoing problems are taken into account and phydrochlorile taxonomists and specialists in other fields, a variety of useful characters may emerge which may permit more precise and thorough study of critical taxa. In my view there should exist at least several unrelated, stable characters which clearly define one taxon from another before it should be given specific rank. I strongly support the notion that two taxa which differ in only one character, be it chromosome number, sexuality or chemistry, should not be regarded as distinct species. In this context Hawksworth (1976) states that the concept of "morphological species" in lichens is presently highly controversial. Lichenologists are now assigning characters before treating such cases as species, otherwise an infraspecific rank is preferred.

References


BRYOLOGICAL DRAWINGS OF GEORG ROTH (1842-1915) AT MICH

DR. HOWARD CRUM of Ann Arbor, Michigan, informs us that 349 plates of unpublished drawings by Georg Roth, as well as the manuscript for the Orthotricha, were present on loan at the University of Michigan Herbarium (MICH). In addition, there is what appears to be the manuscript but not the drawings for "Die europäischen Laubmoose" (TL-2/79#641), published completely or in part on loan from MICH. The number of species illustrated (12 on each plate) will be over 10,000.

These drawings are important because Roth had access to the collections in the MI Herbarium and many types of Karl Möller hails, which were destroyed together with the majority of papers of the Berlin collections, in 1943. We could, alas, not enter this information into TL-2, but the drawings were preserved for the unpublished volume of the Ausserer Laubmoose et al., were at MICH in January, 1987, and can now be accessed in the sense that the drawings and manuscript are at MICH permanently.


FIELD MEETING IN NEW ZEALAND

The THIRD in a series of annual bryological field meetings will be held 31 January - 3 February, 1986 at the University of Canterbury Field Station at Cass, New Zealand. Field trips will be made to montane, subalpine and alpine localities in Arthurs Pass National Park and will be organized by Allan Pfeil and Bryony Macmillan of Botany Division, DSIR. Registration will be limited to 25 participants. Overseas bryologists who may be visiting New Zealand at this time would be most welcome.

Details of the weekend have yet to be finalised. For further information write to Mrs. Philippa Horn, Plant Sciences Department, Lincoln College, Canterbury, New Zealand.

IAB

CONSTITUTION BALLOT

The results of the postal ballot were as follows:

59 votes received
50 in favour of all proposals
Hence all proposals accepted (2/3 majority required).

A copy of the revised Constitution will be published, in due course, in these columns.

S.R. Gradstein, Secretary, IAB, 15.v.1985.

No. 33, 1985.

The Bryological Times


sophisticated staining worthwhile, but this is not true. Cytological
circumstances of the class are demonstrated photographically
in a number of research papers (e.g. Segawa, 1965; Ono, 1970;
Inoue & Yamashita, 1974; Inoue & Yamashita, 1980 and McAdam,
1982) are indisputable evidence that the standards of prepara
tion required for banding have been attained repeatedly.
Inconsistent banding should therefore follow as a matter of course.

Of the many banding tech
iques now available, G-banding has recently been achieved in
Pinus resinosa (Drury) 1982 but has met with very little success
elsewhere in the plant kingdom, whereas R-bands, the reverse of
G-bands, have not been demonstrated in plants at all. None of the
conventional banding techniques outlined below are known to be
relevant to this group of plants.

C-banding is a useful technique in the determination of qualita
tive and quantitative characteristics of chromosomes and the
study of evolution in plants. It is based on the occurrence of
DNA in constitutive heterochromatin. DNA is the genetic mate
rial in all living organisms. It is present in all cells of the body
and is essential for the normal function of the organism. The
DNA in a cell is in the form of chromosomes, which are struc
turally and functionally different from other types of DNA.

References
Bowie, J.R. 1975. Sex chromosomes in higher plants. Chromosoma,
22: 139-158.

Drury, A. 1980. G-banded chro

Funaki, K., Matsui, S. & Sasaki, M. 1975. Location of nucleo
lar organizer in animal and plant chromosomes by means of an improved N-band

Gerlich, W. 1977. N-banded karyotypes of wheat species. Chromosoma,
56 (3): 203-214.

Hajekel, K. 1977. N-banding in polyploid chromosomes of Chi


Hillwig, T. & A. Grop. 1972. Staining of constitutive heterochromatin in mammalian


Inoue, S. 1971. Karyological studies on mosses. VII. Karyotypes of fourteen spe
cies in Smatophyllaceae, Hype

The Bryological Times

7th All India Botanical Conference
JAIPUR

IN THE PAPER READING SESSIONS, nine papers were presented on bryophytes, five from Lucknow University and one each from Kumon University (Nainital), Rajasthan University (Jaipur), the Botanical Survey of India (Allahabad) and the National Botanical Research Institute (Lucknow).

The titles and authors of the papers were as follows:


I WISH TO RECEIVE living or re-vivable material of the following genera of Marchantiales for work on their chromosomes.

Athalamia spp. Monoselinium Aitchinsoniolejeunea Bucceria Poeltoplepis Cornelia Sauteria Cryptostylis Stephensonella Cytotadium Wiesenhera

I would be grateful to receive any samples of these plants.

Prof. Dr. O.H. Volk, Botanisches Institut, 35 Mittlerer Dallenberg, D-8700 Würzburg, West Germany.

Desidaria

I WOULD BE GRATEFUL to receive samples of very young and older capsules of Fontinalis antipyretica (or other Fontinalis species) for study of sporogenesis by TEM.

Anne Seé, Laboratoire de Cryptogamie, 12 rue Buffon, 75005, Paris, France.

Wanted: Living European Tortella species

I HAVE STARTED WORK on a "Taxonomical investigation of European Tortella species" as a thesis for a doctoral degree. Samples of Tortella species from different European countries are needed for cultivation for cytological, chemotaxonomical and eco-physiological investigations.

The following species are of special interest.

Tortella densa, Tortella rigens F. fragilis F. nitida F. humilis T. flavovirens F. inclinata forms + varieties only forms + varieties only forms + varieties only

To anyone willing to help me I can offer in return to help with the determination of critical and difficult Tortellas of Europe.

Please write to: Rudolph May, University Duisburg, Fachbereich 6: Botanik, Lotharstr. 1, 4100, Duisburg, West Germany.

No. 33, 1985.


The Bryological Times

No. 33, 1985.

Congratulations and Thanks to Dr. Sinske Hattori

By Hiroshi Inoue

AUGUST 10th is the 70th birthday of Dr. Sinske Hattori, well-known, eminent Japanese hepatologist, and the Director of the Hattori Botanical Laboratory.

Praha, 1982.
(Courtesy of M. Andre Causee)

Until 1940, bryology in Japan was sustained by a small but dedicated group of professionals and amateurs. Dr. Hattori is almost entirely responsible for changing the scope and direction of those early studies and for promoting them to their present internationally-recognized level. He graduated from the University of Tokyo (formerly Tokyo Imperial University) in 1940 with the thesis for B.Sc., which was published in 1943 as "Contributio ad floram hepaticarum Austro-Kiussuensem" by the National Science Museum, Tokyo. In 1941, he got a position at the National Science Museum, Tokyo (formerly Tokyo Science Museum) as Assistant Curator of Botany, and he held this position until 1945 when he went back to Nichinan, Miyazaki Pref., his home town. At Nichinan he started immediately his preparations to establish his own private laboratory, which was named the Hattori Botanical Laboratory. It was officially recognized by the Japanese Government on March 1st, 1946, and he became its Director. In 1948 he was awarded the degree of D. Sc. from Tokyo University for his thesis "Contributio ad floram Hepaticarum Yakusimensem" which appeared in the Journal. Hattori Bot. Lab., No. 1-6 (1947-1952).

Although Dr. Hattori has never had a position at a University, he has helped many young students in Japan. In the early days of the laboratory he took two young students as staff members: they were Dr. S. Hwatsuki (in 1954) and Dr. M. Mizutani (1956). Furthermore, he encouraged and guided in the direction of bryology many young students, among whom were Dr. N. Kitagawa (hepatics), Dr. K. Yamada (hepatics), Dr. T. Amakawa (hepatics) and the author.

Numerous bryological contributions made by Dr. Hattori are well known and highly valued, and further remarks about this aspect of Dr. Hattori's achievements are certainly unnecessary. Recently, he has become a specialist of the troublesome genus Frullania, and numerous contributions, and treating the species from almost the whole world. He is a very busy person, but still finds time to conduct his laboratory or his companies, but still he is examining Frullania specimens, typing manuscripts, letters, etc. His most time-consuming business is editing the Journal of the Hattori Botanical Laboratory, as he checks all manuscripts throughout by himself and makes many corrections.

For his activities in bryological science, several honorable prizes have been awarded to him. Among these are the Cultural Prize of Miyazaki (in 1952), the Puryear Rubber Medal (in 1970), and the Asahi Cultural Award (in 1976).

In spite of all these activities, Dr. Hattori is quite human! His productivity is very warm and generous, and he is always thinking about other persons. He is very thin, but still has enormous vitality! He also has great talent for entertaining! With 2-3 glasses of beer (but, formerly Japanese sake) his spirit relaxes and he enjoys singing folk songs of Miyazaki, entertaining others with his beautiful voice.

In Japan, the age of 70 is said to be "Koki" which traditionally means "very uncommon age". Someone said in Japan that "Koki" age is still young, like a little boy. So I hope Dr. Hattori still has a lot of "power" to shake up the field of bryology in the future.

Congratulations for his "Koki!"

Division of Cryptogams, National Science Museum, Ueno Park, Daito-ku, Tokyo, Japan.

Recent Publications


The herbarium consists of two parts: a "main" part of some 10,000 specimens and another of more than 4,000 collections not incorporated. Additionally there are over 4,000 specimens in the index sets not issued by Sullivan, and an undisclosed number of hepatics. While strong in American material, there is also a large "foreign" component, as Sullivan regularly exchanged material with the leading figures of his day. In 1980-82 the herbarium was completely remounted and the nomenclature standardized "into a state consistent among its parts and with Sullivan's publications".

The index is to the "main" part of the moss herbarium. It consists of a list of genera, with sheet numbers, followed by an alphabetical list of specific and infraspecific epithets, each preceded by a sheet number(s) and the number of specimens, and followed by the name of its genus. As many of Sullivan's specific geographic types are in the separate collections, they will not be found in the index.

The whole is clearly presented and easy to consult, but the use of a cheap, spiral or velo binding would have been more helpful, particularly as none of the pages bear a running title or other identifier mark.

Letters to the Editor

Dear Sir,

The Mixed Collection "Heresy"

The arguments (Wyatt et al., 1985) over the use of mixed collections in bryophyte taxonomy would appear to be no more than a rediscovery of a previously abandoned topic, but the arguments considered then must be equally valid now, and I question the value of a re-run of battles fought long ago.

Our problem is that, in general, we have not been able to culture our plants well enough for wholly natural morphology and reproduction to be achieved, and we are forced to use herbarium material on the majority of occasions. We must all know that our herbarium colleagues lay great weight on breeding relationships within experimentally amenable groups, and that on a wide scale most herbarium taxonomic studies still utilise the broad fields of comparative morphology and anatomy. And so of course, do most botanists. In real life it is simply not constructive for herbologists to have access to phytotrons, etc., to issue a diktat that everyone else's work is useless; all the practical necessity is that we adjust our taxonomy progressively in the light of further and improved knowledge, but we do not throw away the accumulated knowledge of our 'ignorant' predecessors.

This is not in any way to denigrate the value of experimental phenotypic and genotypic studies when they are feasible. Indeed, without them, the demonstration of specific distinction is probably impossible - but let us keep a sense of proportion. Surely the answer is to encourage the use of experimental techniques when appropriate and to emphasise their value, but to accept that by default a great deal can still be achieved through the comparative study of herbarium samples, (mixed or otherwise).

Reference

D.H. Dalby, Department of Pure and Applied Biology, Imperial College, London SW7 2BB.

Dear Sir,

The "Mixed Collection Method" AGAIN

Three colleagues have recently criticized the practice of using mixed stands for taxonomic purposes (J. Hattori Bot. Lab. Ser. 31: 698-704, 1982). From the review in The Bryological Times, 21:3, 1985, I was led to think that these authors are surprised that no rebuttal has been presented in print. I confess, there is, indeed, one point that may deserve a comment.

I have been flattered by the wide publicity this simple and cheap method has received through the papers cited above and about its occasional ascription as the mixed collection method of Isovita, and the attribution to me is, of course, misleading.

Nobody knows who was the first person to use or the first taxonomist, to sort out individuals of "closely-related plants" (a completely subjective concept) in mixed populations seen in the field (or in herbarium packets) and use their morphological differences for distinctive taxa. The "method", basically a matter of self-evidence, was brought alive and found particularly useful by keen observers such as some promoters of Nordic phytosociology.

Among bryologists, two early users of the method in the late 1800s and early 1900s were H. Lindberg and H. Buch respectively. That I have a few colleagues, felt it necessary to discuss the matter in some detail in our papers was largely because very few colleagues abroad seemed to be aware of it.

If the name of a botanist should be associated with this "heresy", I should suggest its attribution to R. Tuomikoski, now well-known for his critical and successful use of the method in his studies performed nearly half a hundred years ago. Actually, even this historical fact is clear in the Taxon paper referred to above. So what!...!

Pekka Isovita, Botanical Museum, University of Helsinki, Unioninkatu 44, SF-00170, Helsinki, Finland.

Deaths

CRAMER, Jörg, Cryptogamic publisher, at Braunschweig, on 4 June 1985; born 1 Dec. 1931.
DIARY

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

Aug. 2-4. BLAM, Harz Mountains. Leader: W. Heimhold. Further information from W. Heimhold, Rottenweg 4, 3394 Lengelshain 1, B.R.D.

Aug. 5-10. IAB. Budapest and VácgrótÁÁ. Conference on Bryoecology. For 3rd Circular, see Bryol. Times, 30:9.

Aug. 7-11. SBLS. Field work in Engelberg (northern Alps) in relation to mapping programme. Further information from: Dr. K.A. Ammann, Synt.-Geobot. Institut, Altenbergrain 21, CH-3013 Bern, Switzerland.


Sept. 7-8. SBLS. Romont (Canton Fribourg, limit plateau prealps). Bryophyte mapping weekend. Further information from Dr. K.A. Ammann, Synt.-Geobot. Institut, Altenbergrain 21, CH-3013 Bern, Switzerland.


Sept. 20-22. 4th Midwestern bryological Foray. Cusino Lake Field Station of Northern Michigan University. Professional foresters, students and amateurs are cordially invited to participate. Further information from Dr. Maynard Bowers, Department of Biology, Northern Michigan University, Marquette, Michigan 49855, USA.


Oct. 31 - Nov. 1. WGBAE. 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, Universite de Liège, Station Scientifique des Hautes Fagnes, B-8593 Mont-Rigi, Robertville, Belgium. For details see Bryol. Times 32:4


--- 1986 ---

Jan. 31 - 3 Feb. Case, New Zealand. 3rd Annual bryological field meeting. See this issue, p. 3.

April 2-9. BBS. East Dereham, Norfolk. Spring field meeting. Local Sec.: Mr. P. Stevenson, 11 Wootton Road, King's Lynn, PE30 4RD. Preliminary details in Bull. BBS, 46.

July 23 - 3 Aug. BBS. West of Scotland. Summer field meeting. 1st week, Port William; 2nd week, Gairloch, Wester Ross. Local Sec.: Mr. G.P. Rothero (for Port William), Benmore Centre, by Dunoon, Argyll, Scotland and Mr. D.G. Long (for Gairloch), Royal Botanic Garden, Edinburgh EH3 5LR. Preliminary details in Bull. BBS, 46.


THE INTERNATIONAL ASSOCIATION OF BRYOLOGISTS publishes The Bryological Times every two months, and the Advance 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. R.P. Gradstein, Institut voor Systematische Plantkunde, Heidelberglaan 2, 3584 CS Utrecht, The Netherlands.

THE BRYOLOGICAL TIMES is published in Utrecht and distributed from Beijing (China), Kingston (Tasmania), Missouri (U.S.A.), Reading (U.K.), Tokyo (Japan), Vácvaródt (Hungary) and Utrecht. All correspondence concerning mailing to: M.A. van Slageren, Institut voor Systematische Plantkunde, 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, England (Telex 04783 HULIB 1) by 1st Sept. 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.

Copyright © International Association of Bryologists