



Dr. Roland Beschel died suddenly in his home in Kingston, Ontario, on 22 January 1971, at the age of 42. A Professor of Biology at Queen's University, he was widely known for his development of lichenometry, a means of dating surfaces using the growth-rate of lichens. He considered himself a "geobotanist" in the classical sense and dealt with all aspects of whole-organism biology: ecology, taxonomy, and phytogeography. He was also active in developing new approaches to analytical ecology, phenology, and studies of lichens and cities. His active mind was always seeking new ways of looking at old problems and nothing made him happier than debating with a friend or colleague. His interest and activity in local conservation will make him sorely missed by his friends in southern Ontario.

Dr. Beschel was truly an international lichenologist. He spoke German, English, French, and Russian and was known and liked throughout the world. He was born in Austria and only came to Canada in 1956. His tragic death cut short a remarkable career.
—I. M. Brodo

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Editorial

Information and Automation in Herbaria

At a time when taxonomists and ecologists are pressing governments to make industry internalize the cost of pollution (Hardin, 1969) and thereby adopt a more realistic policy of environmental control it would be well for biologists and research scientists in general to take a hard look at their own accounting procedures. In keeping with theories on homeostatic mechanisms biologists should be among the first to expect a backlash from industrialists who may be tempted to argue that if they are to be compelled to internalize costs then scientific workers should also be asked to do the same. In the case of "pure" research this is clearly impossible as no rigorous analysis of cost-benefit return to society is possible, but scientists nevertheless have a responsibility to conduct their research in a productive and efficient manner. Are curators convinced that this standard applies to the current administration of herbaria?

Perhaps we should consider the function of herbaria. In many respects they are similar to libraries and primarily so in the fact that they are storage places for information. We are concerned with two types of information in herbaria, the information content of the specimen itself and the information

on its label. It should be possible to make the latter type more available and hence more efficiently utilized. I will return to this point later. Taking our analogy further we note that librarians are reluctant to purchase multiple copies of books for the good reason that they contain completely redundant information (making the assumption that they contain no printing or binding errors). If we equate information with diversity in the sense of Margalef (1958), then we can value herbaria by their diversity as measured in bits per individual, maximum diversity being attained when each specimen belongs to a different species and a minimum, close to zero, when all specimens belong to the same clone. Unlike librarians, however, curators are also faced with the problem of within-species diversity and hence with information at this level. "Multiple listings" within species are essential but there comes a point when additional specimens are redundant and add nothing to our information bank. I would hazard a guess that a large proportion of herbarium acquisitions stem from specimens and their duplicates deposited by ecologists as vouchers. Most of this material belongs to ubiquitous species which are already well or over represented in herbaria and curators might question whether or not the cost of adding this material to their collections is commensurate with the information gained. Possibly the only curators who face up to this decision are those for whom cabinet space is limiting. This is not to say, however, that specimens of common species which represent range extensions should not be added to collections because these also represent information gain, information which is pertinent to spatial diversity or pattern diversity (Pielou, 1966) as it is sometimes called by ecologists interested in community structure. The final analogy which I will draw between libraries and herbaria, related to the above, is that of stability (Margalef, 1969) of the collections they house. The situation in herbaria may not be critical in this respect at the present time, except where type specimens are concerned, but both books and lichens are progressively destroyed by legitimate usage and accidental damage.

This, together with loss, represents a reduction of information content which will have to be offset by replacement with specimens of comparable information content if the information spectra within herbaria are to remain constant.

Most of the above may appear to contain nothing new (redundant information!) but perhaps it has served to emphasize the fact that it is now possible to calculate the diversity and hence estimate the information content of herbaria and compare this with their utilization, this being one approach to a cost-benefit analysis. However calculated, it is apparent that the ratio of utilization to information will be exceedingly low and we must endeavor to improve this situation. The information inherent within specimens can only be interpreted by taxonomists and the rate of utilization of such information is governed by the supply of trained personnel. We may not be able to change this position very easily but in the case of the information on the specimen label there is more hope, provided that the label has been prepared in a suitable manner.

It is not the purpose of this editorial to review the recent advances in automated herbarium procedures as this has been very well documented by Beschel and Soper (1970) but rather to air some of the excitement and misgivings about these methods which have arisen in my personal experience. Firstly the automated production of herbarium labels should not be viewed only as a souped-up administrative procedure but as a system which makes label information more readily available to the taxonomist. This is quite possible if the data fed into the computer is stored permanently on punch cards, tape, or preferably on disc file. Most interest in data retrieval currently centres around mapping so that ecological and other relevant information is usually not stored. It is a great loss, since the ecology of organisms presumably reflects their genotype in a similar manner to their phenetic characters. In fact, it would appear that ecological "characters" are less ambiguous than distribution patterns which are influenced not only by ecological factors but also by historical factors. If we had the relevant

data on file, someone might even be stimulated to separate these two factors by the application of multivariate statistics and raise the subject of phytogeography from the nebulous state in which it now finds itself.

Methods of automated mapping are of particular relevance to North American lichenologists at the present time since the American Bryological and Lichenological Society is currently studying the feasibility of launching a mapping scheme. The British Lichen Society is already well under way with such a project based on the methods of Perring (1963) (see Sheard, 1967 for the first results). My initial reaction to these plans is that the benefits accruing from any such scheme would be far greater if they were integrated with a more wide ranging system of automated herbarium procedures from the start. There is an urgent need for cooperation amongst curators to design an automated herbarium system which would serve the needs of the majority of herbaria. This would avoid smaller institutions and universities having to employ the very expensive services of programmers. It would also avoid duplication of effort and curtail the rapid proliferation of different systems which will be difficult to integrate in the future. The most flexible method of input which is within the reach of most curators, while perhaps not the most elegant, is one based on the familiar 80-column punch card. Most operating systems output summary data cards which are then used as input for mapping programs. However, if label data were stored on disc, there would be no necessity to output these data cards and this immediately negates the problem of coding information in order for it to be accommodated on the limited space available on the cards. This procedure would also make other information such as habitat notes, not normally included on summary cards, available. In order for ecological data to be generally useful it would be necessary to gather the data in a standard form and herein lies the difficulty. The associated problems, however, may not be insuperable if a system of gathering data on environmental parameters is adopted which is comparable to

that of Braun-Blanquet as exemplified by Barkman (1958) for lichens and bryophytes. Such information would be invaluable to taxonomists and ecologists alike.

The physical problems of plotting maps, I/O operations for label production, sorting, listing and other procedures are details which can be overcome by programmers and biologists with experience in these areas. It is far more important at this stage for curators to develop a philosophy on the subject and decide upon a strategy that will serve the longterm needs of lichen taxonomy in the best way. Perhaps some of these ideas will serve to promote cooperation and stimulate discussion in this important field.

John Sheard

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Research Notes

Ahmadjian, V. (U.S.A.)—Several years ago I received from the Eli Lilly Pharmaceutical Company lyophilized cultures of lichen fungi which I had sent them for their screening program. I inoculated malt-yeast extract agar with these lyophilized pellets and obtained growth from a variety of the mycobionts, including *Acarospora fuscata*, *A. smaragdula*, *Cladonia cristatella*, *C. piedmontensis*, *C. rangiferina*, *Dermatocarpon fluviatile*, *Graphis tenella*, *Lecidea* cf. *cinereoatra*, and *Sarcogyne simplex*. The original cultures which were lyophilized and preserved with liquid nitrogen consisted only of vegetative hyphae.

Jones, C. B. (U.S.A.)—*Physconia pulverulenta* (Schreb.) Poelt (syn. *Physcia pulverulenta* (Schreb.) Hampe) is an uncommon species which normally grows on the lower trunks of trees. In August 1970, while collecting lichens for inclusion in a checklist of the flora of Capulin Mountain National Monument (Union County, New Mexico), I found this species growing on a small clear glass bottle near Giant's Grave (a collapsed lava tube). The bottle dates from the late 1930's and presumably had been there since about that time. Several small (less than 1 cm²) and one larger (9 × 3 cm) specimens were present on the neck of the bottle which was completely out of contact with either the soil or the lava blocks. Other than the absence of apothecia, the thalli observed were normal for the species.

News

Bird, C. D. (Canada)—These students at the University of Calgary are working under me: Ramakant Kalgutkar (corticolous lichen ecology in the Rocky Mountains of SW Alberta); Mrs. Eileen Matthews (revisionary studies of *Ramalina* in N. America); and Patricia MacNeill (lichens of the Cypress Hills in Alberta).

Bowler, P. A. (U.S.A.)—Am working on the chemical ecology of the genus *Ramalina* with P. W. Rundel of the Department of Population and Environmental Biology, University of California, Irvine, Calif. 92664. Any specimens from the *R. farinacea* group for determination or exchange will be appreciated.

Follmann, G. (Germany)—J. Redon (Department of Biology, University of Chile, Valparaiso) received a fellowship from the German Humboldt Foundation and began his studies on the systematics, chemistry, and ecology of Chilean lichens in the Department of Botany, Natural History Museum, Kassel.

Good, H. M. (Canada)—The lichen collection of Dr. Roland Beschel will be maintained at Queen's University and made available to any who are interested.

Hale, M. E. (U.S.A.)—Spending three weeks in March visiting herbarium collections at P, G, W, S, LD, UPS, and BM in connection with studies on the Thelotremales.

Kurokawa, S. (Japan)—Dr. Eilif Dahl visited Japan on the way from Australia to Norway from 15 December 1970 to 1 January 1971. He spent most of his time at the lichen herbarium of the National Science Museum in Tokyo. During his stay he met Dr. Y. Asahina, Dr. M. Sato, and Miss Mariko Nuno. He also made an overnight collecting trip to the base of Mt. Fuji and a one day trip to the Izu Peninsula with me.

Thomson, J. W. (U.S.A.)—Mrs. Adelaide Soares of Brazil finished a master's thesis last June on the relationship between the fungi and the green and blue-green algae in the thallus of *Lobaria* and *Solorina* as studied with the electron microscope. William P. Jordan is working on a monograph of the North American species of *Lobaria*, including intensive microchemical and thin-layer chromatographic studies of the substances and studies of the morphology, one paper of the latter having already appeared in the Bryologist. Miss Gilian Newberry is working on the ecology of lichens in central Wisconsin in the vicinity of some of the sulphite paper mills to determine if possible the influence of air pollution in their vicinity. I myself continue with studies of American arctic

lichens with the preparation of a manual of American Arctic Lichens. Our staff illustrator, Bethia Brehmer, has almost completed the drawings of the foliose and fruticose species for this manual. They should be done some time this spring.

Trass, H. (Estonian S.S.R.)—Lichenologists of the Department of Plant Taxonomy and Ecology, Tartu State University, collected lichens in 1970 from Tschukotka peninsula, Far East U.S.S.R. (Taimi Piin, more than 3000 specimens) and in Estonian S.S.R. (Eva Nilson, Anne-Liis Symermaa, Hans Trass). J. Martin (Tallin Botanical Garden) spent July in the Taimyr peninsula (northern Siberia) collecting lichens (2000 specimens). Our department maintains a special arcto-alpine herbarium (lichens from the Kola peninsula, Polar-Ural, Taimyr, Tschukotka, Kamtschatka, and other regions). Vol. 9 of "Papers on Botany" (Transactions of the Tartu State University, vol. 268) came out in August 1970. The papers in this volume reflect the research work conducted by members of the department during the past five years in taxonomy, biology, ecology, and geography of lichens, fungi, and algae. Four lichenological papers are included: Hans Trass, "The elements and development of the lichen flora of Estonia" (233 pages, 47 figs., 50 distribution maps, and 5 tables); E. Nilson, "On the chemotaxonomy of some species of *Cetraria*" (15 pages) and "Some notes on *Pseudevernia*;" and A.-L. Symermaa, "Epiphytic lichens found in main forest types of Estonia" (33 pages). Articles are in Russian with English summaries.

Webber, M. and P. (U.S.A.)—We have been on the faculty of the University of Colorado's Institute of Arctic and Alpine Research (INSTARR) since September 1969. Three years before this we were at York University, Toronto, Canada. Mukta Webber has begun a systematic study of lichen ultrastructure (*Can. J. Bot.* 48:1521-1524, 1970) and would like to correspond with others engaged in this work. Pat Webber, though primarily concerned with tundra vegetation analysis and its productivity, is continuing his lichenometrical interests which were spawned while working under the late Roland Beschel

at Queen's University (*Arctic and Alpine Res.* 1:181-194, 1969). He is currently preparing a Manual for Lichenometry with John Andrews (also of INSTARR) for the British Geomorphological Research Group Technical Bulletin. If any readers have recent measurements of lichen growth or know of new applications of lichenometry outside of substrate dating, such as for pollution indices or primary production estimates, then they would like to hear of them. Pat Webber has also just received a grant of \$113,505 from the Bureau of Reclamation to make a four-year study of the impact of increased snowfall on the alpine vegetation of the San Juan Mountains in southwestern Colorado. Special emphasis is being placed on the effects on lichens of increased snow from cloudseeding using silver iodide. Experiments using snowfences to augment winter snowpack are also being made.

Awards

Anne-Liis Symermaa (now at the Institute of Zoology and Botany of the Academy of Sciences of the Estonian S.S.R.) was awarded in June, 1970, the degree Candidate of Sciences which is equivalent to the Ph.D. degree. Her dissertation was "Ecology and coenology of epiphytic lichens in the main forest types of Estonia."

Isao Yoshimura received a Ph.D. degree in December, 1970, from Tokyo University of Education. His dissertation on the Asian *Lobarias* will be printed in issue No. 34 of the *Journal of the Hattori Botanical Laboratory*.

Views

I would like to see taxonomists pay more attention to the identification of algal symbionts. Many taxonomists have adopted the use of microchemical tests and readily identify the lichen substances within a particular thallus. Yet the same taxonomists pay little heed to the phycobiont or if they do use

zahlbrucknerian terminology to indicate type of algal symbiont. I do not advocate that lichen taxonomists include culture studies as part of their work, although the techniques for culture are as easy as the microchemical tests, but I do offer one clue which may assist individuals in this regard. The most common algal symbiont, *Trebouxia*, can be recognized easily in sections or crushed preparations of lichen thalli. *Trebouxia* has a large chloroplast which fills most of the cell and a ring-shaped pyrenoid in the center of the chloroplast. The pyrenoid usually stands out quite clearly in algal cells of freshly collected thalli. *Trebouxia* is restricted to discolichens and from my experience there is no other algal symbiont in this group of lichens with the combination of a large central chloroplast and a ring-like pyrenoid. If you see in the thallus of a discolichen algal cells with these characteristics you can identify them with confidence as *Trebouxia*.—V. Ahmadjian

New Books

Les Lichens: Étude Biologiques et Flore Illustrées by Paul Ozenda and Georges Clauzade. Masson et Cie, Paris, 1970; 801 pp., 642 figures. This book is intended to be a guide for the identification of the lichens of France and neighboring regions and an introduction to the biology of lichens. It is an impressive book, in size, scope, and price (400 F; \$75.28).

Meetings

Lichen Excursion in Edmonton, Alberta (Canada) in June

The Bryological and Lichenological Foray of the 20-24 June 1971 annual meeting of the American Bryological and Lichenological Society will be divided into pre-session (18-20 June) and post-session (25-27 June) trips. The pre-session trip will be conducted through the Canadian Rocky Mountains between

Calgary and Edmonton, Alberta, and the post-session trip will be through the aspen parkland and prairie regions east of Edmonton, ending in Regina, Saskatchewan.

Those planning to attend either or both forays should send \$35.00 per field trip which covers lodging and meals for the 3 days to Dr. L. C. Bliss, Department of Botany, University of Alberta, Edmonton, Alberta, Canada, before 15 April 1971. Transportation will be by personal automobile.

Cover: Section of ascocarp of *Graphis subelegans* Nylander
Drawing by M. Wirth

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Corrigenda; p. 2, l. 11, delete "close to zero" and in l. 12 read "species" for "clone."