BRITISH BRYOLOGICAL SOCIETY
SPECIAL VOLUME NO. 1

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BRITISH BRYOLOGICAL SOCIETY DIAMOND JUBILEE

Proceedings of the Jubilee Meeting
held in
Bedford College, London, 17-18 September, 1983

Edited by

R. E. LONGTON and A. R. PERRY

Cardiff 1985

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Introduction

THE BRITISH BRYOLOGICAL SOCIETY DIAMOND JUBILEE, 1983

During 1983 the British Bryological Society celebrated the sixtieth anniversary of its metamorphosis in 1923 from the Moss Exchange Club, founded in 1896. To mark this occasion several events were planned by a small committee, appointed by Council in 1981, and chaired by Mr P.J. Wanstall. Other Committee members were Dr G.C.S. Clarke, Mr J.C. Gardiner, Dr A.J. Harrington and Dr R.E. Longton.

The principal event was a weekend Jubilee Meeting held on 17-18 September in the Department of Botany, Bedford College, London, through the kindness of Professor W.G. Chaloner, and organized by Mr Wanstall. The meeting proved to be one of the most popular ever arranged by the Society, with over 100 members and guests attending at least one of the sessions. The Society was particularly pleased to welcome a number of overseas members, including two of the speakers towards whose travelling expenses the British Council generously contributed.

The morning and afternoon of Saturday, 17 September, were given over to a series of six papers and an open discussion on past, present and future developments in bryology, with particular reference to the role of the BBS. Professor P.W. Richards initiated the proceedings by describing the development of Bryology in Britain, with emphasis on the years since 1923. Copies of his paper were distributed at the meeting, and it is reprinted here in a slightly revised form. Professor Richards was followed by Dr Hélène Bischler of the Museum National d'Histoire Naturelle, Paris, currently Vice President of the International Association of Bryologists, who gave an informative account of the scope and activities of other bryological societies throughout the world, in a paper written jointly with the IAB Secretary, Dr S.R. Gradstein. Dr E.V. Watson then reviewed the work of the BBS in recording the distribution of British bryophytes over the years since the Society's inception at the Moss Exchange Club, first on a vice-county basis, and more recently also through a computerized mapping scheme. Dr Watson's talk led naturally into an account of the activities of the Working Group for Mapping Bryophytes in Europe, by the Group's Secretary, Professor R. Schumacker, of the Université de Liège. Dr Schumacker presented evidence of considerable progress in a large assemblage of maps, only a selection of which can be included here. After lunch, Dr H.L.K. Whitehouse gave his Presidential Address on the life histories of British bryophytes, and Dr R.E. Longton adopted the role of Gypsy Rose Lee by attempting to forecast some aspects of future bryological research. The ensuing Discussion on the future of the BBS was chaired by the Society's immediate Past President, Dr S.W. Greene, who, in the present publication, has added some of his personal views to those expressed by members at the meeting.

After the Society's AGM, the participants adjourned for a reception hosted by Bedford College and a buffet supper at which they were addressed in entertaining style by Professor Chaloner. This was followed by a Conversazione in the Botany Department, where 17 exhibits had been put on display with the enthusiastic assistance of Dr S.J. Waters and the Department's technical staff.

On Sunday, 18 September, 40 members journeyed to Surrey by motor coach, meeting others who travelled by car to form a party of over 60 for a field excursion to Box Hill led, most ably as always, by Mr E.C. Wallace. So large was the party that it was divided into three groups for a most pleasant day spent rambling in search of the many interesting bryophytes to be found in the area's chalk grassland and woods. Mr A. Eddy and Dr A.J. Harrington assisted Mr Wallace by acting as group leaders. The Jubilee meeting ended over tea at Juniper Hall Field Station provided through the courtesy of the Warden, Mr J.E. Bebbington.

Other Jubilee events included a photographic competition run by Dr M.C.F. Proctor, assisted as judges by Drs S.R. Edwards and H.L.K. Whitehouse, and a week-long training course in bryophyte taxonomy sponsored by the Systematics Association. The course was held in the Department of Botany, University of Manchester, at the invitation of Professor Elizabeth Cutter, where it was organized by Drs Martha Newton and S.R. Edwards, with the assistance of Dr M.O. Hill, Mr C.V. Horie, Mr C.W.A. Pettitt and Dr A.J.E. Smith. With over 20 people attending it proved to be a great success. The logo appearing on the cover of this publication was adopted by the Society during Jubilee Year.

The present publication includes the six papers presented at the Jubilee Meeting, together with accounts of the related activities. Dr Greene's account of the discussion on the future of the Society is intended to stimulate further discussion among members, who are encouraged to express their views in the Bulletin of the British Bryological Society. We should like to thank most warmly, on behalf of the BBS, those individuals and institutions referred to above, and others too numerous to mention, who helped to ensure the success of the Society's Jubilee celebrations. It is a pleasure to thank Mrs Jean McKenzie (Cardiff) for so expertly typing the manuscript.

Nomenclature of bryophytes follows that of Distribution of Bryophytes in the British Isles, by M.F.V. Corley and M.O. Hill, Cardiff (1981), for British species; for others the authority is cited.

R.E. Longton (University of Reading)

A.R. Perry (National Museum of Wales, Cardiff)

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THE BRITISH BRYOLOGICAL SOCIETY 1923-1983 *

by

P. W. Richards

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The British Bryological Society, which celebrates its Diamond Jubilee this year (1983), is the only society in Britain, and one of the very few in the world, devoted to the study of mosses and liverworts (bryophytes). Under its present name it goes back to 1923, but it is in fact a continuation in an enlarged form of an earlier society, the Moss Exchange Club. This can claim to be the first bryological society in any country, as it was founded in 1896, antedating by some two years its American counterpart, the Sullivant Moss Society, originally the 'Sullivant Moss Chapter of the Agassiz Society', and since 1969 the American Bryological and Lichenological Society.

The beginnings of bryology in Britain

Though no bryological organisation was formed in Britain until the end of the 19th century, mosses and liverworts had attracted the interest of British botanists much earlier. Gerard's famous Herball (1597) illustrates several mosses and thallose liverworts. Thomas Johnson (1604-1644), the London apothecary, recorded a few mosses, now difficult to identify, which he found on botanical excursions to Hampstead Heath (now within the boundaries of Greater London) and Kent (Gilmour, 1972) and the remarkable Welshman Edward Lhuyd (1660-1709), who became Keeper of the Ashmolean Museum at Oxford, drew Ray's attention to a moss readily recognizable as Racomitrium lanuginosum, which he said was a pest in the grasslands of Wales. The great scientist and inventor Robert Hooke (1635-1703) made remarkable observations on the microscopic structure and life-history of mosses (Richards, 1981), though he was not much interested in their taxonomy.

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* In the pamphlet, The British Bryological Society 1923-1983, which was distributed at the Jubilee Meeting in September 1983, there were two unfortunate errors on page 3 in paragraph 6. In the present version these have been corrected and a few other small changes have been made. P.W.R.

But the systematic study of British bryophytes really began with the work of John Jacob Dillenius (Dillen) (1684-1747), a German who came to England in 1721 and became the first Sherardian Professor of Botany at Oxford. He collected bryophytes in various parts of England and made a notable tour of North Wales (Richards, 1979). His Historia Muscorum (1741) describes and figures a large number of species of mosses and hepatics and also deals with algae, lichens and some pteridophytes. As in other botanical works of the time, the nomenclature was cumbersome - an example is Bryum foliis latiusculis congestis, capsulis longis nutantibus, The transparent and bigger tufted Bryum, with long stooping Heads (Bryum capillare), but Dillenius' Historia remained for many years the chief reference book for British bryologists.

Towards the end of the 18th century, the work of Hedwig on the sexual organs of mosses and the adoption of the binomial system of nomenclature revolutionized bryological taxonomy. The first British floras dealing only with bryophytes to follow these advances were Turner's Muscologiae Hibernicae (1804), W.J. Hooker's British Jungermanniae (1812-1816) and Hooker & Taylor's Muscologia Britannica (ed.1, 1818). Wilson's Bryologia Britannica (1855), which was originally intended to be a revised (3rd) edition of Hooker & Taylor's book, incorporated many improvements in classification from Bruch, Schimper and Gümbel's Bryologia Europaea (1836-1855), and was for many years the standard work on British mosses. At about the same time Hofmeister's work on the higher cryptogams brought a new understanding of the life-histories of bryophytes.

Several British moss floras were published after Wilson's Bryologia including Berkeley's Handbook of British Mosses (1863), Hobkirk's Synopsis (ed.1, 1872) and Braithwaite's magnificent British Moss Flora, begun in 1887, but not finished until 1905, and supplemented by his Sphagnaceae of Europe and North America (1880). The hepatics fared less well, for after Hooker's pioneer work of 1812-1816, no complete British flora appeared until M.C. Cooke's Handbook (1894) and Pearson's two-volume Hepaticae of the British Isles (1899-1902), neither of them wholly satisfactory.

The need for a practical, up-to-date and not unduly expensive moss flora was not met until the publication of H.N. Dixon's Student's Handbook of British Mosses (ed.1, 1896): among its many excellent features were the drawings and keys by H.G. Jameson, adapted from his own Guide to British Mosses (1893). Further editions of Dixon's Handbook appeared in 1904 and 1924 and it remained the standard work on British mosses until superseded by A.J.E. Smith's Moss Flora of Britain and Ireland (1978a). Probably encouraged by the success of Dixon's book, a similar Student's Handbook of British Hepatics by S.M. Macvicar was published in 1912: there was a second edition of this in 1926, but a more modern flora of British hepatics is now long overdue.

The Moss Exchange Club, 1896-1923

In February 1896 a notice appeared in the Journal of Botany (vol.34, pp.88-89), and at about the same time in Science Gossip and the Irish Naturalist, proposing the formation of a 'Moss Exchange Club'. The writer was the Rev. C.H. Waddell, a Church of Ireland clergyman living in Co. Down, who was a keen and very knowledgeable field botanist. He was keenly interested in bryophytes, especially hepatics, as well as in flowering plants (particularly the 'critical' groups such as Rubi and Hieracia). The club was to be modelled on the long-established Exchange Clubs for vascular plants (which eventually became absorbed into what is now the Botanical Society of the British Isles). The main object of the Moss Exchange Club, like that of any other exchange club, was to assist members in building up collections of correctly named specimens. It was also hoped to produce new catalogues of British bryophytes to replace the Botanical Record Club's already out of date London Catalogue of British Mosses (Lees, 1881).

The history of the Moss Exchange Club, which has been chronicled by one of its original members, Miss E. Armitage (1944), and also by W.D. Foster (1979), need be dealt with here only briefly. Waddell hoped to attract 30 members; 23 joined in the first year, but in 1899 there were 37 and by 1914 the number had risen to over 60. The Club held no meetings and regular contacts between members were mainly through the annual exchanges of specimens and the short printed reports; for some years also a notebook was circulated among members in which they could write comments on the specimens distributed in the exchange or on other matters of interest.

From its early years one of the Club's aims was to compile reliable records of the distribution of British bryophytes on a 'vice-county' basis. The results appeared in the first Census Catalogue of British Mosses in 1907 and the Census Catalogue of British Hepatics in 1903, replacing a previous catalogue compiled by C.H. Waddell in 1897. Several revisions of the Census Catalogues have since been prepared, a complete bibliography being provided in the most recent version (Corley & Hill, 1981).

Throughout its existence the Moss Exchange Club was concerned almost entirely with British bryophytes, which was not surprising as all the members were resident in Great Britain or Ireland. But even in the first year the Rev. C.H. Binstead wished to include continental European mosses in the exchange and contributed mosses from Norway. Later, after a visit to Ceylon and Borneo, he tried to arouse an interest in the Club in the 'extensive moss flora of the tropics'. W.E. Nicholson in 1901 had tried unsuccessfully to organize a 'Foreign Section' of the Club.

The original members included well-known experts such as Dixon, Macvicar, Nicholson and Waddell, and 'beginners' with very little knowledge or experience. To help the latter a 'Section 2' was instituted in 1900. As the years passed many of the 'beginners' became 'experts' and the separation into two sections became less useful. Nearly all the original members of the Moss Exchange Club were amateurs in various walks of life; one who afterwards became a professor of botany resigned after one year. Later on a few university teachers and professional botanists joined the Club, but they were always a small minority. The aims of the Club may have been narrow, but it should be recognized that during a period when bryophytes were almost completely neglected in British universities it kept an interest in mosses and hepatics alive and made a considerable contribution to knowledge of the British bryophyte flora.

The British Bryological Society, 1923-1945

In 1922 the sudden illness of William Ingham, who had been Secretary of the Moss Exchange Club since Waddell retired in 1903, led to a proposal that the two Sections should be merged. The members were circulated and an informal meeting at Dolgellau in Wales was convened, with D.A. Jones, the Secretary of Section 2, as 'leader'. There it was decided to reorganize the Moss Exchange Club as the British Bryological Society (as from 1 January, 1923), with Dixon as President: Jones and Miss E. Armitage, both of whom had taken a large part in the discussions leading up to the meeting, were to be the Secretaries. Rules were drawn up and an important decision was that there should be an Annual Meeting and Excursion.

The reorganization quickly had beneficial effects. The membership began to increase and reached 100 by 1934. The meeting at Dolgellau was followed by a successful one at Buxton, Derbyshire and the opportunities for members to meet had a stimulating effect on their activities. For the first time members from other countries joined the Society which by 1934 included distinguished overseas figures such as Pierre Allorge, E.B. Bartram, A.W. Evans, L. Loeske

and N. Malta. The somewhat parochial Moss Exchange Club had become an internationally recognized society.

After the demise of Section 2 of the Moss Exchange Club there was no official provision for 'beginners', but various senior members of the Society took trouble in recruiting and encouraging young members. Notable among them was W.R. Sherrin, Curator of the South London Botanical Institute, who, as recorded in the reminiscences in Bulletin of the British Bryological Society 42 (1983), gave much help to several young bryologists, including D.G. Catcheside, E.C. Wallace and the writer of this article, all of whom later played active parts in the Society.

The British Bryological Society continued to prosper until the outbreak of the Second World War. During the war years meetings were necessarily suspended, though some of the older members did what they could to keep the Society alive.

The British Bryological Society, 1945-1983

In May 1945, a few weeks after the war in Europe ended on 'VE Day', a small group of members met for a weekend at a hotel in Borrowdale to discuss reviving the Society and in September an informal Annual Meeting was held in London, presided over by W.R. Sherrin in the absence of Miss Armitage, the President, who was ill. This was followed by a field trip to Newlands Corner in Surrey. In 1946 an Annual Meeting and Excursion in the pre-war style took place at Appleby, Westmorland in April and in September there was a meeting in London to celebrate the founding of the Moss Exchange Club fifty years earlier. At the Jubilee Dinner in the Eccleston Hotel Dr John Ramsbottom of the British Museum (Natural History) was the guest of honour.

After this the Society, with E.C. Wallace as its able and devoted Secretary from 1948 to 1969, grew and flourished to an extent undreamt of before the war. The membership soon passed the pre-war total and reached 250 in 1950. By 1971 it had risen to 500 and since then has remained at about that level. A considerable number of prefessional botanists joined the Society, and as most of them, like the much beloved E.F. Warburg ('Heff'), were lecturers in universities or colleges, many of their students also became active members. In contrast to the situation before the war, the Society attracted many members from overseas, who now (1983) number between 150 and 200.

The rapid growth of the British Bryological Society after its revival in 1945 was probably due to several causes. One was the great upsurge of interest in natural history and nature conservation in Britain after the war, another was the expansion of the universities and the development in their biological departments of a new interest in bryological research. But there can be little doubt that one of the most important factors was the success of the Journal of Bryology. In its early years the Society's only publications, other than Census Catalogues, had been slim Annual Reports which seldom contained anything beyond lists of species contributed to the exchanges, lists of recent publications, officers' reports and other domestic items; only occasionally were there short notes on new or critical species. In 1947 the Society began to issue a journal, originally called the Transactions of the British Bryological Society, but after 1972 changed to the Journal of Bryology. The decision to publish the Transactions was mainly due to the foresight and enthusiasm of an amateur bryologist and lichenologist, F.A. Sowter, and he was the first editor. Thanks to Sowter and his successors, the Journal of Bryology has established itself as a scientific periodical of the highest standards and has a circulation much wider than the Society's membership. Since 1963 the Journal has been supplemented by the Bulletin, which deals mainly with the Society's own affairs, and also includes short notes and papers of bryological interest.

One of the aims of the British Bryological Society, and of the Moss Exchange Club before it, has been to compile reliable records of the distribution of bryophytes in the British Isles. The results have appeared as Census Catalogues giving the occurrence of each species in the vice-counties originally defined by H.C. Watson in 1852 for recording the distribution of higher plants. Additional records are published every year in the Society's reports (now in the Bulletin). Since 1946 records have been accepted only if supported by a properly determined voucher specimen: these specimens are deposited in the Society's herbarium (at present at the National Museum of Wales, Cardiff) which is thus a valuable archive of bryophyte distribution in Britain. The most recent catalogue (Corley & Hill, 1981), the first to include mosses and hepatics in one volume, outlines the history of the vice-county recording system for bryophytes, and discusses its merits and disadvantages. Since 1960 recording by vice-counties has been supplemented by recording on 10 km squares of the National Grid. 'Dot maps' of species distributions on this system began to appear in 1963, and in 1978 a Provisional Atlas (Smith, 1978b) was published showing the distribution of 104 species.

The main interest of the Society has always been in taxonomy and the study of mosses and hepatics in the field, but there are now many members who are active research workers on the ecology, physiology, biochemistry, genetics and other aspects of bryology. Since 1959 a well-supported annual paper-reading meeting has catered for these interests and many papers on such subjects have appeared in the Journal. However, the number of papers on non-taxonomic bryology needs to be increased and the view that bryology is wider than merely the classification and identification of bryophytes still needs to be encouraged.

As in the Moss Exchange Club's early years, there is still a gap between 'experts' and 'beginners'. The field meetings provide good opportunities for the latter to learn from the former, but for financial and other reasons many members find it difficult to join field meetings regularly. With this problem in mind, two-day 'taxonomic workshops' have been held in recent years. In 1983 a more formal course on bryophyte taxonomy was organized jointly by the British Bryological Society and the Systematics Association. Four members of the B.B.S. taught in this course, which was given at Manchester University. On 16-19 August, 1978, also in co-operation with the Systematics Association, an international symposium on bryophyte systematics was held at the University College of North Wales, Bangor. A volume containing the 21 contributions was afterwards published (Clarke & Duckett, 1979).

As long ago as 1896, H.N. Dixon expressed anxiety that the exchanges of specimens 'might tend towards the extermination of our rarer species' (Foster, 1979). The danger from collectors remains and today threats to bryophytes from the destruction or modification of habitats such as woodlands, fens, bogs, old trees and old walls, as well as from atmospheric pollution to which bryophytes like lichens are very sensitive, is enormously greater than in the last century. The B.B.S. has long abandoned organized exchanges of specimens and its members are well aware of the need to collect sparingly, if at all, because so many species are endangered. In 1977 a Conservation Officer was appointed, and a Code of Conduct has been printed and distributed to universities, field study centres and naturalists' trusts to alert a wider public, especially students, to the urgent need to conserve our bryophyte flora. In the last hundred years only two or three species of bryophytes have become extinct in the British Isles as far as is known, but unless determined efforts are made, losses in the century ahead may well be much greater.

The next sixty years

Like other branches of science, bryology today is becoming more and more sophisticated; for some kinds of research expensive apparatus and techniques

only available to professional scientists are necessary. Yet in the next sixty years, as in the past, there will undoubtedly be a useful role for amateurs. Apart from describing and identifying bryophytes, recording and similar work, non-professionals can play an indispensable part in co-operative projects such as monitoring the survival of rare species and the spread of immigrants, studies of phenology, reproduction and other branches of bryophyte natural history. The B.B.S. can be of great value in stimulating an interest in students and others, and in helping them to develop it. For this reason 'workshops' and lecture courses such as those given in recent years are of great importance. In universities at present the demands of other biological disciplines leaves little money or time for subjects such as bryology and in the future the pressures may be even greater. If this is so, our Society will have an increasingly important part to play in keeping scientific bryology alive in Britain. As a society bringing together amateurs and professionals, the B.B.S. can look forward to the future with confidence.

References

Armitage, E. (1944, reprinted 1956). A Short Account of the Moss Exchange Club and the British Bryological Society. Berwick (privately printed).

Berkeley, M.J. (1863). Handbook of British Mosses. London.

Braithwaite, R. (1880). The Sphagnaceae or Peat-mosses of Europe and North America. London.

Braithwaite, R. (1887-1905). The British Moss Flora. 3 vols. London.

Bruch, P., Schimper, W.P. & Gümbel, T. (1836-1855). Bryologia Europaea. 6 vols. Stuttgart.

Clarke, G.C.S. & Duckett, J.G. (eds.) (1979). Bryophyte Systematics. London.

Cooke, M.C. (1894). Handbook of British Hepaticae. London.

Corley, M.F.V. & Hill, M.O. (1981). Distribution of Bryophytes in the British Isles. A Census Catalogue of their Occurrence in Vice-Counties. British Bryological Society, Cardiff.

Dillenius, J.J. (1741). Historia Muscorum. Ed.1. Oxford.

Dixon, H.N. (1896). The Student's Handbook of British Mosses. Ed.1. Eastbourne.

Foster, W.D, (1979). The history of the Moss Exchange Club. Bull. Br. bryol. Soc. 33, 19-26.

Gerard, J. (1957). The Herball or Generall Historie of Plantes. London.

Gilmour, J.S.L. (1972). Thomas Johnson: Botanical Journeys in Kent & Hampstead. Appendix III. Notes on Johnson's names for bryophytes and lichens. By W.D. Margadant and P.W. Richards. Pittsburgh, Pennsylvania.

Hobkirk, C.P. (1872). A Synopsis of British Mosses. Ed.1. London.

Hooker, W.J. (1812-1816). British Jungermanniae. London.

Hooker, W.J. & Taylor, T. (1818). Muscologia Britannica. Ed.1. London.

Jameson, H.G. (1893). Illustrated Guide to British Mosses. Eastbourne.

Lees, F.A. (ed.) (1881). The London Catalogue of British Mosses. Ed.2. London.

Macvicar, S.M. (1912). The Student's Handbook of British Hepatics. Ed.1. Eastbourne.

Pearson, W.H. (1899-1902). The Hepaticae of the British Isles. 2 vols. London.

Richards, P.W. (1979). A note on the bryological exploration of North Wales. In Bryophyte Systematics (ed. G.C.S. Clarke & J.G. Duckett), pp.1-9. London.

Richards, P.W. (1981). Robert Hooke on mosses. Occas. Pap. Farlow Herb. 16, 137-146.

Smith, A.J.E. (1978a). The Moss Flora of Britain and Ireland. Cambridge.

Smith, A.J.E. (ed.) (1978b). Provisional Atlas of the Bryophytes of the British Isles. Natural Environment Research Council, Biological Records Centre, Abbots Ripton.

Turner, D. (1804). Muscologiae Hibernicae Spicilegium. Yarmouth.

Wilson, W. (1855). Bryologia Britannica. London.

APPENDIX

Principal officers of the Moss Exchange Club and the British Bryological Society.

MOSS EXCHANGE CLUB

The affairs of the Moss Exchange Club were conducted principally by the Secretary of Section 1 and the Distributor, there being no President.

Secretary	Distributor	Year
C.H. Waddell	C.H. Waddell	1896-1899
C.H. Waddell	J.A. Wheldon	1900-1901
C.H. Waddell	T. Barker	1902
W. Ingham	T. Barker	1903
W. Ingham	R.H. Meldrum	1904-1905
W. Ingham	D.A. Jones	1906
W. Ingham	E. Cleminshaw	1907-1908
W. Ingham	H.H. Knight	1909-1910
W. Ingham	W.H. Burrell	1911-1912
W. Ingham	Eleonora Armitage	1913
W. Ingham	D. Lillie	1914
W. Ingham	P.G.M. Rhodes	1915-1916
W. Ingham	Eleonora Armitage	1917
W. Ingham	D. Lillie	1918
W. Ingham	Eleonora Armitage	1919
W. Ingham	A. Wilson	1920
W. Ingham	W.G. Travis	1921
D.A. Jones & E. Armitage	Eleonora Armitage	1922

BRITISH BRYOLOGICAL SOCIETY

President	Secretary	Year
H.N. Dixon	D.A. Jones	1923-1924
S.M. Macvicar	D.A. Jones	1925
C.H. Binstead	D.A. Jones	1926-1928
W.E. Nicholson	D.A. Jones	1929-1930
W. Watson	D.A. Jones	1931-1932
H.H. Knight	D.A. Jones	1933-1934
D.A. Jones	D.A. Jones	1935
D.A. Jones	A. Thompson	1936
J.B. Duncan	A. Thompson	1937-1938
Eleonora Armitage	A. Thompson	1939-1943
E. Armitage (until Sept.'45)	A. Thompson	1944-1945
W.R. Sherrin (from Sept.'45)		
W.R. Sherrin	A. Thompson	1946-1947
A. Thompson	E.C. Wallace	1948-1949
P.W. Richards	E.C. Wallace	1950-1951
Lorna Scott	E.C. Wallace	1952-1953
E.W. Jones	E.C. Wallace	1954-1955
L.B.C. Trotter	E.C. Wallace	1956-1957
F.A. Sowter	E.C. Wallace	1958-1959
Evelyn Lobley	E.C. Wallace	1960-1961
E.F. Warburg	E.C. Wallace	1962-1963
E.V. Watson	E.C. Wallace	1964-1965
Joan Appleyard	E.C. Wallace	1966-1967
J.H. Peterken	E.C. Wallace	1968-1969
A.J. Pettifer	D.H. Dalby	1970-1971
E.C. Wallace	D.H. Dalby	1972-1973
A.C. Crundwell	A.R. Perry	1974-1975
Jean Paton	A.R. Perry	1976-1977

P.W. Richards	A.R. Perry	1978-1979
S.W. Greene	A.R. Perry	1980-1981
H.L.K. Whitehouse	R.E. Longton	1982-1983

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A CAUSERIE ON BRYOLOGICAL SOCIETIES

by

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Historically, bryology dates from long before Linnaeus, but it was not until the middle of the nineteenth century that the number of botanists devoting their main work to bryophytes had become fairly large. From historical documents we know that correspondence and exchange of ideas between bryologists was already quite intense and it was probably at that time that the germs were laid for the future development of bryological societies. An example of a small regional team of bryologists active in the mid-nineteenth century was the group around Gottfried Nees von Esenbeck, Professor of Botany in Breslau, which prepared an overview of the world's Hepaticae, the Synopsis Hepaticarum (Gottsche et al., 1844-1847). Co-authors were Gottsche and Lindenberg in Germany, while Hooker and Taylor in Britain and Montagne in France served as foreign correspondents. A work of extraordinary quality resulted, still invaluable today. It was the first example in bryology of a small working group, serving a specific goal but lacking formal organization. More recent examples of this type of "special-purpose" working group are the teams of the Index Muscorum, the Index Hepaticarum, the Moss Floras of Mexico and of Arctic North America, and the Hepatic Flora of Cuba.

The first organizations resembling bryological societies as we know them at present arose at the end of the last century in Britain and North America. Usually, they had close links with regional natural history societies and served as "moss exchange clubs". Some still exist as clubs and never became more formally organized, for instance the French moss exchange club. Others started to appoint officers and collect annual fees and became proper societies, independent of the natural history societies, such as the American

Sullivant Moss Society (now American Bryological and Lichenological Society), which claimed its independence as a society within one year of its foundation in 1898. In Britain this metamorphosis from the club phase into the adult society phase took a bit longer, although the Moss Exchange Club, founded in 1896 was an independent organization from the outset as Professor Richards has explained (p. 4).

Let us now turn to the present. What bryological societies now exist, what are their goals, activities, similarities and differences? Table 1 provides some basic information upon which we shall comment. It appears that common features of all bryological societies are the organization of meetings, fieldtrips, teaching, exchange and naming of specimens. Some societies have special herbaria and libraries, periodicals publishing high level scientific papers, and newsletters giving information on society activities. Exchange of specimens has recently somewhat declined but nature conservation and pollution problems have gained in importance. Societies serve as nursery centres or breeding places for amateurs and students, but they are also the main audience for the professional researchers. It is in the society where research is popularized and where needs are outlined, keeping bryology alive and saving it from over-specialization.

Bryological societies are by no means identical but it is not easy to tell exactly what the differences are. For fieldtrips a comparison has recently been made by Glime (1982), in a lovely manner, and we may summarize her interesting conclusions as follows:

- in some societies, participants on fieldtrips collect frenetically whereas in others they just look at the plants and hardly gather a tiny piece;
- some transform excursions into marathons, others walk slowly and take much time for conversation;
- some emphasize teaching, in others the main preoccupation is purely personal interest;
- some try to perform ecological work, others limit activities to taxonomic and floristic observations;
- and finally, in some drinking is much welcomed while others behave like the Blue Ribbon Army.

Usually, fieldtrips bring together 25 to 50 participants, but excursions of the Japanese Bryological Society gather about 120 participants and almost resemble an annual bryological transcendence. The Japanese have also huge "night parties" afterwards in which also children take part, thus securing the bryological lineage.

A special aspect is the relation to lichenology, which is combined with bryology in several societies, although from a taxonomic point of view this relationship is certainly not a natural one. The reason for this marriage was given by the secretary of the Sullivant Moss Society in 1917 as follows: "..almost from the first, lichens had been sent in for determination, as beginners often confused the groups when found together with the mosses...". The aid of lichen specialists had therefore to be called in and so lichens became and remained married to bryophytes within the society. We must recognize, however, that some societies prefer to remain celibate, for instance in Britain and Scandinavia, while the union works very well in several others.

There are also great differences in administration. This may sound a very dull subject but there are two extremes worth mentioning. Firstly, a projected Indian Bryological Society was founded in 1966 in Chandigarh on the basis of a several-page long constitution and a council of no less than 13 members. Unfortunately only 12 bryologists were willing to join it, so it could never

Societies	year of foundation	actual number of members incl. foreign*	lichenology included	meetings field**	meetings scientific	publications periodical	publications others
British	(1896-) 1923		-	+	+	+	+
North America	1898	400	+	+	+	+	+
Dutch	1947	200	+	+	+	+	+
Swiss	1956	150	+	+	+	-	-
Nordic	1967	200	-	+	-	+	-
World (IAB)	1969	400	-	+	+	+	+
Japanese	1972	375	not yet	+	+	+	-
Polish	1978	50?	-	+	-	-	-
Belgian	1978	75	-	+	-	+	-
Latin American	1982	50	-	not yet		not yet	
Regional working groups							
Central Europe (BLAM)	1968	250	+	+	-	+	-
Australasia	1977	25	-	-	+	+	-
Eastern Europe (CEBWG)	1978	125	-	+	+	-	+
European Mapping Group (WGMBE-GTCBE)	1980	75	-	+	+	-	+

* The Australian figure excludes foreign members.

** The British, North American, Dutch, Swiss and Japanese Societies regularly hold two or three field meetings each year.

TABLE 1: Bryological Societies and Bryological Working Groups.

get started. Over-administration killed it instantly. On the other hand the German-Austrian "Bryologisch-lichenologische Arbeitsgemeinschaft für Mitteleuropa" (BLAM), never accepted formal society-status although its activities resemble those of a society. The reason, given in the first issue of their periodical Herzogia, seems to be in some sense just laziness. Our German colleagues apparently judged the administrative work involved too heavy and have left it entirely to one single coordinator for many years. German bryologists call their annual field meeting a "Spaziergang" (which may be translated as "ambulatory conversation").

Membership of the different societies is also not alike. The American Bryological and Lichenological Society, for instance, included at the time of its foundation many amateurs, but after 1917 it evolved towards an association of professionals. Membership subsequently declined and in 1949 reached a level lower than that of 1910. This decay may be due in part, at least, to the great distances there, which may make it difficult for local amateurs to attend the meetings. To overcome this problem, the Americans are now organizing so-called regional forays, for instance the "Midwest Bryological Foray"; we have no information yet about their effect but expect them to act in a positive manner.

The Japanese Bryological Society is worth mentioning here because no other society has grown so fast in such a short time. Established only ten years ago, it now has 375 members of which only 13% are professionals or graduates. It probably stands out by the large number of businessmen that are members. But we should realize that Japan is the one country in the world where bryophytes have a special and cultural significance. They have been important elements in garden architecture since Samurai times and are so popular that colour picture books on bryophytes are profitable to publishers and authors. One of the national daily newspapers even issued a Sunday magazine recently, entirely devoted to bryophytes.

We come to another very important component of societies activities: their publications. The Bryologist, Journal of Bryology, Lindbergia, and Advances in Bryology are the major scientific journals of the societies; in addition some, but not all, publish a News Bulletin. The Dutch Bryological and Lichenological Society has a special arrangement with the national Natural History Society, to which it is formally affiliated, to publish bryophyte books (floras, atlasses) with the Natural History Society at reduced prices. In other countries publication of books is less closely tied to the bryological society although the society may nevertheless play an active role. An early example is Grout's Mosses with a Hand-Lens (Grout, 1947), a charming identification work for North America, which was promoted by the Sullivant Moss Society. There is, as far as we know, only one example of a well-established bryological society which has never engaged in publishing activities, i.e. the Swiss Bryological and Lichenological Society. It is a small, active organisation which manages to have several successful trips each year in spite of the high mountain ranges that separate the individual members from each other. This country has no recent flora nor checklist; in this respect the recent initiative of Dr Urmi (Zürich) and others to start a mapping project for the country should be welcomed.

Traditionally, all bryological societies are concentrated in the northern temperate region of the world. They are clearly a product of our western civilization and sprout like mushrooms when climate and substrate are favourable. In Europe, these conditions have been favourable so far only in the western and northern parts, what one might call the Anglo-German part of Europe. Except for Poland, where an organization exists on which we have very little information, there is no bryological society in Eastern Europe and we doubt there will be any in the near future. Instead, bryologists of the European socialistic countries have chosen a more informal, regional

organization, the "Central and East Bryological Working Group" (CEBWG), which organizes biennial conferences in various eastern European countries. The group has a coordinating committee in which each participating country is represented (see Bulletin of Bryology XIV, Taxon 27, 433, 1978). Its conferences - three since its establishment in 1978 - are attracting an increasingly large number of participants, also from western countries, and have, in fact, become an important meeting place for bryologists from all over the world!

Rather striking is the total absence of bryological societies in the South, the Roman part of Europe, i.e. France, Spain and Portugal, Italy and Greece. Most of these countries have in fact only very few bryologists, but France has quite a number. Parallel to the lack of societies in these regions, we see a lack of recent inventories and floras. It is a pity that regions with such rich bryofloras have remained so backward as compared with the situation further north. Fortunately we are recently seeing signs of improvement (Schumacker, 1982). A definite stimulus to bryology in these regions, as well as others, has been the recently (1980) established "Working Group for Mapping the Bryophytes of Europe", on which Dr Schumacker will report (this publication). Though more of a "special purpose" type of working group, it definitely stands out among similar existing organizations of that kind by its large number of participants. Stimulation of collaboration among Mediterranean bryologists is, moreover, the aim of the newly established committee for bryophytes of OPTIMA (Organization for the Phyto-Taxonomic Investigation of the Mediterranean Area, see Bryological Times 23, 7, 1983).

Moving further southwards, we may say a word on the Tropics. All congresses that we have recently attended have stressed, via resolutions, the need for more attention to the exceedingly rich, yet rapidly vanishing tropical bryophyte flora. One of the measures recently taken by the International Association of Bryologists was the establishment of a working group for bryologists living in the Tropics, the "Committee for Tropical Bryology", to identify the needs and take appropriate action. This may be very good but is certainly not enough. What we believe is also needed is for tropical societies, just like the BBS and others, to promote bryology on a local level. The first and only example of this kind of society is the "Sociedad Latino-Americana de Briologia". This is still less than one year old and has not yet had time to win a reputation.

Finally, those who were able to join the XIII International Congress in Australia in 1981 noticed the existence of a small yet very active bryological community in that part of the world, which holds scientific meetings and regional congresses, and publishes the "Australasian Bryological Newsletter" once or twice a year. A small regional society may eventually emerge here.

It is now time to look back and make some concluding remarks:

- As long as bryophytes remain organisms in which "there is no money" as Mr Crundwell puts it, we forsee only few major changes in the bryological scene taking place. Now that anti-cancer properties have been found by a Japanese researcher in Marchantia (Asakawa, 1981), however, anything might be expected!

- In Europe, amateurs still form the majority of the membership of the societies and it follows that societies should remain particularly aware of their needs. Good fieldtrips and instructions for beginners should probably remain the backbone for survival of these societies.

- Among the world's societies, the British Bryological Society is the largest and probably the most successful society in history, although we expect it in the near future to be surpassed in size by the Japanese. We also expect some

new societies to enter the scene, for example in France and Australasia.

- We see general- or special-purpose working groups increasing in number. Some of them may be ephemeral but others may prove successful alternatives to the more rigid, formalized society structure.

- Finally, we should make two points about the International Association of Bryologists, which was founded as recently as 1969. Firstly, the IAB works primarily on a world-wide level rather than regionally, and via its newsletter, The Bryological Times, tries to tell people what is going on in Alaska, Belgium, The Philippines, Tasmania or anywhere else. Those who read the Times - and we know many of you do - find there a lot of information on the activities of the regional societies. Secondly, the IAB organizes a world meeting about every two years, preferably a joint one where a local bryological society exists. As we have not yet had a joint meeting of the IAB and the BBS, we would express the hope that such a joint meeting could take place in the near future, preferably before the next jubilee meeting of this society.

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References

Asakawa, Y. (1981). Biologically active substances obtained from bryophytes. J. Hattori Bot. Lab. 50, 123-142.

Glime, J.M. (1982). Bryological Excursions: a comparison. Bryological Times 17, 1-2.

Gottsche, C.M., Lindenberg, J.B.G. & Nees, C.G. (1844-1847). Synopsis Hepaticarum. Hamburg.

Grout, A.J. (1947). Mosses with a Hand-Lens. Ed. 4. Newfane, Vermont.

Schumacker, R. (1982). Outline of the current state in floristical and chorological studies on bryophytes in Europe. Lejeunia 107, 1-60.

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THE RECORDING ACTIVITIES OF THE BBS (1923-83) AND THEIR IMPACT ON ADVANCING KNOWLEDGE

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If people were not in some unexplained way fascinated by bryophytes they would not record them at all. They would not even look at them, let alone find a name for each and feel inspired to record its distribution. It is perhaps salutary to remind ourselves that, of our present population, only one person in 100,000 is so fired by enthusiasm for bryophytes that membership of the BBS inevitably follows. All the rest of the population of these crowded islands remain indifferent and seek only to know how they may get rid of the moss from their paths and lawns.

What, then, are the elements making up this fascination which bryophytes exert on a tiny proportion of us? And why are so few affected by it? The elements are no doubt complex, but for many, I submit, it is the beauty and intricacy of form which first of all fascinates in moss or liverwort, while also playing a part are inherent curiosity and a desire to advance knowledge, and for some (particularly in the past was this so) the satisfaction of amassing a collection. As to why so few are drawn to the study perhaps a principal reason lies in the fact that the subject is rather complex and technical. Many bryophytes are so small as to border on the microscopic, their description is wrapped in language incomprehensible to the layman and their names do not exactly slip readily off the tongue. The path of the novice is not an easy one. Hence the number of bryologists in the land is, and always has been, relatively minute.

These general considerations are relevant to our understanding of the position in the Society sixty years ago. That was a time vastly different from today, when recording activity was scarcely the highest priority in the minds of members. One has only to look over those early BBS Reports, for the years 1923 to 1939, to appreciate this. Recording on a vice-county basis was in full swing, it is true, but one gains the impression that pride of place in the Society's activities went to the Annual Distribution. The Reports of the

Distributors occupied most of the pages in those modest publications of the 1920s and 1930s, with long lists of the species submitted and the localities in which they had been found. Each new vice-county record (NCR) was merely marked by an asterisk and asterisks were rather thinly scattered. Although it may not be possible always to get an accurate figure for NCRs we were told, for example, in the Distributors' Report for 1931 that, out of a total of 52 vice-county records sent in for all the mosses (including Sphagnum) no less than 34 came from a single observer, Miss E.M. Lobley. This citation alone suffices to indicate the modest scale of the NCR annual figures in those days, a fact which may surprise us in view of the acute eye which characterised many members of that time. It is all the more surprising in view of the enormous amount of information on vice-county distribution which was waiting to be uncovered. With vice-county distribution still comparatively sketchily known, why did not an avalanche of new records descend upon the head of the Recorder every year?

There would appear to be several reasons for this. In the first place there were no Recorders as such listed among the officers each year, and those who kept the records worked quietly behind the scenes. There were referees, together with referees-in-chief - not surprisingly H.N. Dixon for mosses and S.M. Macvicar for liverworts (W.R. Sherrin was referee-in-chief for Sphagnum): and there were distributors whose onerous job it was to receive, sort and comment upon (here they were helped by the referees) the contents of each parcel that came in. Secondly, numbers in the Society for some time remained small. It was only in 1931, in his Secretary's Report for 1930, that D.A. Jones was able to rejoice at total membership having reached a new 'high' of 120. Thirdly, it seems, quite simply, that other considerations held priority. Almost all the most experienced and influential members were people for whom bryological acitivity was purely a recreation or hobby, to be enjoyed by each in his or her own way. To be sure, members would have been trying to find out all they could about bryophytes, meanwhile building personal reference herbaria commensurate with this aim. Small wonder that such emphasis was laid on the Annual Distribution, usually anything from five to 20 or more packets of each of a range of reasonably interesting species being submitted by each contributing member. These in due course were dispensed to recipients, usually in strict accordance with 'desiderata lists' which each had provided. The BBS may no longer have been called an 'Exchange Club' but it still ran an 'Exchange' on a massive scale. In no year, from 1924 to 1934 inclusive, did the total number of packets sent in fall below 4,500, an all-time high having been attained in 1925, with 1688 Sphagnum packets, 6280 packets of so called true mosses and 1227 of hepatics, giving a grand total of 9,195. In that year the Rev. C.H. Binstead alone sent in no less than 765 packets of mosses.

The climate of British bryological thought at that time is reflected in the slightly monotonous similarity of pattern in the contents of one Report after another. Occasionally short notes appeared on the recognition of difficult or critical groups of species and in 1926 there appeared the first of Dr L.B.C. Trotter's useful bibliographical compilations. On the whole, though, in all these early years the Report was dominated by long lists of species and localities which gave a 'summary statement' of the plants sent in by members, elaborated in many instances by the critical comments of the appropriate referee. There were 34 pages of this in the Report for 1924, 57 pages in that for 1925. True, valuable nuggets of information were tucked away in these long annotated lists, and it is of interest to look back and see just where particular species were found. True, too, that every such entry was a record of a kind. Every so often an asterisk would proclaim a range extension for some species to a new vice-county, and the brief 'Reports of Annual Excursions' would provide more of these. Apparently J.B. Duncan, for mosses, and A. Wilson, for hepatics, were all the while keeping a tally of NCRs in their notebooks, in readiness for the appearance of new editions of the Census

Catalogues. Thus, just three years after the founding of the BBS, Mr Duncan was able to offer at the price of 2 shillings (or 2/6 interleaved) the 2nd Edition of A Census Catalogue of British Mosses, and four years later Albert Wilson produced the 3rd Edition of A Census Catalogue of British Hepatics (we notice that this cost only 1/6, or 2/- interleaved).

By 1930 then, with a pair of up-to-date statements of known vice-county distribution to hand, the scene would appear to have been set for rapid, perhaps spectacular, advance along these lines. Yet somehow, despite the outstanding talents of some of the leading members of the day, and notwithstanding the arrival in their midst of a small number of younger observers with keen eyes, no obvious forward 'spurt' can be detected as one turns the pages of these old Reports. Rather it seems as if, away back in 1923 - or even long before in the days of the Moss Exchange Club - a pattern had been set for the Society's activities, complete with the annual 'get-together' (combining AGM and Field Meeting), and a pattern set too for the format and contents of the Report. It was, incidentally, not uncommon for 35 to 40 members to attend the Annual Meeting, or something like one third of the total membership. Perhaps because there was only one meeting per year a special effort was made to attend; and it would surely have been an occasion looked forward to with the keenest anticipation by bryologists who would be operating to a large extent on their own for all the rest of the year. Keenness in plenty was shown, strong support given by members, but no obvious 'forward spurt' is detectable in or around 1930. For this the Society would have to wait another 16 years.

The reason may have lain, in part at least, in the accepted taxonomic framework within which all work at the time was done. That framework was provided by the Handbooks of Dixon (1924) and Macvicar (1926). One gains the impression that, if H.N. Dixon, out of his vast experience and accumulated wisdom, had quietly given a view on some controversy, the matter was thereafter closed. In the 17 years, 1923-39 inclusive, very few species new to Britain were in fact detected. A conservative view prevailed. It was, however, a view in which much attention was paid to the question of the correct status to be accorded to every new variant that turned up. This led to the listing of a multiplicity of infra-specific taxa, often without due consideration having been given to the real nature of what had been found. Were these variants genotypic or phenotypic in character? Most often the question was not asked. If it was asked it was unlikely that the machinery would be set in motion whereby it could be answered. In the moss census catalogue of 1926 (excluding Sphagnum) no less than 256 varieties were recognised over and above the 'type varieties' of the species. The corresponding number of hepatics, in 1930, was 107 (this included a few formae). Contrast the 1981 position (Corley & Hill, 1981), where the lower ranking taxa numbered, for mosses 10 subspecies and 85 varieties, for hepatics three subspecies and only 12 varieties.

The genus Sphagnum was something of a special case. In the Census Catalogue of 1926, Dixon's arrangement with 18 species and 30 additional varieties, and Warnstorf's system of which Mr Sherrin was a devotee, were both included. In Warnstorf's system there were no fewer than 47 species and 96 additional varieties (not to mention formae and subformae). Under this system Sphagnum became something of a 'splitter's paradise', if such can be envisaged. In the Report for 1925, for example, we meet the taxon: Sphagnum papillosum var. sublaeve, forma validum, subforma pycnocladum. Then, and up to 1932, W.R. Sherrin was the sole and seemingly tireless commentator. Thereafter the genus was divided up between Mr Horsley, Miss Lobley and Mr Thompson, with Mr Sherrin officiating as "Referee-in-Chief". It can have been no easy matter to effect that transformation in the treatment and recording of Sphagnum which came some 20 years later and levelled off the recognised taxa at 29 or 30 species and just four additional varieties. Looking back on the position as it was just 50

years ago we can hardly fail to see it as a glaring case of taxonomic elaboration, and hence complexity of recording, that had gone beyond the bounds of reason.

One final aspect of those early days in the Society's life must be touched upon, if only briefly. It concerns the connection between detecting rarities and gathering appetising material for the Distribution. Alas, there is ample evidence that the two were closely bound up together. It almost looks as if the rarer the species the choicer prize it was to put into one's 'distribution parcel'. Thus, Cyclodictyon laetevirens from that cave at Mousehole (West Cornwall) was relentlessly gathered for exchange purposes year after year; and when the Rev. C.H. Binstead made his extended personal tour of Lakeland in September and October 1924 most of his more exciting finds duly found their way into the next Distribution - and that would entail many packets of each. On the other hand, in the report on the Ben Lawers excursion of the mid-Perthshire meeting of 1929 we read as follows: "In the opinion of bryologists who have known the Lawers Flora for many years, several of the local plants were in less quantity than before, and the same observation applies to the Phanerogamic Flora. With regard to the latter (i.e. the flowering plants) the bryologists were most scrupulous only to point out the rare plants, and they were not gathered". Exactly what happened to the bryophytes we are not told, but a bit later on the point is made that "no one was allowed to gather Habrodon notarisii (=H. perpusillus) from the original habitat on the old sycamore at Killin". This passage notwithstanding, in the extended commentary on material submitted for the next Distribution a fair selection of the Ben Lawers rarities can be found.

If now we leave the far past and, in our mind's eye, travel forward to the present day, we can point to many contrasts in the Society's recording procedures and activities. First, the BBS is four times as large as it was in the 1930's. Its membership list includes many professionally trained botanists. Behind the scenes, research on bryophytes goes on apace, research into their cytogenetics, developmental physiology, ecology and phytochemistry, and the critical study of foreign floras; all this quite apart from taxonomiic research more directly related to the recording of distribution in Britain. A massive Journal, of varied content, appears twice a year; in addition there is a Bulletin dealing with a range of domestic topics, but also carrying some short papers and articles. Members can avail themselves of two field meetings, a paper reading meeting and a taxonomic workshop in any one year. They are encouraged to record, both on the old vice-county basis and on the basis of 10 km squares. They have access to a new comprehensive moss flora (Smith, 1978a) and an up-to-date Census Catalogue giving the vice-comital distribution of all bryophytes in the British Isles. Through the International Association of Bryologists members can establish far closer contact with bryologists in other lands. Bryological books of many kinds proliferate, while records and lists of mosses and liverworts find a place in countless ecological papers. Long-distance travel is immeasurably more easily undertaken than of old. Funds can often be tapped both for research equipment and for travel. In brief, the British bryologist of today lives in an altogether different world from that of those early BBS members who tramped the hills of Perthshire in 1929, recording after their own fashion and slipping into their vascula Hypnum bambergeri, Hygrohypnum smithii and others in amounts sufficient for the Distribution.

Change then, in plenty, we can recognise. We now have to ask ourselves how all this came about and, in particular, how it has influenced the recording activities of the Society. Some change came gradually, in response to a changing climate of biological thought and a variety of extraneous influences; but there were also, from time to time, quite sudden leaps forward, or dramatic turning points in the Society's life. One of these was the re-organisation that took place just after World War II, when the notion of innovation was

actively grasped and volume one of the Transactions of the British Bryological Society duly appeared. Another surely was the introduction of paper-reading meetings, at the instigation of Dr S.W. Greene, in the late 1950s; and a third was the launching of the Mapping Scheme in 1961. Still another step distancing us further from those early members was the decision, reached after some deliberation by Council in 1970, to discontinue the Annual Distribution in the interests of conservation. Our main concern, however, is with recording procedures down the years. These must now be examined.

Without doubt the scale of vice-county recording reached a peak during the 1950s and 60s. It is perhaps worth recalling that the late 1950s were a time when Dr D.A. Ratcliffe was tramping the more remote parts of northwest Scotland in connection with the account of Scottish Highland vegetation which was soon to appear (McVean & Ratcliffe, 1962) and Dr H. Milne-Redhead, in what time he could spare from a busy medical practice, was roaming the hills of Galloway. Between them they accounted for many NCRs. The authors of the 1981 Census Catalogue cite approximately 420 moss and 250 liverwort NCRs in 1964, to which have to be added a further 250 for new segregates in the Bryum erythrocarpum complex. These are impressive figures, but those for some other years did not fall far short of them. Thus, the records detailed in 1958, following the Irish meeting of summer 1957, were particularly numerous (c. 300 hepatics, 75 Sphagnum and 575 mosses); and again in 1961, following a very fruitful meeting based on Ullapool, NCRs amounted to some 220 hepatics, 30 Sphagnum and just under 500 mosses. Throughout the 1950s no other system of recording distributional information was in use. The outcome (see 1981 Census Catalogue) was that by the mid-1960s a total of some 60,000 vice-county records had accumulated, with a further 10,000 coming in during the ensuing 20 years. I well recall Dr E.F. Warburg remarking, when he had been Recorder of Mosses for some years, how he was always expecting the rate of influx of new records to fall, but somehow it never seemed to do so. During this past decade, however, the rate has fallen appreciably.

It is evident that, with almost 1,000 species and just over 150 vice-counties, completing a tally of information on a vice-comital basis is a matter of being able to answer 'yes' or 'no' to approximately 150,000 questions. Is species X present in vice-county A or is it not? If we already have to hand some 70,000 positive answers, and if (as must be so) we can say confidently 'no' to a great many more (no, Scorpidium turgescens does not occur in Kent, for example), it follows that we should be coming within measurable distance of a complete statement on this basis, were it not for continual changes in (a) the list of species under scrutiny and (b) the real distribution of a small number of species, which are fast altering their status in these islands. Campylopus introflexus and Orthodontium lineare are two well-known examples of dramatic spread in the last half century or less; there are other species in which a more subtle increase appears to be in progress. Others again, especially pollution-sensitive epiphytes, have virtually disappeared from areas where they once were common. All such instances of changing status are one built-in source of instability in the distribution record as stated at any one time. The growing species list is another.

The species list has altered to a quite remarkable extent over the past 60 years. I allude to changes resulting from (a) taxonomic revisions of particular groups of species within the last three decades and (b) the discovery of species new to the British Isles. Timely revisions have illuminated, for us all, such hitherto confused and confusing groups as the Plagiothecium denticulatum complex (Greene, 1957), the old Bryum erythrocarpum and B. murale (which emerged (Crundwell & Nyholm, 1964) as no less than nine species) and, more recently, the bulbiliferous Pohlia and Bryum species (Lewis & Smith, 1978; Smith & Whitehouse, 1978). All these examples entailed the recognition of some additional full species to the British list, for which

vice-county recording would have to start from the beginning. Also, and more exciting, there are those additions which represent either range extensions, to include the British Isles, of species well known abroad, or, most notable of all, genuine complete novelties, i.e. species new to science.

This flow of species new to Britain was at first very gradual. Of eight noted in the 17 years 1923-39 four were subsequently rejected. In the decade 1940-49 the outstanding discovery in this line was that of Seligeria carniolica beside the Black Burn, Newcastleton, in 1948. The 1950s did sharply better, with 10 accessions to the British list, starting with Cryptothallus mirabilis in 1950, and this figure excludes two that came out of the Plagiothecium revision of 1957. The period 1960-69, however, produced the astonishing total of 26 additions to the British flora. This includes three alien colonists but omits the seven new taxa coming out ot the revision of the old Bryum erythrocarpum complex. There were also some additions during this decade which represented the elevation of hitherto well known varieties to full specific rank, and the description anew of plants that had in the past been imperfectly understood; if all these were taken in, the number would go up to 35. The next decade, 1970-79, produced a further 21, a figure which includes two that seem likely to be alien colonists but omits all that came in through taxonomic revisions of various groups. A comprehensive total for this decade would have been 32. Thus, it was only marginally less productive in this respect than the 1960s. Both were extraordinarily prolific. Now, in the 3 years 1980, 1981 and 1982 nine more have come in. The spectacular acceleration of the rate at which species new to our flora came to light is shown by the fact that from 1923 to 1939 it stood on average at one new species every four years, but through the 23-year period 1960-1982 the rate stood at more than nine times this value.

Bryologists of fifty to sixty years ago could hardly have anticipated that in the 19-year period from the start of 1964 to the end of 1982 there would appear descriptions of no less than 20 species new to science, all acquisitions for the British bryophyte flora, and including, in Pictus scoticus (Townsend, 1982), a representative of an entirely new genus. After all, the British bryophyte flora was thought to be reasonably well known. How, then, can we explain the advent of so many species new to Great Britain and Ireland over the past 25 years, no less than twenty of them new to science? The discovery and publication of all these additions to the British flora must surely be reckoned one of the most notable recording achievements of our Society during the second half of its 60-year life. To account for it, however, is quite another matter. It may be worthwhile considering some contributory causes. One is that, in the observation and description of bryophytes, it is becoming usual to take account of the whole structure of moss or liverwort, including the finest details of its stem and leaf anatomy, any rhizoid tubers it may bear, the SEM picture of its spores and so on. Hence a closer scrutiny is brought to bear on a suspiciously interesting looking plant. Secondly, we notice that the majority of the completely new species have been recognised as such and described by a very small number of BBS members, and these same members have, with few exceptions, either detected or had a hand in the elucidation of most of the plants new to the British Isles. This is because these observers combine a discriminating eye with an exceptional knowledge of bryophytes, not just in Britain, but in North Europe, the Mediterranean lands and parts of North America. In short, they are ready for new plants to turn up, and equipped to notice them when they do.

A third consideration in accounting for this great influx of species new to Britain lies in the readiness of biologically trained observers in recent years to look at the validity of species from all angles. Ever since the coming of the so-called "New Biology" (cf. Huxley, 1940) there has been a tendency to examine potential species not just in the light of structure but, in addition, through the techniques of cytogenetics and cultivation experiments. This

approach has led to the recognition of some new species, though also to the elimination of others. Some newly recognised bulbil-bearing Bryum and Pohlia species have come in thus; but some formerly recognised varieties of Drepanocladus fluitans and D. exannulatus, for example, have been eliminated (Lodge, 1960).

As regards the real history and mode of origin of the new mosses and liverworts detected, in some instances we may find evidence for believing the addition to represent a genuine new arrival to Britain; but almost certainly we must see the majority of apparent novelties as having been here for an indefinite time but hitherto overlooked. Whatever the likely explanations may be, both of the origins of our new species and of the accelerated rate of their discovery, the point that emerges clearly is that no statement of distribution by vice-counties is ever permanent. No sooner has the immense task of preparing a new summary of such distribution been completed than it starts to become obsolete.

At the same time, ever since 1961, recording has been going on apace on a different basis, under the auspices of the Mapping Scheme. The year 1961 was a time of transition. The Secretary could still write - "The Annual Exchange has again been very much appreciated by members" yet many had their eyes fixed on the greater precision which the new 10 km square mapping would bring. It was evident at the outset that this was a tremendous undertaking. An answer 'yes' or 'no', not to 150,000 questions, but to approximately 3,500,000 questions would have to be given if the ultimate goal of completed maps for all species were to be attained. 'Yes' or 'no' to what kind of question? Did a tiny, unobtrusive plant, occupying perhaps a few square cm of terrain, whose identification might prove no easy matter, occur somewhere in an area 100 million times the size of itself? That would be the position if a 10 km square were a flat surface, like some huge airfield (there would simply be a lot of it to crawl over, on hands and knees!). In reality, however, it consists often enough of innumerable ups and downs, mountain slopes and steep ravines, rock surfaces with clefts and crevices, the trunks and branches of countless trees, steep riverbanks which the bryologist searches at his peril, and so on. In short, the potential total surface area to be scrutinised in one 10 km square is often far in excess of 100 million times that of the little plant being sought. On the face of it, to do anything as formidable as this more than 3½ million times would seem to be a well-nigh impossible task, even given an army of bryological experts to carry it out. I have to confess that, when the Mapping Scheme was first mooted, gloomy reflections along these lines passed through my mind and, as it were, coloured my views on it in singularly sombre hues. Such 10 km square mapping might be an excellent idea for wild flowers, or for breeding birds - with 10,000 or more well-informed amateur enthusiasts to ensure completion in a reasonable time; but for bryophytes, to attempt the task would be a case of enthusiasm obscuring good judgement.

The reality is not quite like this at all. This picture is misleading and unduly pessimistic for two reasons. First, the experienced bryologist will know in precisely what habitat a given species is likely to occur. Looking for it therefore will always be a selective search. Also, many bryophytes are large and conspicuous, so that a confidently positive answer to the question (present or not?) is in many 10 km squares extremely quickly obtained. The field worker, armed with printed card of abbreviated names, can quickly put a stroke through many of them. More than half the potential tally for a given square may well be obtained in a single afternoon.

The two difficulties which appear to remain are (1) being certain that a negative answer to the question really means total absence of that species from the square; and (2) guaranteeing the accuracy of all identifications, without which false information will be recorded. It will be possible to return to

these two points later. First, however, we must consider the achievements of the Mapping Scheme to date.

All members who have not played a prominent part in the Mapping Scheme must agree that after just over 20 years from its inception, it has achieved a remarkable amount. This arises from the tireless efforts of the Mapping Secretary, Dr A.J.E. Smith, the relentless searching of 10 km squares by a growing number of active field bryologists, and the planning of numerous BBS field meetings with the study of underworked 10 km squares in view. Starting in 1963, and continuing for 16 years without a break, batches of maps were published, mostly of relatively rare or local species, and amounting to some 222 in all. Not only did each map give the known distribution of the plant in question, based on all traceable records, but in almost every case the map was accompanied by a statement of its ecology and often of its world distribution as well. Only 28 members were the authors of this initial set of maps; and only eleven had a hand in more than five of them. Three bryologists either prepared or shared in the preparation of 24, 25 and 27 maps respectively; while no less than 41 maps were the work of the Mapping Secretary himself.

There followed (Smith, 1978b) a Provisional Atlas of 105 species, mainly less rare than many in the earlier series, and in some instances really widely distributed plants. In this series there are no accompanying statements on ecology or geographical distribution. Three species of liverwort and three mosses, of which maps appeared back in 1963-65, reappear in the pages of the Atlas. The three liverworts are Jubula hutchinsiae (up from 75 to 158 squares), Marchesinia mackaii (from just over 150 to c. 250), and Ptilidium pulcherrimum (from 79 to 172). Thus each reveals a massively increased distribution record in the second set of maps. As for the three mosses, the number of 10 km squares in which each is known to occur has climbed from 20 to 38 in Herzogiella seligeri, from 38 to 86 in Homalothecium nitens, and from 39 to 115 in Dicranum tauricum, a species known to be extending its range in Britain.

The maps provided in this Atlas do not just give a 'bird's-eye view' of the recorded British distribution of species. They also illustrate - in a way that can be seen at a glance - a series of characteristic distribution patterns. We see, in cartographic form, prevailing southern distributions, such as that of Eurhynchium schleicheri, plants of the south and west, like Neckera pumila, plants of north and west Britain like Hedwigia ciliata, and so on. An Atlantic montane distribution is illustrated by the map of Anastrepta orcadensis, a distribution more or less perfectly following the chalk outcrop is shown here, predictably, by Seligeria paucifolia, a fairly strictly maritime pattern emerges for Pottia heimii, a characteristic western maritime one for Schistidium maritimum; but when we look at the map of Tortula ruralis ssp. ruraliformis we are struck by the large number of squares in which it occurs that are far away from the coast. Here, then, is an example of modern BBS recording in a beautifully assimilable form. Members will now await with keen anticipation the appearance of a more complete Atlas.

To return briefly to the recording of distribution by vice-counties, it is instructive to look at the scale of increase in information, on this quite different front, which has taken place over the past 60 years. One way of doing this is to take a set of three figures for a series of species, these figures simply representing the number of vice-counties from which each had been recorded, in 1926/30, in 1963/65 and in 1981, in successive Census Catalogues. The sets of figures can present strikingly different pictures in different species. Table 1 illustrates a few typical examples, from each of three chief categories: (1) the category into which the majority of species looked at fall, i.e. those reflecting a steady widening of known distribution down the years; (2) many fewer cases which show only a very slow advance in

known range, and sometimes no advance at all in the last 16 to 20 years (Polytrichum sexangulare and Grimmia incurva are examples); (3) a small group of species in which there appears to have been a reduction in known vice-county range (it includes, for example, the liverwort Pedinophyllum interruptum and the mosses Tortula cuneifolia and Bryum knowltonii). The explanation of apparently shrinking distribution usually lies in the fact that some old records have proved unreliable. In a few instances, as in species highly sensitive to pollution, extinctions arising from this cause may be involved.

One cannot fail to notice that some uncommon or rare species, despite close search over many years, and greatly extended exploration of many of the more remote parts of the Scottish Highlands, have yielded up new vice-county records only very slowly, while others have moved ahead in a spectacular way. Of the former Chandonanthus setiformis and Arctoa fulvella are good examples, each having been detected in only three new vice-counties in more than 50 years; whilst illustrations of rapid increase are provided by Calypogeia sphagnicola, Thuidium delicatulum and Ditrichum cylindricum.

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TABLE 1: The changing record of known vice-comital distribution, as shown for selected species, based on the total number of vice-counties in Britain + Ireland for which each was recorded in successive Census Catalogues. Where a number appears in brackets it refers to additional vice-counties in which the species has not been seen in the past 50 years. C: Channel islands.

(a) Liverworts	1930	1965	1981
Haplomitrium hookeri	7 + 2	9(5) + 1(1)	31(4) + 9(1)
Jungermannia paroica	14	33(1) + 3	52 + 9
Leiocolea heterocolpos	3	10	24 + 1
Pedinophyllum interruptum	8 + 6	11 + 9	5 + 6
Calypogeia sphagnicola	4	30(1) + 7	49(1) + 21
Chandonanthus setiformis	12	15	15
Adelanthus decipiens	9 + 9	10 + 13	14 + 14
Pleurozia purpurea	24 + 13	24 + 23	25 + 23

(b) Mosses	1926	1963	1981
Sphagnum imbricatum	14 + 3	31 + 13	38(3) + 22
Polytrichum sexangulare	7	9	9
Ditrichum cylindricum	15 + 3	75 + 9	104 + 23; C
Rhabdoweisia crenulata	13 + 2	28 + 7	34 + 13
Arctoa fulvella	20 + 1	21(2) + 1	22(2) + 2
Dicranum tauricum	7	25	49
Tortula cuneifolia	22 + 7; C	17(3) + 9; C	14(5) + 9; C
Barbula nicholsonii	9	23 + 3	27 + 3
Oxystegus sinuosus	46 + 5	57 + 19; C	70 + 25; C
Grimmia incurva	10(1)	11	12
Pohlia filum	5	4(1)	23(1) + 2
Bryum knowltonii	19(1)	16(3)	10(12)
Amblyodon dealbatus	36+8	37(5) + 13	38(7) + 17
Thuidium delicatulum	20(3) + 12	39 + 20	62 + 29
Herzogiella striatella	14	17	17
Campylium polygamum	43 + 13	58 + 18	68(2) + 23
Hypnum bambergeri	1	5	6
Two mosses showing most spectacular increase related to undoubted spread:			
Campylopus introflexus	*5(3) + 5	26 + 19	102 + 39; C
Orthodontium lineare	3	64 + 2	94 + 5; C

* In 1926 confused with C. polytrichoides. Genuine C. introflexus first appeared in 1941.

Obviously, we discover more when we see, in each case, the actual vice-counties involved in 1926 or 1930 and in what directions any subsequent spread has gone. In Orthodontium lineare, for instance, there was something like a radiation outwards from the point of original colonisation back in 1920, in south-west Yorkshire. The moorland of Kinder Scout, where I recall seeing it in abundance during the Buxton meeting of 1948, was not far away and must have been colonised at an early date, since when the species has spread far and wide in many directions. The sets of figures for our two outstanding examples of invading species speak for themselves (Table 1). Fuller exploration of the precise direction and extent of the various range extensions recorded for different species is impracticable. It is, however, worth looking a little more closely at the relative merits of these two distinct ways of recording distributional data. Both are able to give us a good general idea of the British distribution of a species. What recording by 10 km squares has done, however, is to present some picture of just how widespread a species is within any vice-county for which there are records. Take the case of Pogonatum nanum in Skye. In a map of vice-comital distribution, v.-c. 104 (N. Ebudes) would be marked in some way (e.g. shaded), to show that the species occurred there; but from the data in the Provisional Atlas we learn that there are very few 10 km squares on Skye in which it has not been found: it is all over the place (though, according to Birks & Birks (1974-1975), local and seldom in quantity). By contrast, in a map of the distribution of Pottia recta based on v.-c. records, v.-c. 85 (Fife & Kinross) would be duly marked showing that it occurred there. Yet map 48 of the Provisional Atlas shows us at a glance that it is in fact found in just one 10 km square in the entire vice-county.

It should not be forgotten that most cartographic methods of presenting the facts of distribution share two built-in drawbacks. The first entails presenting a map picture which enormously exaggerates the abundance of the plant in question. It cannot readily be otherwise. For whether it be the area of a whole vice-county shaded in, or a 10 km square practically covered by a round black blob, the impression inadvertently given is of a situation approaching complete cover by the moss or liverwort thus mapped. The reality, as we all know, may be anything from a tremendously widespread scatter of colonies of the plant down to a situation where it covers perhaps a few square centimetres in the entire area. In a word, cartography must ever be a somewhat blunt-edged tool for representing the results of our recording efforts: it is not very discriminating.

The second built-in drawback of presenting distributional facts by means of a map arises from the essential ambiguity attaching to every unmarked square. This could mean that the species in question quite definitely is not there, despite exhaustive search; but equally it could mean exhaustive search has not yet been made, and that it is there but has not yet been found. It is true that reference to a general situation map (e.g. Smith, 1971) showing well-worked, underworked and unworked squares can be helpful here, even if not conclusive.

A difficulty of quite another kind is not merely relevant to the elegant cartographic abstractions which represent the visible results of countless hours of recording, but is a potential source of error built into the whole recording process. I refer to faulty identification. Occasional errors in identification are inevitable at every level of bryological skill and experience. They will never be totally eliminated. Again, some record making is subsequently rendered invalid on account of changes in species concept in some group or other. It is, however, worth emphasising just one or two points on this subject, for it is a matter highly relevant to the recording activities of the BBS. First, I believe thoroughly accurate identification in the field is for many people - and not just beginners - extremely difficult to achieve. Many bryophytes pose problems enough even under the microscope.

At the Nottingham meeting, 1982, Professor J.G. Duckett gave figures relating to his own expertise (Duckett, 1983). He could recognise, he said, 498 mosses and 213 liverworts in the field, 150 of the mosses and 54 of the liverworts without even using his hand lens. I would submit that anybody who can be confident that he can put the right names on no less than 711 species of bryophyte in the field, no matter in what circumstances he comes across them, must be a person of exceptional skill in this direction. Many people who enjoy studying bryophytes do not have field knowledge and expertise even remotely approaching this.

I believe there is a decided tendency to be over-confident about one's skill at field identification, and at the same time a tendency to underestimate the real identification problems within certain groups of species. Moreover, quite apart from the taxonomically critical and the excessively minute, there is, among bryophytes, always the possibility of some atypical growth-form turning up and defying rapid recognition. In view of all this, we cannot be too careful about accuracy in identification. Perhaps we should ponder the words of our recent American visitor, Janice M. Glime, who noted how sharply the British differed from American bryologists in the field (Glime, 1983). "The British" she said "collect only a small bit of the species of uncertain identity (and those are rare), but instead busy themselves ticking off names on a card, much as do American bird watchers". She goes on to say that many American professional botanists "collect large handfuls of nearly everything because it can be used for exchange to build a herbarium. No one carries a card, and usually no group species list is compiled". She points out that a 10 km square distribution does not interest American bryologists, but a new state record excites them. One is thus rather led to believe that for most American bryologists serious work on what has been found begins back in the laboratory where surely some surprises will await the field worker as he examines his copious collection. What interests me in Miss Glime's comparison is not her apparent detection of subtle national differences between us and the Americans where bryological 'modes and manners' are concerned. Rather is it that her picture of American bryologists in the field today tallies almost exactly with our own impression of the way BBS members went about their field studies 50 or 60 years ago. Our predecessors were often still hotly debating the identification of a gathering months later as it passed through the machinery of the Distribution. One is tempted to ask whether modern British bryologists, as they strike through the names on their card with such alacrity, pause often enough to ask "Am I absolutely sure that that shrivelled up fragment of something or other which my friend 'X' has confidently called out to me as being so-and-so has been correctly identified?" Nor are we necessarily safe when home. I have a vivid memory of some relative beginner, a few years back, tipping out the contents of the day's 'bag' on to the low coffee table of a crowded hotel lounge, where in the dim and mellow light which so often prevails in such places, amid a cloud of tobacco smoke and in the benign aura of alcoholic refreshment, an experienced member who happened to be on hand rattled off the names of everything at dazzling speed. No doubt the beginner went away satisfied as to the names of what he had found. For myself, I went away just a little worried by this virtuoso display, not of field identification but of 'dimly lit hotel lounge identification'! We must never forget that every erroneous identification that finds its way on to a card has the potential to implant error into the permanent record of distribution.

In this account I have drawn attention to the mapping achievement of the past 20 years; also to the continuing process of recording distribution by vice-counties, all the way from 1923 to 1983. It has not proved practicable to deal with another branch of recording work which has always been the province of individuals, or sometimes small groups of members: the preparation of a County or Vice-county Flora. Since they are not the outcome of planned corporate activity on the part of the Society they fall outside my present

terms of reference. Yet the preparation of a county flora is a substantial task, its completion always a landmark. All are indirectly the fruits of the fieldwork of a multitude of observers, and all are valuable repositories of records.

It will be apparent that no precise assessment has been made, after all, of the impact of recording activities on the advance of bryological knowledge as a whole. What I have tried to demonstrate is how these activities have constantly extended our knowledge of bryophyte distribution in these islands; also how this characteristic BBS activity has been, throughout the 60 years, intimately bound up with our ideas as to the correct taxonomic interpretation of the plants we study. The great access of new species to our flora (some 90 in all) and our revised views on group after group, reflect this fact. Beyond this we cannot easily go. For manifestly, many fields of bryological research which have engaged the attention of certain members lie outside the range of BBS recording activities, as ordinarily understood. The two simply do not impinge on one another.

This recording activity brings its own reward in the form of a vastly increased knowledge of the distribution of mosses and liverworts in Britain and Ireland; and this increased knowledge illuminates in turn some corners of plant geography and ecology. It provides the essential foundation on which others in time can build. By its unabated activity in the field, year after year, the Society has made its greatest and most notable impact on our knowledge of distribution itself. Part of this achievement has come from the constant underpinning given by the existence of the British Bryological Society as an organization, brought into being with foresight and vision, 60 years ago. Part of it we owe to the presence in our midst of a handful of exceptionally gifted and dedicated bryologists. A third component, not to be under-estimated, is the membership as a whole; for all have played their parts at different times, in various ways. However many people join in the hunt, this work of recording will surely never be complete. There will always be something new awaiting discovery. Meanwhile, interspecific boundaries will continue to be debated; the validity of infraspecific taxa will not cease to exercise our minds.

References

Birks, H.J.B. & Birks, H.H. (1974-1975). Studies on the bryophyte flora and vegetation of the Isle of Skye. I. Flora. J. Bryol. 8, 19-64 (1974); 197-254 (1975).

British Bryological Society. Reports, 1923-1939.

Corley, M.F.V. & Hill, M.O. (1981). Distribution of Bryophytes in the British Isles. A Census Catalogue of their Occurrence in Vice-Counties. British Bryological Society, Cardiff.

Crundwell, A.C. & Nyholm, E. (1964). The European species of the Bryum erythrocarpum complex. Trans. Br. bryol. Soc. 4, 597-637.

Dixon, H.N. (1924). The Student's Handbook of British Mosses. Ed. 3. Eastbourne.

Duckett, J.G. (1983). Does photography render the collection of bryophytes unnecessary? Bull. Br. bryol. Soc. 41, 10-12.

Glime, J.M. (1983). A Michigan view of a BBS field trip. Bull. Br. bryol. Soc. 41, 3-4.

Greene, S.W. (1957). The British species of the Plagiothecium denticulatum - P. silvaticum group. Trans. Br. bryol. Soc. 3, 181-190.

Huxley, J. (ed.) (1940). The New Systematics. Oxford.

Lewis, K. & Smith, A.J.E. (1978). Studies on some bulbiliferous species of Pohlia section Pohliella. I. Experimental investigations. J. Bryol. 9, 539-556: II. Taxonomy. Ibid. 10, 9-27.

Lodge, E. (1960). Studies of variation in British material of Drepanocladus fluitans and Drepanocladus exannulatus. I. An analysis of the variation.

Svensk bot. Tidskr. 54, 368-86: II. An experimental study of the variation. Ibid. 54, 387-393.

McVean, D.N. & Ratcliffe, D.A. (1962). Plant Communities of the Scottish Highlands. H.M.S.O., London.

Macvicar, S.M. (1926). The Student's Handbook of British Hepatics. Ed.2. Eastbourne.

Smith, A.J.E. (1971). Distribution maps of bryophytes in Britain. Situation map. Trans. Br. bryol. Soc. 6, 331.

Smith, A.J.E. (1978a). The Moss Flora of Britain and Ireland. Cambridge.

Smith, A.J.E. (ed.) (1978b). Provisional Atlas of the Bryophytes of the British Isles. Natural Environment Research Council, Biological Records Centre, Abbots Ripton.

Smith, A.J.E. & Whitehouse, H.L.K. (1978). An account of the British species of the Bryum bicolor complex including B. dunense sp. nov. J. Bryol. 10, 29-47.

Townsend, C.C. (1982). Pictus scoticus, a new genus and species of pleurocarpous moss from Scotland. J. Bryol. 12, 1-6.

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WORKING GROUP FOR MAPPING BRYOPHYTES IN EUROPE: OBJECTIVES, AND POTENTIAL FOR BRITISH PARTICIPATION

by

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For the secretary of the Working Group for Mapping Bryophytes in Europe (WGMBE-GTCBE), this meeting offers an unique opportunity to make the project more widely known. I shall outline the objectives of the project, report some of our achievements to date, and consider some of the problems we have encountered. In this way, I hope to gain some new and welcome help for the development of the project, especially from active members of the BBS - the Best Bryological Society, as it might be called.

The project

The project was born in April 1980 after preliminary discussions between Polish, German, Dutch and Belgian bryologists at Mont-Rigi and also in Duisburg. A first invitation was then sent to some 100 bryologists recorded in the Directory compiled by Gradstein (1979), and as a result 34 bryologists from 14 European countries were present at the first Meeting of the WGMBE held in Mont-Rigi at the beginning of November 1980. Among them were British bryologists, including Drs M.O. Hill and A.J.E. Smith, Messrs M.F.V. Corley and E.C. Wallace. It was a very good meeting: after an extensive review of the state of the bryofloristic and mapping projects in the different countries (Schumacker, 1982), and a discussion on the methods to be used for our purposes, four subgroups of participants with Atlantic, Boreal-alpine, Mediterranean or Continental interests presented a list of about 300 species to be mapped in the next five years. A copy of this list is available on request from the author. This meeting was also important in catalysing discussion on the realisation of checklists for mosses and liverworts, those recently published (Corley et al., 1982; Grolle, 1983) giving a modern, common taxonomical and nomenclatural basis for future work of European bryologists dealing with floristics and bryogeography.

The second meeting was also held at Mont-Rigi at the beginning of November 1982, with the same success, and was followed by two days of bryological excursions to some interesting sites in Belgium and the Grand-Duchy of Luxemburg. The excursions led to the discovery of some new species for our countries, thus increasing our bryological knowledge and strengthening friendships within the group. A third meeting is planned for November 1984.

The main principles of the project are:

- the use of the same grid as that used in Flora Europaea (Tutin et al. 1964), i.e. the UTM grid with squares of 50 x 50 km;
- the use, as far as possible, of records based on revised herbarium material; data coming from the literature will be designated differently on the maps;
- the distinction between data before and since 1950;
- the inclusion as far as possible, of data on fertility and ecology, at least for some interesting taxa.

The need for, and scientific interest in, such an atlas of bryophytes on a European scale have been stressed at recent meetings in Geneva (Geissler & Greene, 1982), Poznan (Szweykowski, 1982), and more recently in Prague (Schumacker, in press) where I developed many arguments supporting the necessity of such an instrument. Reference to exactly mapped patterns seems to be the only scientifically acceptable method of defining the bryofloristic elements accurately, as assigning species to these elements merely from lists of countries where they are present will only lead to misunderstanding and confusion. Thus, the recent distribution studies of Duell (1982) for liverworts and of Størmer (1983) for mosses, even though they represent important syntheses, are not convincing and bring no really useful instrument to bryogeography.

A problem exists owing to the confused state of the biogeographic vocabulary and a European conference seems necessary to clarify the matter. For example, what are the precise meanings of 'eu-atlantic', 'atlantic', 'subatlantic'? Similarly, 'oceanic' is commonly used with half a dozen prefixes, often without explicit reference to any original definition; and who is able to translate in objective terms the implicit meaning of an author? The excellent critical discussions on 'eu-atlantic' mosses presented by Petit & Szmajda (1981) illustrates very well the state of our confusion in this matter.

As in the case of the Atlas of Flora Europaea for phanerogams, the European mapping scheme for bryophytes will offer the most objective and scientific base possible for discussing bryogeographical problems, at least at the European level. To achieve our objectives, we - the community formed by all European bryologists - have only to capitalize on the abundance of bryological information already available for most of the European countries. As examples: for 167 species of liverworts existing in Belgium we have about 40,000 data from herbarium material, field lists and literature sources; the projected British atlas of distribution of bryophytes will be based on 380,000 field records and many thousands of herbarium specimens; Duell's bryophyte atlas for Nordrhein-Westfalen used about 30,000 data (Duell, 1980); millions of specimens are preserved in herbaria, mostly carefully, but regrettably in some cases stored in very bad conditions, and thus completely inaccessible. It would be really a shame if such an immense accumulation of scientific data were to remain untapped. Using it for distribution maps is not only a scientifically valuable work for the future, but also a kind of homage to our eminent and industrious predecessors.

State of the mapping

In 1976, long before the start of the project, we published a map of Discelium nudum using the Flora Europaea grid (de Zuttere & Schumacker, 1976). I believe it was the first map of this type for bryophytes. It is interesting because it illustrates one of the difficulties encountered by anybody working on such a project. At the time it was quite impossible for us to check the whole of the Scandinavian and Russian literature and all the herbaria of these countries. Therefore we could only put asterisks in the center of the provinces where the species was mentioned by Nyholm (1956). Thus, the map gives a very poor idea of the distribution of this moss in boreal regions. The same difficulty was encountered during the mapping of Sphagnum imbricatum (sensu lato) by Ph. de Zuttere, and another problem became evident: there is a need for more mutual exchange of information between bryologists on what work is in progress. We learned only in 1983 that a worldwide revision of this taxon, and fine mapping of the two generally recognized varieties, had been undertaken by Dr Flatberg in Bergen! Of course, he was the best qualified to produce the map.

Some 40 maps have now been prepared within the project and 20 others are nearly complete. They include Sematophyllum demissum, showing a puzzling relictual pattern (Schumacker & de Zuttere, 1982); Eremonotus myriocarpus, a typical member of the Arctic-alpine element mapped by E. Urmi from Zürich (Schumacker, 1982); Plagiochila spinulosa, a mostly northern-atlantic species with some subatlantic occurrences, rare in Macaronesia and P. killarniensis, more strictly Atlantic-macaronesian (Grolle & Schumacker, 1983); Gymnomitrion crenulatum, strictly Atlantic (Lecointe et al., 1982); and three species of the difficult genus Pohlia (P. lescuriana, P. lutescens, P. vexans (Limpr.) Lindb.), showing interesting patterns (Nordhorn-Richter, 1982).

Among the other maps which are ready for publication are those of Colura calyptrifolia by B. de Foulcault; Cololejeunea minutissima and Lophocolea fragrans by E.C. Wallace; and some endemics of the Iberian peninsula, or species disjunct between there and other continents, such as Goniomitrium seroi Cas. de Puig, Gigaspermum mouretii Corb. also known from Asia Minor, Oedipodiella australis (Wager & Dix.) Dix., Triquetrella arapilensis Luis. and Claopodium whippleanum (Sull.) Ren. & Card., which were all mapped very actively by our colleagues C. Casas, R. Cros and C. Sérgio. Bryhnia novae-angliae (Sull. & Lesq.) Grout, confined in Europe to south-western Scandinavia, has been mapped by T. Hallingback, Braunia alopecura (Brid.) Limpr., an endemic of the Great Lakes region by J.-P. Frahm, and the very strange Hedwigia integrifolia by myself with the help of many collaborators (Fig. 1).

Mapping of Hyocomium armoricum (Schumacker, Lecointe et al., 1981) is a good example to illustrate how long erroneous data may be transmitted in the literature without reaction by bryologists. Its distribution was mapped by Allorge (1932), showing outside western Europe disjunct occurrences in Colchid mountains and in Japan - a puzzling disjunction with no equivalent. By checking most of the available material for Europe, I noted many confusions with Ctenidium molluscum and I tried to retrieve material from the disjunct stations; two years were necessary before I obtained all the samples, especially the Japanese ones. All were curious forms of Ctenidium molluscum. Clearly nobody had checked these samples since they were collected and published. So was rejected - after fifty years of survival - one of the most puzzling examples of disjunct distributions among the European bryophytes. This is a good lesson for mappers: puzzling disjunct occurrences must be carefully checked by examining herbarium material.

Some maps can only be established on the basis of material revised by monographers. Monographic revisions are good opportunities for producing

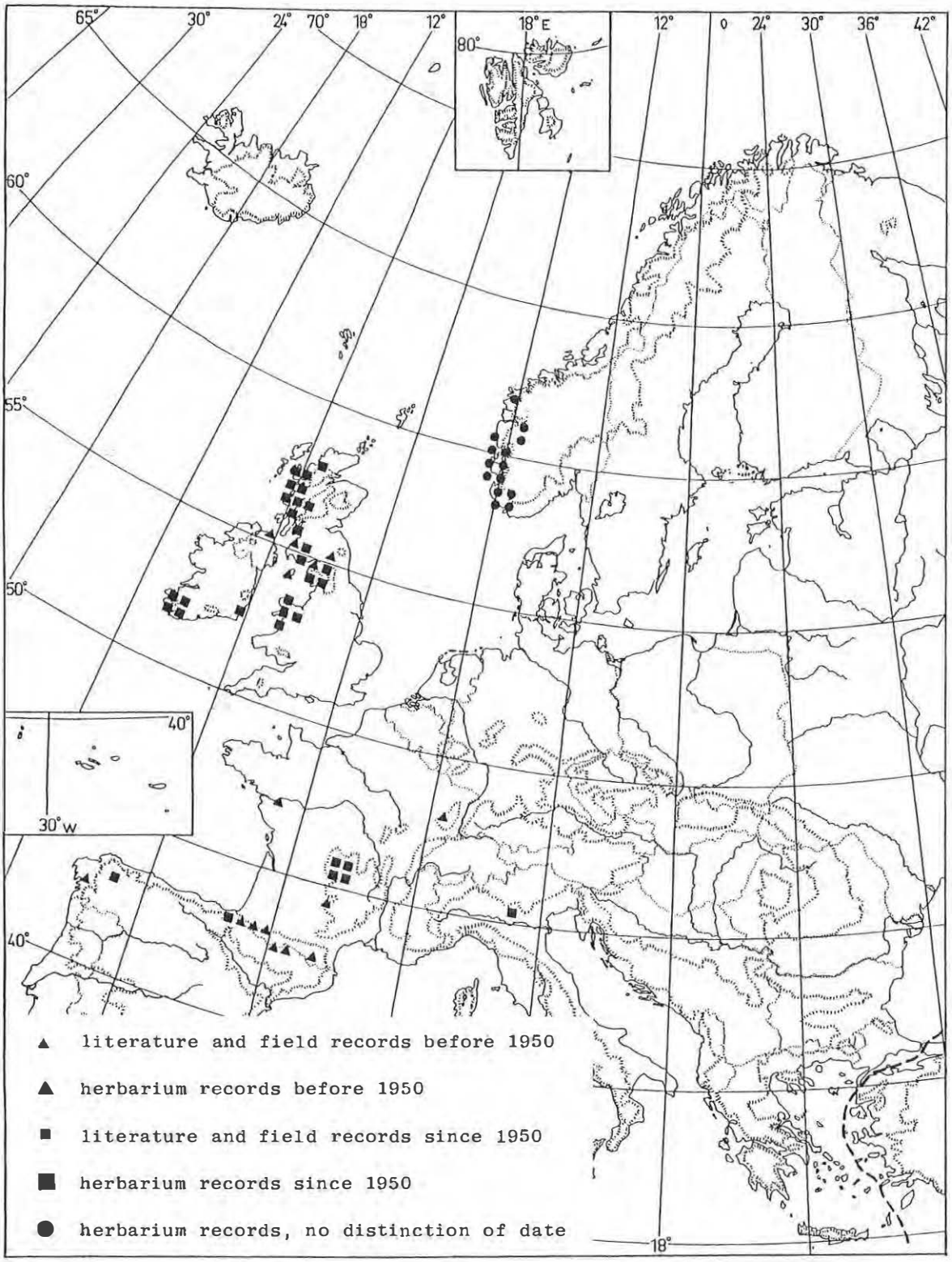

Fig.1. Distribution of Hedwigia integrifolia P. Beauv. in Europe, mapped by R. Schumacker, with special help from A.J.E. Smith, P. Størmer and J.-P. Frahm. The species is also recorded from the Caucasus. Each dot indicates the presence of the species within a 50 x 50 km UTM-square following the grid of the Atlas of the Flora Europaea.

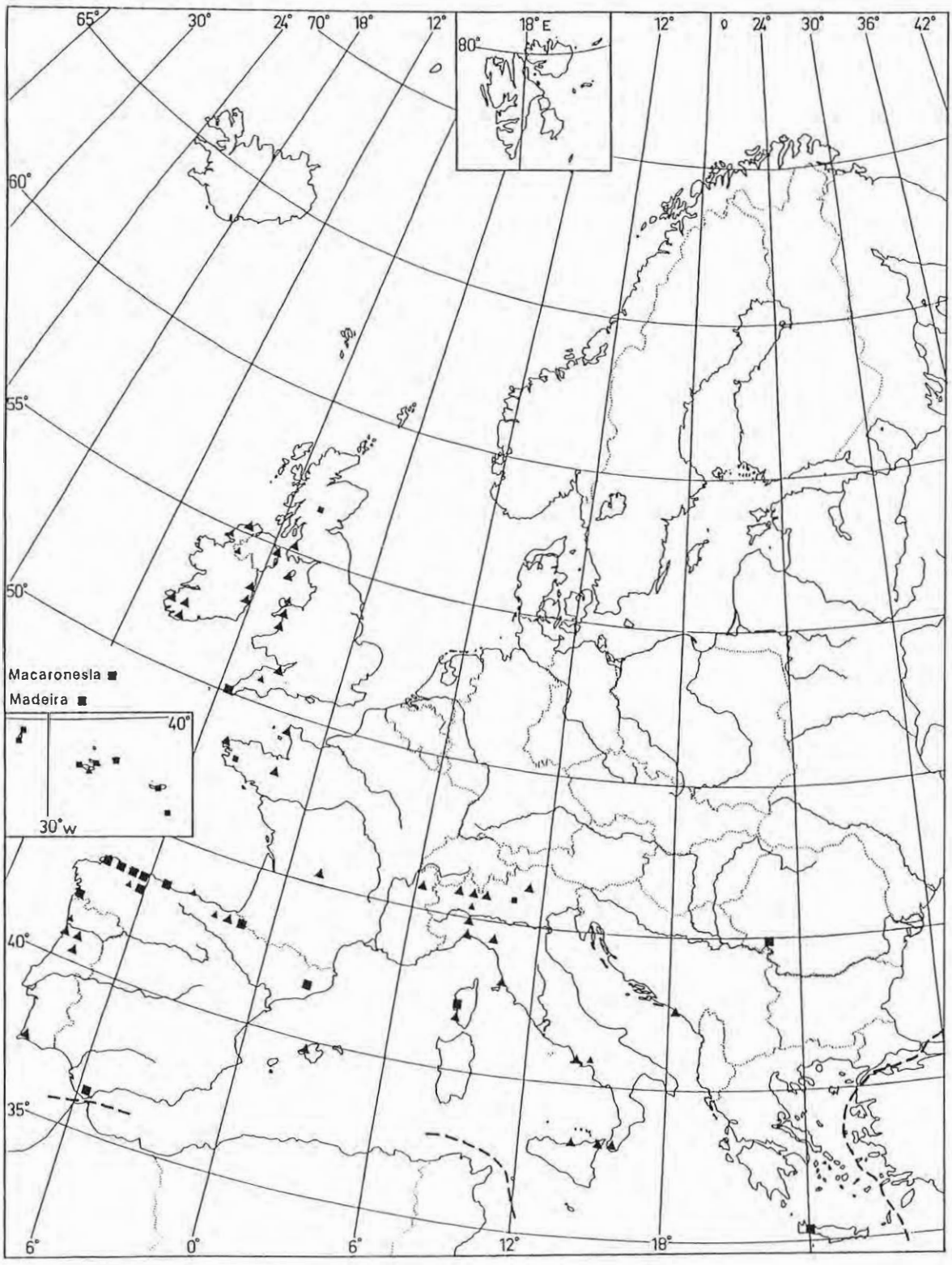

Fig. 2. Distribution of Philonotis rigida Brid. in Europe, mapped by C. Raymaekers. For explanation of symbols see Fig. 1.

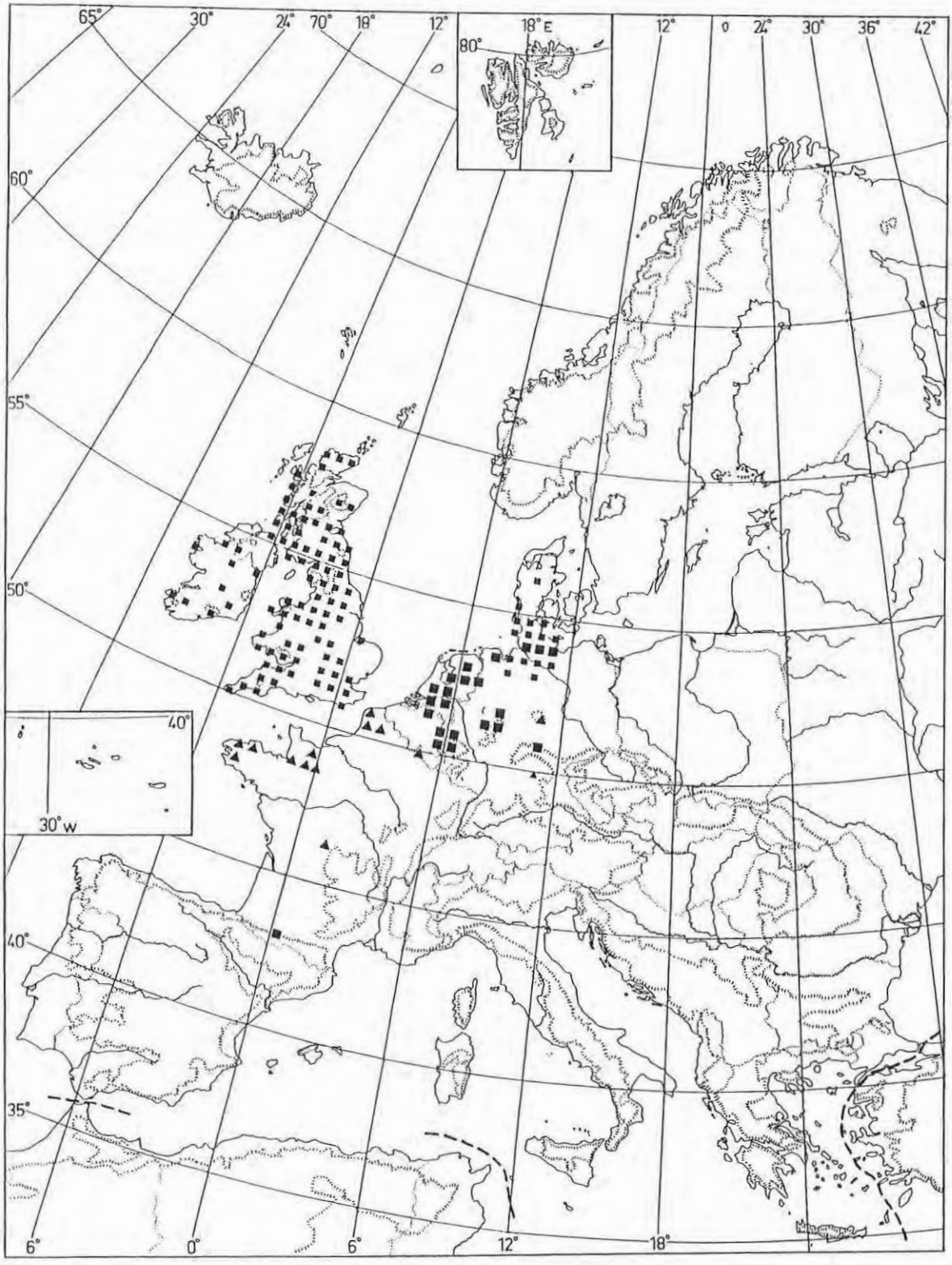

Fig. 3. Distribution of Leptodontium flexifolium (With.) Hampe in Europe, mapped by R. Schumacker and Ph.de Zuttere with special help from A.J.E. Smith, J.-P. Frahm, A. Lecointe and M.A. Rogeon. For explanation of symbols see Fig. 1.

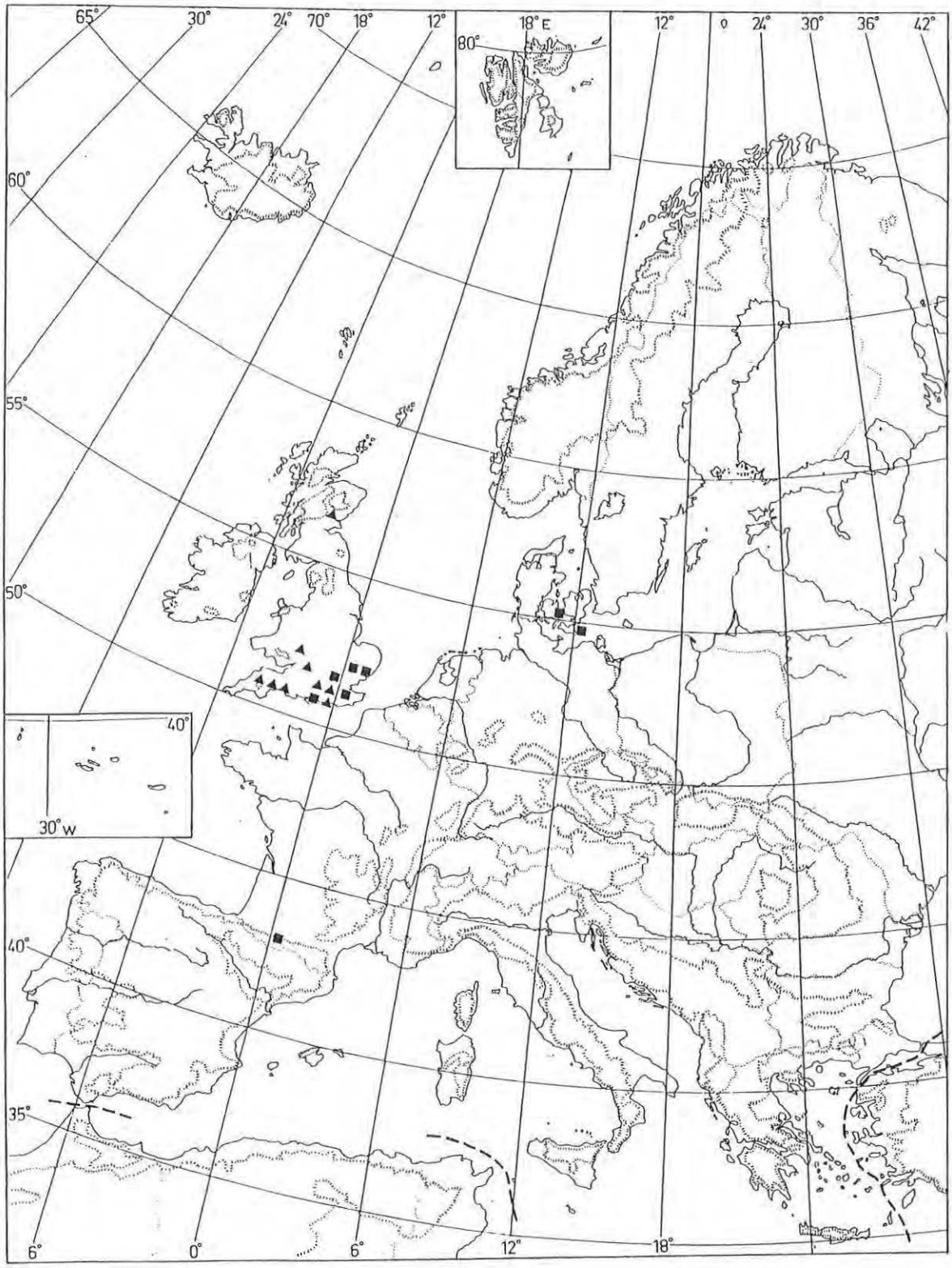

Fig. 4. Distribution of Leptodontium gemmascens (Mitt. ex Hunt) Braithw. in Europe, mapped by R. Schumacker and M.A. Rogeon with special help from A.J.E. Smith. For explanation of symbols see Fig. 1.

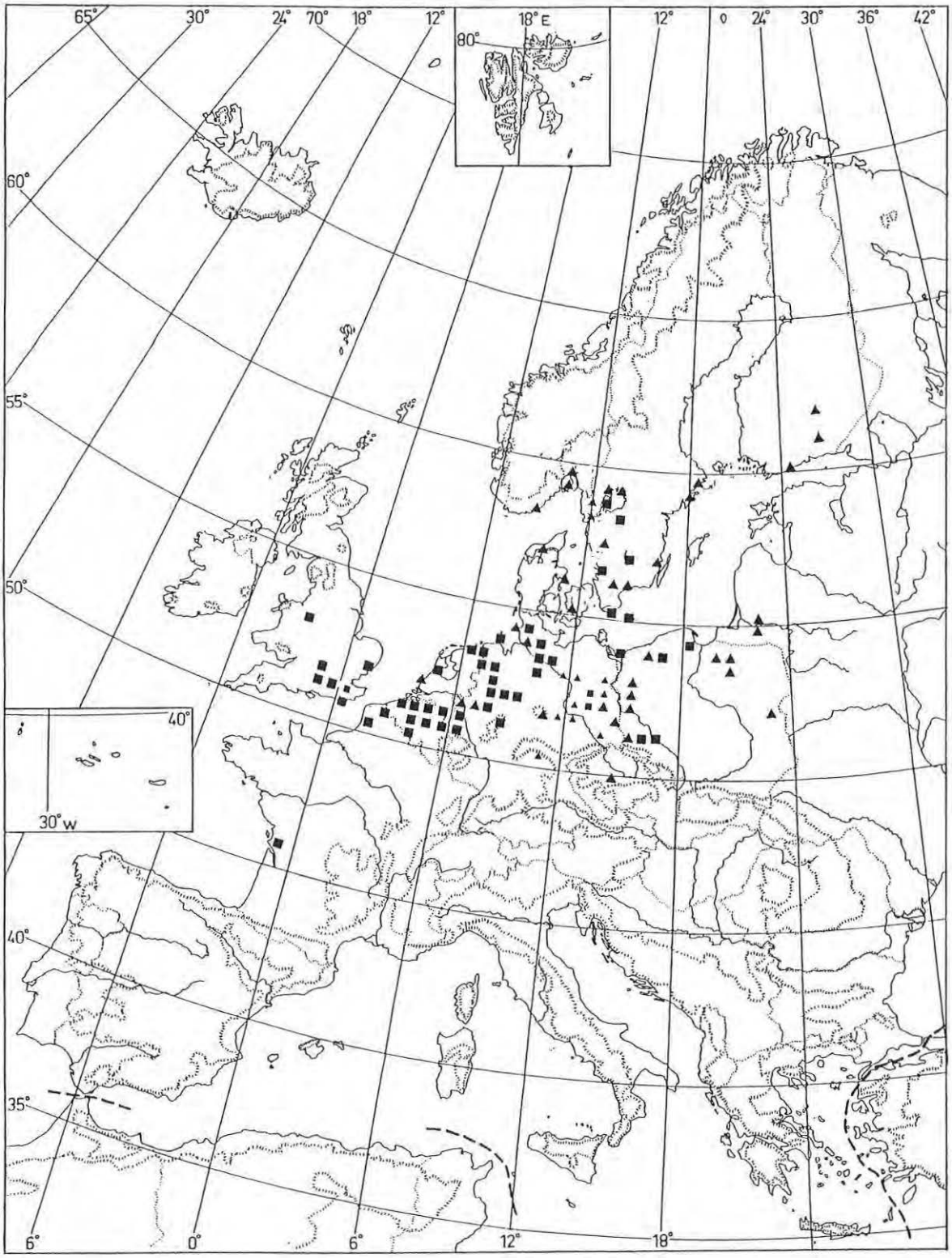

Fig. 5. Distribution of Lophozia capitata (Hook.) Macoun in Europe, mapped by R. Schumacker with special help from R. Duell, L. Meinunger, A.J.E. Smith, A. Torkelsen and P. Isoviita. For explanation of symbols see Fig. 1.

accurate European maps: it takes no more time to put the localities into the UTM system than to place dots carefully on a map. Among species mapped in this way are Jungermannia handelii (Schiffn.) Amak. by Váňa, Jungermannia borealis with relictual occurrences in central Europe, and Philonotis rigida carefully mapped by G. Raeymaekers (Fig. 2).

Some maps are useful in suggesting areas where a species may have been overlooked, as illustrated by Leptodontium gemmascens, L. flexifolium and Lophozia capitata. Both Leptodontium flexifolium and L. gemmascens (Figs. 3 & 4) were for a long time thought to be endemic to the northern-atlantic regions. Why did they not also occur in the western Pyrenees? Discussing this question in 1981 with a French hobby-bryologist having a second residence by Bagneres-de-Bignorre, I learned he had found L. gemmascens to occur frequently on thatched roofs in these mountains. Two years later, L. gemmascens was known from 60 roofs in the region, and L. flexifolium had been discovered intermixed with it at a few sites. A draft map of L. flexifolium made some years ago also suggested that old records from Iceland were wrong, as J.-P. Frahm recently verified by checking Hesselbo's material; it was Pottia heimii. In continental Europe most of the records from outside the main area of distribution were systematically checked; the majority arose through confusion with Dichodontium pellucidum (Schumacker & de Zuttere, 1981).

The question 'why not there?', asked after considering a distribution map and the distribution of climatical and/or edaphical factors, also led to interesting discoveries with Lophozia capitata (Fig. 5). We recently mapped this species after its discovery in many new Belgian localities and also in one locality in NW France by Prof J.R. Wattez (Schumacker, Wattez & Pierrot, in prep.). In 1982, visiting an interesting locality in the Charente-Maritime together with R.B. Pierrot, one of the best French bryologists, I said in an old sand quarry at Cadeuil "Just the right place for Lophozia capitata". Although Pierrot had visited this locality many times before, we found it, in quantity, at two different places several kilometres apart. It covered a number of square metres and was fruiting, 600 km south of its southernmost known locality. The map fits exactly the distribution of acidic sandy deposits from Tertiary and Quaternary times. Certainly it must exist in other places along the French atlantic coast, and also in the eastern baltic regions, but information from these countries is very rare or difficult to obtain.

Now, some will ask why these maps are not published, and the answer is for technical reasons. It was formerly decided to publish using the same map as used in Flora Europaea, but Messrs Wallace and Preston showed us the map used by the Committee for mapping the invertebrates in Europe. It is also based on UTM squares of 50 x 50 km, but the projection enables the Macaronesian islands to be placed in their proper position and also the full outline of the Mediterranean region to be included. This projection offers evident advantages especially for Mediterranean or Atlantic-mediterranean patterns. Unfortunately there are technical difficulties for printing this map on a reduced scale, and considering also that a mapping project covering the Mediterranean region will be developed by OPTIMA, we will publish the maps using the Flora Europaea map.

Possibilities for British input

There are many ways for the BBS and its members to help with the project, independently of efforts to complete the bryological survey of the British Isles. The first, and best approach would be for each member of the BBS to take a map in hand as Mr Wallace has done. He alone produced the basic maps of Cololejeunea minutissima and of Lophocolea fragrans, and is now preparing the map of Lepidozia cupressina. I will express here my personal congratulations for this important contribution that he promised in November 1980 at the Mont-Rigi Meeting. Would it be difficult for anybody to do the same?

Certainly not. You can work in groups of two or three interested in some species you know very well and which excites your bryogeographical curiosity. I am sure you will find support for mapping onto the UTM grid from several British institutions or from the author.

A second approach is to check the material from foreign countries kept in your private and institutional herbaria. Thousands and thousands of collections from Europe are involved, especially in the British Museum collections, but also in others. For example the most important collections of bryophytes from the Central Massive, the herbarium Heribaud, was purchased by the British Museum in Clermont 50 years ago; there are no duplicates either in Paris or in Clermont, and no critical inventory of this herbarium has been made. The same remark is valid for other countries: plenty of collections from the Pyrenees, and from Macaronesia are kept in British private or institutional herbaria. Most of the Iberian collections are kept outside Spain and Portugal as underlined by Casas Sicart (in Schumacker, 1982). Please work on this precious material of the species to be mapped within our programme, and send the data to the author or other interested people, in order to make the information available. I recall that last year, submitting a paper about the discovery of Anomodon rostratus for publication in Journal of Bryology. Dr A.J.E. Smith kindly sent it to Dr E.W. Jones, who remembered he had collected that species eight years previously in the French Alpes-Maritimes, but never published this exceptional find which bridged the known alpine and Pyrenean localities. Also, checking material classified by herbaria as "undetermined" (that often means critical genera!) will often lead to surprising discoveries: three liverworts new to the Belgian flora were recently discovered (and since located in the field) by applying this method.

A third and last way: British people - among them many bryologists - visit continental Europe more and more. France, many Mediterranean countries and Macaronesia are favourite regions. Please, collect bryophytes anywhere you are and send the results of your observations to interested bryologists of these regions and to the author. Stop anywhere, and collect. Even in Belgium you have a 40% chance of being in an underworked or poorly worked square. In France the figure is 75%, in Italy, Spain and Portugual 80%. Look for any species, including the most common ones. Look with your eyes, your eyes trained to British bryophytic vegetation. In the oceanic regions, you certainly will find a lot of new species for your locality even if it is species-poor. In the richer place - a priori well-worked and described in numerous publications - look not only for the previously recorded species, but also for the additional species you would expect in such ecological situations. The discoveries will sometimes be surprising.

Just on this point let me tell two short stories. In 1978, my friend Ph. de Zuttere came just at nightfall into the Gorges du Coronc in central Brittany with a group of hobby-bryologists. Few of you know him. But he is as a sporting dog ... for bryophyte rarities. He plunged into the chasm and scraped anything he could see, or feel with the fingers. In the evening, after microscopical examination, Gymnomitrium crenulatum stood revealed as new to France. It was only the third occurrence on the continent, and this was found in a locality where F. Camus and R. Gaume undoubtedly collected intensively.

Second, at the beginning of the excursion during the second meeting of the Working Group in Mont-Rigi last year, I said that it would be wonderful if one could re-discover Plagiochila spinulosa, collected here in great abundance 60 years ago and probably within the first kilometre of the excursion. After 100m Mr Preston said to me: "Oh, with us it will grow here, for example". He took in his hand a plant of the fern Athyrium filix-femina covering a small vertical face of quartzite stone... and rediscovered Plagiochila spinulosa in Belgium. We were previously many times in this place to look for it and we never saw it.

For Plagiochila spinulosa British eyes are better!

Look at bryophytes wherever you are; collect carefully as many species as possible; keep the collections in your herbarium, publish, or, at least communicate your observations, not only for rare or new species, but, especially for supposedly common species, anywhere in Europe. This will be a very effective contribution from those BBS members visiting foreign countries. As a first step it would be very kind of you to look in your herbarium, and in your field notebooks, for observations of both Frullania dilatata and F. tamarisci in France, Spain and Portugal, Italy, Scandinavia and Central and Eastern Europe. I am sure you will add a lot of new dots to both maps.

Acknowledgements

To be invited to participate in the Jubilee Meeting of the British Bryological Society and also to describe our project of bryophyte mapping at a European level, was for me - and for the members of the Working Group - an invaluable honour. I am greatly indebted to Dr Longton, Dr Greene and Mr Wanstall for this invitation and for their friendly help, and to the British Council for financial support.

References

Allorge, P. (1932). Hyocomium flagellare (Dicks.) Bryol. Eur. Die Pflanzenareale 3, 50-51, Karte 44.

Corley, M.F.V., Crundwell, A.C., Düll, R., Hill, M.O. & Smith, A.J.E. (1982). Mosses of Europe and the Azores; an annotated list of species, with synonyms from the recent literature. J. Bryol. 11, 609-689.

de Zuttere, Ph. & Schumacker, R. (1976). Une rare espèce de la flore bryophytique belge a Bevercé (Prov. Liège): Discelium nudum (Dicks.) Brid. Bull. Soc. roy. Bot. Belg. 109, 297-305.

Duell, R. (1980). Die Moose (Bryophyta) des Rheinlandes (Nordrhein-Westfalen, Bundesrepublik Deutschland). Decheniana, Beih. 24, 1-365.

Duell, R. (1982). Distribution of European and Macaronesian liverworts (Hepaticopsida). Bryol. Beitr. 2, 1-115.

Geissler, P. & Greene, S.W. (eds.) (1982). Bryophyte taxonomy. Methods, practices and floristic exploration. Beih. Nova Hedwigia 71, 1-558.

Gradstein, S.R. (1979). Directory of bryologists and bryological research. Ed.2. Regnum Vegetabile 99, 1-81.

Grolle, R. (1983). Hepatics of Europe including the Azores: an annotated list of species, with synonyms from the recent literature. J. Bryol. 12, 403-459.

Grolle, R. & Schumacker, R. (1983). Zur Synonymik und Verbreitung von Plagiochila spinulosa (Dicks.) Dum. und P. killarniensis Pears. J. Bryol. 12, 215-225.

Lecointe, A., Schumacker, R. & de Zuttere, Ph. (1982). Précisions sur la distribution de Gymnomitrion crenulatum Gott. en Bretagne (France) et en Europe. Acta bot. rhedon. A17, 47-56.

Nordhorn-Richter, G. (1982). Verbreitungskarten von Moosen in Deutschland III. Pohlia carnea (Schimp.) Lindb., P. lescuriana (Sull.) Grout, P. lutescens (Limpr.) Lindb. f. und P. vexans (Limpr.) Lindb. f. Lindbergia 8, 148-153.

Nyholm, E. (1956). Illustrated Moss Flora of Fennoscandia. II. Musci. Fasc. 2. Lund.

Petit, E. & Szmajda, P. (1981). Remarques sur la distribution des mousses "eu-atlantiques". Univ. Mickiewicza w Poznaniu. Ser. Biol. 20, 88-104.

Schumacker, R. (ed.) (1982). Outline of the current state in floristical and chorological studies of bryophytes in Europe. Lejeunia, N.S. 107, 1-60.

Schumacker, R. (in press). Mapping bryophytes in Europe: a new account for an integrated approach of European phytogeography. Prag. Rep. 2d Meet. Bryol. Eastern Eur. Countr.

Schumacker, R. & de Zuttere, Ph. (1981). Leptodontium flexifolium (With.) Hampe (Pottiaceae, Musci) en Belgique. Étude chorologique, écologique et phytosociologique. Herzogia 5, 589-607.

Schumacker, R. & de Zuttere, Ph. (1982). Sematophyllum demissum (Wils.) Mitt. (Musci), espèce nouvelle pour la bryoflore belge. Étude critique de sa répartition en Europe. Bull. Soc. Bot. Belg. 115, 14-22.

Schumacker, R., Lecointe, A., Touffel, J., de Zuttere Ph., Leclercq, L & Fabri, R. (1981). Hyocomium armoricum (Brid.) Wijk & Marg. en Belgique et dans le nord-ouest de la France (Ardenne, Bretagne, Normandie). Étude chorologique, écologique et phytosociologique. Cryptogamie, Bryol. Lichénol. 2, 277-321.

Størmer, P. (1983). Characteristic features of the moss flora of the various parts of Europe. S.loc., s.ed., 91 p. (ISBN 82-991031-1-8).

Szweykowski, J. (ed.) (1982). New perspectives in bryotaxonomy and bryogeography. Univ. A. Mickiewicza w Poznaniu. Ser. Biol. 20, 164 pp.

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ADVANCES IN KNOWLEDGE OF THE LIFE STRATEGIES OF BRITISH BRYOPHYTES

by

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At the first meeting that I attended, which was at Appleby in April 1946, there was discussion about organised observations on the biology of bryophytes (Richards, 1946). Subsequently, the timing of the maturation cycle was established for a number of species (Greene, 1960) and now a new project surveying the reproductive biology of selected mosses is under way (Longton & Miles, 1982; Miles, 1983).

A landmark in attempting to organise ideas about life-histories is During's paper (During, 1979) on life-strategies. Scott (1982) described it as a remarkable paper that seems certain to become a classic, and I agree. The main features of During's life strategies are given in Table 1. The theme of this talk is to draw attention to some major gaps in our knowledge relevant to life strategies.

About 60% of British moss species are dioecious and 40% monoecious, omitting those that are variable. It is widely believed that monoecy has been derived repeatedly in evolution from dioecy. Smith (1982) pointed out that obligate ephiphytes and epiliths have a low frequency of dioecy. A big factor in this appears to be the peculiarity of the Orthotrichales, only 27% of the British species being diocious. There is great diversity in the British flora between different orders of mosses in the frequency of dioecy, which ranges from 20% in the Funariales to about 90% in the Polytrichales and Thuidiales. The frequencies need to be looked at world-wide before attempting to find an explanation.

Remarkably, 18% of British moss species are sterile, comprising nearly 100 with sporophytes known elsewhere and 30 with sporophytes unknown anywhere. Until recently I erroneously thought that early British bryologists neglected sterile mosses. A histogram of the decades in which the sterile species were first recognised in Britain shows that many such species were discovered last century

but there was an unexplained lapse for about 40 years in the early part of this century. I suspect that a histogram for fruiting species would be similar.

Many other species were sterile when first recognised. An example is Anoectangium warburgii, first found by Dr E.F. Warburg in 1946 in the Hebrides. I recently examined specimens catalogued under Gymnostomum calcareum at the British Museum and discovered there two specimens of A. warburgii collected by John Sim in May and October 1871 on the bank of the R. Dee about 20 miles from Aberdeen. The specimens, which were sterile, were accompanied by a letter from Sim to Hooker at Kew. It is clear from the letter than Sim realised that the plant was new to Britain. At that time, G. calcareum had not yet been found in Britain. Sim's gatherings are mentioned in Braithwaite's Moss Flora under G. calcareum (called Mollia calcarea) var. viridulum (Braithwaite, 1885).

Gemmell (1950, 1952) made several interesting observations on British mosses, using Dixon's Handbook (Dixon, 1924) and the Census Catalogues:

(i) Dioecious species fruit less often than monoecious, but are more widely distributed.

(ii) Sterile mosses are less widely distributed than fertile species and have fewer varieties.

As others have pointed out, there is a need to reassess the data in the light of more recent work. Gemmell concluded that the genetic system provides an explanation of his findings, with the genetic diversity presumed to occur in the dioecious, that is, outbred, species expressed as ecological adaptability. Conversely, sterile species would be propagated as a clone, or a number of very similar clones.

Clonal distribution is illustrated by Hyophila stanfordensis, which appears to exist in Britain and Ireland as two clones differing slightly in morphology. The one, which I first found at the Lizard 25 years ago, was subsequently found on the Magnesian limestone in Yorkshire by Mrs J.A. Paton and in the Wye valley when the BBS met there in 1968. Later it was found all along the Severn, notably by R.J. Fisk, and at scattered localities elsewhere. All plants of this type are female, so it is evidently propagated vegetatively. The other clone was first found by A.C. Crundwell on the banks of the River Mole near Box Hill in 1956. Subsequently it was discovered at Matching, Essex, by K.J. Adams, amd now these two finds appear to be part of a single population, as the plant has been found, notably by J.C. Gardiner and Mrs M. Milnes-Smith, to occur widely in the London area. This second clone was discovered by the River Tweed in 1978 by D.G. Long and is widespread there. Mature capsules are occasionally produced by this type of H. stanfordensis, so it is possible that the plants are not a single clone.

Since Gemmell's papers were published, ideas about the structure of plant and animal populations have undergone a profound change. In 1966 (Harris, 1966; Hubby & Lewontin, 1966; Lewontin & Hubby, 1966) it was discovered that there is vastly more genetic variability in natural populations than had previously been supposed. This discovery was made through the application of the technique of gel electrophoresis. Soluble proteins from the tissue, or whole organism, are introduced in a liquid phase into a gel of starch or agar, across which an electric field is applied. The speed of migration of any particular protein will depend on the size of the molecule and its net charge. After a high voltage has been passed across the gel for 1-2 h, the position of the protein is revealed by a suitable dye. For the first time, information was obtained about how many proteins - and hence genes - did not exist in more than one form. Genetic methods could not detect such genes. Both in animals and flowering plants, up to 50% of the organism's genes that code for enzymes were found to be polymorphic, that is, to exist in more than one form. The old idea held by geneticists was that species existed largely as uniform populations

which they called the "wild type". It is now clear that half the genes are not uniform, but comparable to the human A, B and O blood groups.

A particularly interesting question arises with bryophytes in relation to this polymorphism. Many bryologists believe that little genetic variability can accumulate in bryophytes, since the leafy plant is haploid and hence mutations are immediately expressed and exposed to selection. This view, however, has been questioned by Longton (1976) and Smith (1978), who concluded that the bryophytes are actively evolving and not a relict group, and that they have much evolutionary potential.

The first investigation by electrophoresis of genetic polymorphism in natural populations of a bryophyte seems to have been that of Krzakowa & Szweykowski (1979) with the dioecious liverwort Plagiochila asplenioides (P. major (Nees) S. Arn.) in Poland. They found that the dense carpets in which it grows were heterogeneous for peroxidase variants and were evidently not clones, but comprised several individuals growing in a mixed colony. There was much diversity of genotype also between populations. The situation overall was comparable to that found in diploid organisms such as flowering plants. Yet sporophytes were rare and none was found in their investigation. Essentially similar results were obtained by Szweykowski et al. (1981) with another dioecious liverwort, Pellia neesiana. Surprisingly, P. endiviifolia, which is also dioecious, was found to be monomorphic for peroxidase: there was no variation either within or between populations. The monoecious P. epiphylla showed a level of variation intermediate between that of the other two species of the genus. They regarded this diversity within Pellia as remarkable, since all belong to During's short-lived shuttle life strategy.

Two electrophoretic studies have been made with natural populations of mosses, both with dioecious species: Cummins & Wyatt (1981) studied Atrichum angustatum in Texas, and Daniels (1982) investigated Sphagnum pulchrum in Britain. Both gave results similar to those for Plagiochila asplenioides and Pellia neesiana in Poland, that is, much genetic diversity both within and between populations. The Sphagnum results are particularly interesting because this is one of the species in which sporophytes have never been found in Britain. Daniels favours the diversity surviving from a time, perhaps thousands of years ago, when the species might have been more widespread and have reproduced sexually.

These electrophoretic studies, both with liverworts and mosses, strengthen the view that the bryophytes are actively evolving. Many more such investigations are needed. It would be particularly interesting to look at totally sterile species such as Oxystegus sinuosus and species with sporophytes exceedingly rare like Rhytidium rugosum. It would also be instructive to compare monoecious and dioecious species: this would provide a direct test of Gemmell's conclusions and perhaps help to explain the puzzling situation in Pellia. Ultimately, it should be possible to compare on a wide scale the degree of polymorphism with life strategy.

What is the significance of all the genetic diversity that electrophoresis has revealed? A favoured hypothesis is 'multiple niche selection', implying that the environment of living organisms is very complex. This can be illustrated by the effects of herbivores. Gerson (1982) concluded that those invertebrates that eat bryophytes are usually not host-specific. But he also reported that many bryophyte chemicals repel invertebrates, and some of these chemicals are restricted to particular species or genera. From my limited observations I strongly suspect that moss herbivores are often selective: for example, I have found that Hyophila stanfordensis was eaten in preference to Barbula unguiculata by a microlepidoptera larva when a mixed gathering was kept moist in a polythene bag. Research along these lines is needed. Such an experiment

has just been carried out with different strains of thyme (Thymus vulgaris) and a particular species of slug (Gouyon et al., 1983). The leaves of T. vulgaris contain a variety of terpenes that differ from one individual to another. The slugs had not tasted thyme before and at first had no preference for one terpene over another, but they quickly learned which they preferred. Clearly the presence of some genotypes protects others that are less palatable. Other species of herbivores might develop an appetite for a different genotype - hence the advantage of diversity.

The new outlook about the structure of plant and animal populations implies that whether the species is dioecious, monoecious or sterile will affect the level of genetic diversity within its populations and the rate at which new combinations of genetic variants arise. Which of the three breeding systems is favoured in a particular organism will depend on its life strategy.

Another aspect of bryophyte biology relevant to life strategy is asexual reproduction (see Table 1). Thus, the ability to survive for long periods as a rhizoid gemma or tuber has obvious advantages for arable field mosses. In a herbarium packet the longest survival of a tuber that I have recorded was just over 12 years (Whitehouse, 1966) but I have rarely tested older material. Bristol (1916, 1919) had found moss protonema developing when Rothamsted soils stored moist for nearly 50 years were wetted and exposed to the light. She thought the moss had survived as protonema, but Schofield (1981) suggested it might have been the rhizoids that had survived. Bristol made no attempt to identify the species involved, but one of her illustrations shows a cluster of thickened cells reminiscent of Dicranella staphylina. A visit to Agdell, one of the fields in question, in August 1983 revealed that D. staphylina was indeed the commonest species there. So there is a distinct possibility that it was the tubers of this species that survived for so long.

The list of European mosses with tubers is by no means complete. Nordhorn-Richter (1982) has found them in a Hungarian specimen of Pohlia cruda, though the possibility has not been ruled out that they are a bizarre kind of gall, since they have not been seen in other gatherings of this species.

Gemmae also occur on the protonema of some mosses. Gemmae resembling the tubers occur in vitro on chloronema of Bryum klinggraeffii, as Chopra & Rawat (1973) have reported. Bryum sauteri behaves similarly. In other species of tuber-bearing mosses, when grown in pure culture, there are gemmae on the protonema of different morphology from those on the rhizoids: for example, in B. radiculosum the aerial filaments of chloronema fragment into segments several cells long. Cultures have also revealed that any species able to produce gemmae on the leaves or in the leaf-axils is also able to produce similar gemmae on the chloronema. Over 20 British species have been tested and have produced no exceptions to this generalization. Until recently I thought that protonema-gemmae were largely confined to species growing in deep shade (Whitehouse, 1980), but testing a range of species has revealed that, at least in culture, they occur in numerous species from diverse habitats, for example, in Oxystegus sinuosus, Ulota crispa, Cryphaea lamyana and Homalia trichomanoides. The gemmae vary greatly from one species to another in morphology and cell-wall thickness.

In conclusion, a systematic study is needed to find which moss species produce protonema-gemmae in culture. Knowing the appearance of the gemmae it will then be possible to search for them in wild material, in order to establish the extent to which they occur naturally. It will also be interesting to discover whether or not the occurrence of protonema-gemmae of particular types corresponds with particular life strategies that During (1979) has outlined.

Life-strategy (and environment)	Life-span (years)	Reproductive effort		Spore size (small: less than 20 μm)	Examples (habitat and species)
		Sexual	Asexual		
Fugitive (Highly unpredictable environments that exist for only a short time.)	0.5 - 1	High	Absent	Small	Sites of fires, etc.: *Funaria hygrometrica*.
Colonist (Unpredictable environments that last for some years.)	(1-) few-many	High late in life	High early in life	Small	*Bryum argenteum*, *B. bicolor*, *Ceratodon purpureus*, *Marchantia polymorpha*, *Buxbaumia aphylla*.
Annual shuttle (Habitat present for only 1-2 yr, but predictably reappears nearby.)	(0.5-)1-few	High	Absent	Large	Drying mud: *Physcomitrium pyriforme*. Arable land: *Phascum cuspidatum*, *Ephemerum serratum*. Dung: *Splachnum ampullaceum*.
Short-lived shuttle (Habitat persists for 2-3 yr, but predictably reappears nearby.)	Few-many	Rather high	Rare or absent	Large	Bare patches in salt marshes: *Bryum marratii*, *B. warneum*, *Pottia heimii*. Bones: *Tetraplodon mnioides*.
Perennial shuttle (Habitats stable, but with predictable end.)	Many	Moderate, sometimes low or absent	Moderate, sometimes rather high	Large	Twig epiphytes: *Leucodon sciuroides*, *Antitrichia curtipendula*, *Orthotrichum* spp., *Ulota* spp.
Perennial stayer (More or less constant environment.)	Many	Rather low to nearly absent	Rather low to nearly absent	Small	Fens, bogs and forest floors: *Sphagnum* spp., *Drepanocladus* spp., *Brachythecium* spp., *Leucobryum glaucum*.

Table 1. *Life-strategies of bryophytes* (During, 1979)

Summary

During's scheme of life strategies for bryophytes is summarised. Significant for life strategy is the amount of genetic diversity. Investigations of the degree of polymorphism for protein variants in natural populations of bryophytes are reviewed. They point to a high level of diversity and support the hypothesis that the bryophytes are actively evolving. Further studies of polymorphism are needed. Another problem relevant to life strategy that needs to be tested is selective grazing by invertebrate herbivores. There is also scope for work on protonema-gemmae, which seem to be of widespread occurrence in mosses and evidently play a part in life strategy.

References

Braithwaite. R. (1885). The British Moss Flora, vol. 1, 240. London.

Bristol, B.M. (1916). On the remarkable retention of vitality of moss protonema. New Phytol. 15, 137-143.

Bristol, B.M. (1919). On the retention of vitality by algae from old stored soils. New Phytol. 18, 92-107.

Chopra, R.N. & Rawat, M.S. (1973). In vitro production of secondary gemmae on the protonema of Bryum klinggraeffii Schimp. Bryologist 76, 183-185.

Cummins, H. & Wyatt, R. (1981). Genetic variability in natural populations of the moss Atrichum angustatum. Bryologist 84, 30-38.

Daniels, R.E. (1982). Isozyme variation in British populations of Sphagnum pulchrum (Braithw.) Warnst. J. Bryol. 12, 65-76.

Dixon, H.N. (1924). The Student's Handbook of British Mosses. Ed. 3. Eastbourne.

During, H.J. (1979). Life strategies of bryophytes: a preliminary review. Lindbergia 5, 2-18.

Gemmell, A.R. (1950). Studies in the Bryophyta. I. The influence of sexual mechanism on variental production and distribution of British Musci. New Phytol. 49, 64-71.

Gemmell. A.R. (1952). Studies in the Bryophyta. II. The distribution of the sexual groups of British mosses. New Phytol. 51, 77-89.

Gerson, U. (1982). Bryophytes and invebrates. In Bryophyte Ecology (ed. A.J.E. Smith), pp. 291-332. London & New York.

Gouyon, P.H., Fort, P. & Caraux, G. (1983). Selection of seedlings of Thymus vulgaris by grazing slugs. J. Ecol. 71, 299-306.

Greene, S.W. (1960). The maturation cycle, or the stages of development of gametangia and capsules in mosses. Trans. Br. bryol. Soc. 3, 736-745.

Harris, H. (1966). Enzyme polymorphisms in man. Proc. R. Soc. B 164, 298-310.

Hubby, J.L. & Lewontin, R.C. (1966). A molecular approach to the study of genic heterozygosity in natural populations. I. The number of alleles at different loci in Drosophila pseudoobscura. Genetics, Princeton 54, 577-594.

Krzakowa, M. & Szweykowski, J. (1979). Isozyme polymorphism in natural populations of a liverwort, Plagiochila asplenioides. Genetics, Princeton 93, 711-719.

Lewontin, R.C. & Hubby, J.L. (1966). A molecular approach to the study of genic heterozygosity in natural populations. II. Amount of variation and degree of heterozygosity in natural populations of Drosophila pseudoobscura. Genetics, Princeton 54, 595-609.

Longton, R.E. (1976). Reproductive biology and evolutionary potential in bryophytes. J. Hattori bot. Lab. 41, 205-223.

Longton, R.E. & Miles, C.J. (1982). Studies on the reproductive biology of mosses. J. Hattori bot. Lab. 52, 219-240.

Miles, C.J. (1983). Studies on the reproductive biology of British mosses. Bull. Br. bryol. Soc. 41, 12-13.

Nordhorn-Richter, G. (1982). Third Biennial Meeting of the Central and East European Bryological Working Group, Prague.

Richards, P.W. (1946). Biological observations on bryophytes. Rep. Br. bryol. Soc. 4, 307-308.

Schofield, W.B. (1981). Ecological significance of morphological characters in the moss gametophyte. Bryologist 84, 149-165.

Scott, G.A.M. (1982). The ecology of mosses: an overview. J. Hattori bot. Lab. 52, 171-177.

Smith, A.J.E. (1978). Cytogenetics, biosystematics and evolution in the Bryophyta. Adv. bot. Res. 6, 195-276.

Smith, A.J.E. (1982). Epiphytes and epiliths. In Bryophyte Ecology (ed. A.J.E. Smith), pp. 191-227. London & New York.

Szweykowski, J., Zielinski, R. & Mendelak, M. (1981). Variation of peroxidase isoenzymes in Central European taxa of the liverwort genus Pellia. Bull. Acad. Pol. Sci., Ser. Sci. biol. 29, 9-19.

Whitehouse. H.L.K. (1966). The occurrence of tubers in European mosses. Trans. Br. bryol. Soc. 5, 103-116.

Whitehouse, H.L.K. (1980). The production of protonemal gemmae by mosses growing in deep shade. J. Bryol. 11, 133-138.

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FUTURE DEVELOPMENTS IN BRYOLOGY

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Floristic studies

Bryology is advancing so rapidly, and in so many directions, that a comprehensive assessment of its future is beyond the scope of one brief presentation. I shall thus confine my remarks to systematics, floristics and ecology, the traditional interests of this society, and even here it will be necessary to select for comment only a few of the many intriguing developments that appear to be in prospect.

Dr Watson (this publication) has discussed work extending over many years on the distribution of British bryophytes, but he emphasized that our knowledge remains incomplete. Additions to the flora continue to be reported, including distinctive new species or even genera. New vice-county records still run at over 300 per year, and although recording in the first phase of the mapping scheme has come to a close, less than half the 10 km squares can be considered well worked. Many refinements could profitably be incorporated into the second phase, for example inclusion of ecological or reproductive data. Mapping forms of selected polymorphic species would be of value in interpreting their systematic status. Regular mapping of pollution indicators, perhaps over restricted areas could aid either in warning of deteriorating conditions or, one would hope, in monitoring the effects of remedial action. Regular observations on known populations of rare species would sound an alert to any threat to their survival, while repeated mapping of species thought to be extending their British ranges would yield data of the greatest interest on rates and patterns of dispersal and establishment (e.g. Richards & Smith, 1975).

One therefore hopes that studies on the distribution of British bryophytes will continue apace. However, three facts upon which I should like briefly to elaborate suggest that we have a responsibility to spread our interests more

widely. First, the British flora is already among the most thoroughly studied. Second, the floras of many tropical regions are under threat of imminent destruction. Third, a high proportion of the world's bryological expertise is resident here, in Britain and western Europe.

Only in western and northern Europe and Japan does knowledge of the bryophyte flora approach in detail that of Great Britain, and these floras are incomparably better documented than are those of areas such as the Mediterranean basin and almost the whole of the tropics. For example, Pócs (1982) reported the density of published hepatic records from each African country south of the Sahara: only from four groups of offshore islands are there more than 100 records per 1,000 km^2 . Two countries have 10-100, three between 1 and 10, and most African countries have less than one hepatic record per 1,000 km^2 - records, it should be noted not species. Several, including Botswana and Mali, have none. As a contrast, the figure for Surrey, derived from Gardiner (1982), is 750 hepatic records per 1,000 km^2 of terrain hardly renowned for the diversity or abundance of its liverworts.

These and other comparable data emphasize that high priority must be placed on taxonomic and floristic studies of tropical bryophytes, and as a matter of extreme urgency. Otherwise, there is a grave danger that countless species will become extinct as a result of logging and other forms of habitat destruction even before they are discovered and described, and can thus contribute to an understanding of diversity and relationships. As an example of the threat to tropical vegetation, Myers (1979) wrote " If present exploitation trends continue, pretty well all the lowland forests of Peninsular Malaysia and the Philippines will be logged within another ten years. The same will apply throughout the (South-East Asia) region by the end of the century."

The obstacles to rapid progress in tropical bryology are formidable. One stems from the distribution of bryologists. Of c. 780 individuals listed in the current Directory of Bryologists (Gradstein, 1979), well over half are based in western Europe, including more than 100 in the British Isles. There are 162 in the USA and 51 in Japan, but only 45 throughout the whole of Africa, Latin America and the Caribbean, and tropical Asia apart from India. True, not all bryologists are included in the Directory, but conversely by no means all of those listed work full-time with bryophytes, and many have their principal interests outside taxonomy and floristics. A massive increase in bryological research in tropical institutions would clearly be desirable, but given economic constraints it is unrealistic to anticipate such a development in the forseeable future. Thus, while strenuous efforts should be made to stimulate the development of bryology locally, a major responsibility for documenting the diminishing tropical floras must lie with workers in Europe, North America and Japan, collaborating with colleagues in the tropics whenever feasible.

A second problem arises from a paucity of herbarium material, and the fact that collecting has tended to be concentrated at relatively few rich sites, often in the mountains, rather than systematically undertaken in lowland forests which are under the most immediate threat (Steere, 1982). There is little incentive for any but the specialist to collect in the tropics because of a dearth of publications to facilitate identification. For the same reason much of the existing material languishes unidentified in herbaria. Yet the preparation of authoritative floras demands a comprehensive array of authentically named specimens!

These points relate to a third major problem. Wholesale habitat destruction is likely to occur too swiftly to permit the development of tropical bryophyte floristics according to the traditional model. The latter is essentially a cyclic process: collections are made on an ad hoc basis, taxa are described and named, often far too many at first, and floras written. This stimulates

further collecting which brings to light additional taxa, and provides material for taxonomic and nomenclatural revision of those previously described. The resulting monographs pave the way for improved floras, and the process is repeated, indefinitely, with the introduction of biosystematic studies and other refinements. In Britain, close to 250 years elapsed between Dillenius' Historia Muscorum (1741) and Smith's (1978a) Flora, itself by no means the final word, with three or perhaps four generations of floras in between. This measured approach is inadequate for the tropics where the next 25 years may see the extinction of innumerable species.

Immediate priority must clearly be given to systematically organized collecting, particularly in those areas, identified in Geissler and Greene (1982), that are especially rich, threatened or underworked. Equally important is the identification of the resulting collections, if only to the genus or family level so that they can be made available for specialist study, and their dissemination with sets being deposited in herbaria in the countries of origin. The preparation of first generation floras for the major phytogeographical regions, such as that planned for tropical Africa (Anon., 1983), is also a task of the greatest urgency, as such works would be of inestimable value as a stimulus to further collecting, and as a basis for determining which areas, or taxa, warrant detailed study, or particularly strenuous efforts in conservation. One might venture to suggest that their publication should not be delayed pending time-consuming revision of all the problem groups, or completion of the laborious job of unravelling the nomenclatural confusion created by exuberant, but uncritical naming of species in the past. If perfection is attempted, the first generation floras may well appear too late to fulfil one of their primary roles, that of stimulating the study of plants in the field. I hope our Society will give serious thought to ways of encouraging and assisting its members, amateur and professional, to contribute to these vital projects, perhaps by specialising in the taxonomy of specific groups.

Phylogeny

While pragmatic considerations demand that emphasis be placed on tropical floristics, progress in elucidating evolutionary relationships among the major groups of bryophytes and other cryptogams may be anticipated following the development of new lines of evidence. Assessing such relationships has long been regarded as an intractable problem because of the scant fossil record left by bryophytes since their appearance in the mid-Palaeozoic. Comparative morphology of extant forms for many years provided the basic data available to bryophyte phylogenists, whose speculation concerned particularly the hepatics, which show greater major diversity than the mosses. As is well known, controversy arose as to whether simplification, or increasing complexity of structure, should be regarded as a major trend in hepatic evolution. A contemporary view, expressed by Schuster (1979), postulates that mosses and liverworts evolved from an unknown ancestor in which the gametophyte possessed an erect, radially symmetrical axis with a tetrahedral apical cell, bearing slime papillae but no leaves, and growing near water during the initial colonization of terrestrial habitats. From here, two main lines of hepatic evolution gave rise to the Marchantiidae and the Jungermanniidae (Fig. 1).

If Schuster is correct, evolution of the Marchantiidae involved the originally erect, radially symmetrical gametophyte axis becoming prostrate, perhaps as an anti-desiccation device, planation then resulting in the thallose form. In the Jungermanniidae leaves evolved, possibly from slime papillae, in three ranks corresponding with the cutting faces of the tetrahedral apical cell. The Calobryales, with erect, radially symmetrical gametophytes bearing three rows of leaves are thus regarded as primitive (Fig. 1). Most Jungermanniales retain leafy gametophytes, but have become prostrate, dorsiventrally flattened and

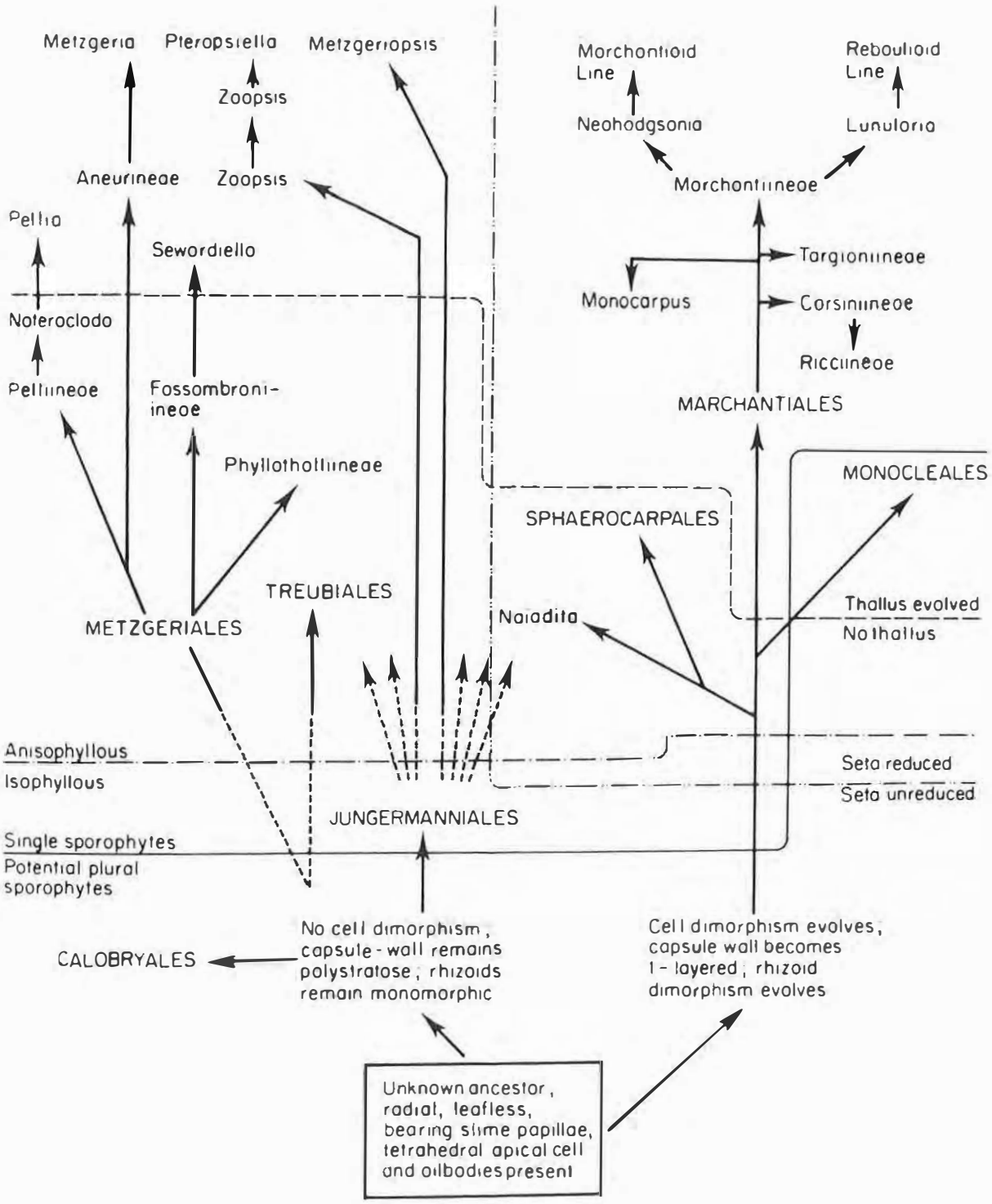

Fig. 1. Presumed phylogeny of the Hepaticae. Only phylogenetically important taxa are indicated. Reproduced from Schuster (1979) by kind permission of the Systematics Association. The Marchantiales, Monocleales and Sphaerocarpales constitute the Marchantiidae, and the Calobryales, Jungermanniales, Metzgeriales and Treubiales the Jungermanniidae.

anisophyllous through reduction and, in many cases, loss of one rank of leaves: some, such as Metzgeriopsis are thallose following loss of leaves and planation of the axis. The Metzgeriales and Treubiales retain no radially symmetric forms, the gametophytes comprising stems bearing leaves in two ranks, or thalli.

The scheme in Fig. 1 implies a shift from radial to dorsiventral symmetry as a prevailing trend in evolution of the hepatic gametophyte, thalli having arisen in several lines, in some cases from leafy forms, and in others directly from an ancestral leafless axis. Schuster believes that simplification of structure has also been a major trend in the sporophyte generation, pointing out that evolution among parasites is thought seldom to involve elaboration. The Anthocerotales are placed in a division separate from the Hepaticae by Schuster and several other contemporary morphologists, who argue that a combination of features including plastid structure, the occurrence of stomata in the gametophyte, the pattern of gametangial ontogeny and the indeterminate nature of sporophyte development with repeated meiosis indicates an independent origin.

Schuster's views were originally (1966) formulated largely on the basis of comparative morphology and cytological features visible by light microscopy, but broad support is provided by the results of ultrastructural, physiological and biochemical studies which are increasingly being brought to bear on the question of bryophyte relationships. Thus observations on antherozoid ultrastructure have revealed several features by which mosses resemble hepatics, for example in the subapical, staggered position of the basal bodies of the blepharoplast, but both groups differ from the Anthocerotales where the basal bodies are apical and opposite (Carothers & Duckett, 1979).

Support for an affinity between the Marchantiales and Sphaerocarpales on the one hand and the Jungermanniales and Metzgeriales on the other (Fig. 1) is provided by evidence that in the two latter orders the sporocytes are quadrilobed prior to meiosis with their walls containing callose, whereas in the Marchantiales and Sphaerocarpales they remain spherical and lack callose. Moreover, the exine in Jungermanniales and Metzgeriales resembles that in angiosperm pollen in comprising an inner region, the nexine, surrounded by the outer sexine which carries the ornamentation, whereas in Marchantiales and Sphaerocarpales the entire exine resembles the pollen nexine (Neidhart, 1979). Studies of comparative sporogenesis in members of the Calobryales, Treubiales and Monocleales would be of great interest in view of the relationships suggested in Fig. 1. Musci and Anthocerotae each possess different combinations of the above, and related characters, emphasizing the distinction between the latter and hepatics. The ornamentation on most moss spores is formed by the perine, which originates as material condensing on the surface of the spore. However, the fact that the perine is absent in Ephemerum and a few other moss genera sounds a note of caution: observations on a greater range of taxa are required to test the validity of the generalisations implied above, a point made also by Carothers and Duckett (1979) with respect to antherozoid ultrastructure.

Another promising line of enquiry is provided by the work of Basile and Basile (1983), whose thesis is that during evolution many developmental capabilities become suppressed, but not lost; if the suppression can be counteracted, latent, presumably ancestral, characteristics will be revealed. Their studies have shown that ethylene and hydroxyproline proteins help regulate morphogenesis in leafy hepatics by suppressing the division or enlargement of localized groups of cells, and that the suppression can be modified or eliminated by treatment with antagonists to their synthesis. This approach has already led to the experimental induction of a third rank of leaves in species of Plagiochila, Scapania and other genera which normally produce leaves in two

ranks, a result regarded as indicative of an evolutionary trend from a 3-ranked to a 2-ranked arrangement, as envisaged in Fig. 1, arising through changes in genes regulating hydroxyproline protein synthesis.

The currently available biochemical data in general support the view that mosses, hepatics and hornworts represent three separate evolutionary lines, and have led Suire and Asakawa (1979) to suggest that the Sphagnales and Andreaeales have only tenuous relationships with other mosses. In contrast, Duckett and Carothers (1979) consider the Sphagnales should be retained within the Musci because of similarities in blepharoplast ultrastructure. Striking among the results to date are differences in secondary compounds between land plants, including bryophytes, and the green algae so far investigated, which have, for example, uniformly lack both flavonoids and monoterpenes. However, there have been few studies of this aspect of the biochemistry of Coleochaete, Klebsormidium and related genera that resemble the charophytes and land plants but differ from most other green algae in three important and functionally unrelated aspects. These are the presence of glycolate oxidase, the persistence of the interzonal spindle during cytokinesis, leading in Coleochaete to the development of a phragmoplast, and the lateral insertion of flagella which are associated with a single broad band of closely adjacent microtubules (Stewart & Mattox, 1975). A biochemical survey of such algae can clearly be expected to shed further light on the origin and relationships of bryophytes and other land plants.

Chemical characters are of greatest value where direction can be established in the evolution of biosynthetic pathways. The biochemists appear confident that this is already possible for certain classes of compounds, but their conclusions do not always coincide with other current ideas. Thus the Calobryales are placed in a primitive position (Fig.1) on morphological grounds, but they have what is considered an advanced flavonoid pattern (Suire & Asakawa, 1982). Schuster (1979) regards the Calobryales as including Calobryum, Haplomitrium and also Takakia, but the latter is chemically distinct from Haplomitrium, a point supporting the traditional view that Takakia occupies an isolated position. It may also be significant that Takakia resembles some hepatics in producing sesquiterpenes, not so far reported in mosses, and some mosses in producing triterpenes with a hopane skeleton, not so far isolated from hepatics (Suire & Asakawa, 1982).

These findings make it particularly desirable to discover more about the morphology of Takakia. The two known species each have erect, radially symmetrical gametophyte axes bearing conical appendages which are circular in cross section, several cells thick, and thus very different from typical bryophyte leaves. Variously referred to as phyllids, enations or determinate lateral branches, the appendages of T. lepidozioides Hatt. & Inoue have a plastic relationship to the axis, occurring irregularly, either singly or in groups of two to four. In T. ceratophylla (Mitt.) Grolle, however, the appendages occur in groups of four, with basal fusion giving a bisbifid arrangement. Moreover, the groups of appendages occur in three vertical ranks on the axis, and each group has been regarded as comprising a quadrifid leaf (Hattori et al., 1974). The archegonia of Takakia are massive, and are borne singly at or near the apex of the axes; they resemble those of the Bryidae and Andreaeidae in having six rows of neck cells rather than four as in the Calobryales or five as in the Jungermanniales. There is no perianth. The chromosome numbers are n = 4 and n = 5, the lowest recorded among bryophytes, and it has been pointed out that doubling these complements in ancient polyploidy would have given n = 8-10, numbers which predominate in modern hepatics (Tatuno, 1959).

There is thus reason to believe that in its gametophyte Takakia has retained an impressive array of primitive features, and in some respects it appears to form

a link between mosses and hepatics. It is therefore singularly unfortunate that the sporophyte is unknown. The two species have apparently survived only in scattered alpine or subalpine localities in the Himalayas and around the northern Pacific in small, exclusively female, populations maintained by vegetative propagation. It would be exciting to promote sporophyte development in Takakia experimentally, either indirectly by chemical or other treatment of female gametophytes to induce antherozoid production, as Hattori (1980) has suggested, or directly by inducing apogamous sporophyte development on female gametophytes.

Recent studies of bryophyte ultrastructure, physiology and biochemistry are thus providing strong support for the view that the Anthocerotales represent an independent evolutionary line. Evidence concerning the relationships between mosses and liverworts is less clear. There are similarities in, for example, antherozoid structure, but important differences in biochemistry and sporogenesis. Most of the recent data are compatible with the broad outlines of hepatic relationships proposed in Fig. 1. It may be anticipated that information on fundamental developmental processes will continue to be forthcoming, and pave the way for a coherent theory on relationships among the major groups of bryophytes, while the advent of nucleic acid- and protein-sequencing offers the prospect of reconstructing the phylogeny of bryophytes and other primitive land plants with greater confidence than seemed possible only a few years ago. In the first bryological study of this type Katoh et al. (1983) have recently presented evidence that species of Lophocolea, Marchantia and Plagiomnium show greater affinity to each other than to Anthoceros in terms of nucleotide sequencies in 5S ribosomal RNA.

Reproductive biology and biosystematics

Ideas concerning the evolutionary history of bryophytes are likely to be clarified by elucidation of the evolutionary mechanisms currently operating within the group, a matter which also has an important bearing on the taxonomic treatment of variation at the species level. Recent years have seen the accumulation of a substantial body of data on morphological, cytological, biochemical and physiological variation, and the application to bryophytes of collateral cultivation and other techniques of experimental taxonomy. However, some important areas remain almost completely open for future investigators, such as experiments on the degree of interfertility between bryophyte populations of the same and related species. Moreover, the various approaches to biosystematics have all too often been applied piecemeal to different taxa, and as argued more fully elsewhere (Longton, 1982), what is now needed are comprehensive investigations of the biosystematics and population biology of selected groups. The value of such broadly-based studies is amply demonstrated by results from morphological, cytological and isozyme analysis of the Pellia endiviifolia complex (Schuster, 1981). Such work will generally demand collaboration between biologists with different areas of expertise, as in the Pellia study.

Attention should also be directed to three features of reproductive biology and life history which some authorities consider to restrict the evolutionary flexibility of bryophytes. Firstly, in bryophytes, alone among green land plants, the gametophyte is both free-living and the phase in the life cycle most exposed to selection pressures exerted by the environment. The gametophyte has historically been regarded as haploid, with every gene governing gametophytic characters thus expressed in the phenotype. Bryophyte populations would therefore be denied what is regarded as an important mechanism in higher plant evolution, i.e. storage within the gene pool of recessives alleles. These could include newly-arising mutants, possibly deleterious individually or in existing environments, but potentially advantageous in a changed environment or in combination with other alleles with

which they become associated following sexual reproduction and meiosis. However, cytological data have raised the possibility that most moss gametophytes are at least diploid. There are significant peaks of chromosome numbers at n = 6-8, 10-14, 18-22 and 26-28. One interpretation is that only species with n = 6-8, a mere 12% of those studied, have genuinely haploid gametophytes (Smith, 1978b). Most hepatics have n = 8-10, but it has been argued that these complements are also the result of duplication in the remote past (Schuster, 1966). If this is true, then the possibility of sheltering recessive alleles in the gametophyte may exist, but the evidence derived from chromosome numbers is circumstantial, and could be explained in other ways. Also, there is no guarantee that the effect of ancestral polyploidy, if it occurred, has not been wholly or partly negated by subsequent genetic changes resulting in loss of homology between pairs of chromosomes. One hopes to see this matter clarified, for examples, by application of giemsa-banding and other techniques in an attempt to locate pairs of homologous chromosomes within gametophytic complements, and by quantitative analysis of variation among the progeny resulting from crosses between different biotypes.

Secondly, many bryophytes are reputed to rely heavily on asexual reproduction, thus precluding the regular occurrence of such important processes as meiosis, hybridization, introgression and allopolyploidy. Some appear never to produce spores, though like Takakia spp., such species commonly show narrow or disjunctive, presumably relict, distributions (Longton & Schuster, 1983). However, most species, particularly of mosses, produce sporophytes at least in parts of their ranges, and where fruiting is rare, as in some dioecious species, compensation is provided by the development of hundreds of thousands, or even millions of spores per capsule.

There are nevertheless few confirmed reports of bryophyte spores germinating in the field and giving rise to a new generation of gametophores. Given the evolutionary significance of sexual reproduction it is important to determine how far this reflects a rarity of reproduction by spores, as opposed merely to difficulties in detection arising from the fact that protonema may form as a result of vegetative propagation as well as from spores. This problem is being investigated for selected British mosses at Reading (Longton & Miles, 1982). In general, we have found that spores fail to germinate and give rise to gametophores when planted in the field, although they do so readily on natural substrata in cultivation. However, preliminary results suggest that spores of Funaria hygrometrica do germinate when planted in a suitable field habitat, and we once located sporelings with shoots several millimetres long in a population of Archidium alternifolium, a species in which problems of detection are eased by the large size of the spores and the limited extent of protonema development prior to bud initiation. These observations raise many questions awaiting future investigation: for example, to what extent is successful reproduction by spores correlated with the different life history strategies discussed by Dr Whitehouse (this publication)?

A third factor with potential to reduce evolutionary flexibility in bryophytes is self-fertilization, sometimes assumed to be obligatory in monoecious species. However, in only a handful of taxa has self-compatibility between male and female gametes in a single clone yet been established. In addition to investigation of this point, there is a need for detailed studies on the timing of antheridial and archegonial maturation on individual shoots and on the distribution of perigonia and perichaetia within populations. Most monoecious mosses appear to be autoecious, an arrangement where the antheridia and archegonia develop further apart on an individual than in paroecious or synoecious forms, and it has been suggested that this may reflect selection for a system favouring a balance between self- and cross-fertilization (Longton & Schuster, 1983). In Entodon cladorrhizans (Hedw.) C. Muell. many shoots produce male and female inflorescences each year and self-fertilization appears

to be frequent (Stark, 1983). However, in Atrichum undulatum and Tortula muralis only a low proportion of shoots fulfil their potential to produce gametangia of both sexes during a given reproductive cycle, most bearing only archegonia. Thus the majority of sporophytes develop on shoots with only female inflorescences, clearly as a result of cross-fertilization between shoots (Longton & Miles, 1982). This emphasizes the need to learn more of the structure of bryophyte populations, since if colonies of monoecious mosses generally compromise members of a single clone then, functionally, self-fertilization will predominate despite the sex distribution patterns just discussed. Studies of meiotic irregularities and of isozyme variation offer approaches to the solution of this problem. Indeed, the potential exists for a quantitative assessment of the frequency of outcrossing, as variation between sporelings from a single capsule in isozymes or other convenient marker would, in species with functionally haploid gametophytes, imply that the parent sporophyte developed following karyogamy involving genetically different gametes. Among other species we are studying Archidium alternifolium from this viewpoint in the hope that the low number of spores per capsule may facilitate genetic analysis.

Ecology and conservation

Turning now to bryophyte ecology, the contributions in Smith (1982) demonstrate a need for comprehensive studies on a variety of topics, including community structure, environmental adaptation and the biochemical basis for the striking levels of desiccation tolerance shown by many mosses. A particularly important area requiring investigation concerns the impact of bryophytes on such fundamental ecosystem processes as nutrient cycling and energy flow (Longton, 1984).

Considering nutrient cycling, it is well-known that within any terrestrial community there is regular circulation of nutrients between living organisms and the soil, as well as input from nutrients dissolved in precipitation, from dust, weathering of soil materials and biological nitrogen fixation, with losses taking place though leaching and surface run off. If losses exceed input the nutrient status of a soil declines. Mosses may be expected to influence these processes in many ways. Their colonies retain precipitation by capillarity, and in ectohydric species water and its dissolved nutrients appear to be taken into the plants directly from this source. By accumulating rainfall, both externally and internally, so that much of it is absorbed, evaporates or drains slowly into the soil, rather than rapidly through the soil, bryophyte colonies are likely to enhance retention within the soil-plant system of nutrients arriving in precipitation. Similarly, water retention by bryophytes is likely to reduce losses of nutrients from the soil by leaching following heavy rain. This applies both to the living moss layer and to humus to which bryophyte remains can contribute significantly (p. 60). Organic compounds released by these plants may accelerate nutrient input through weathering, and bryophytes may enhance the activity of nitrogen-fixing micro-organisms. Conversely, a significant proportion of the nutrient capital in some sytems may be held in a large bryophyte biomass, thus decreasing availability to other organisms. Of these possibilities only nitrogen fixation has been widely investigated, and it has been found that bryophyte colonies may provide a major habitat for nitrogen-fixing blue-green algae and bacteria in Arctic tundra, ombrotrophic mires, coniferous forests, grasslands, in pioneer communities on rock, and among tropical forest epiphylls. Many of these vegetation types occupy habitats with low nitrogen availability and the contribution of bryophyte-associated fixation is thought to be of major significance (Longton, 1984). A study of Welsh oakwoods has confirmed that the moss layer of the wood floor may have a considerable impact on other aspects of nutrient cycling (Rieley et al., 1979). It was shown, for example, that the mosses accumulate almost 50% of the potassium input to the bryophyte layer from

throughfall and from tree and herb litter, and that bryophyte colonies cause a significant change in the chemical composition of precipitation percolating through them. In one of few comparable studies, Weetman (1968) showed that the fine roots of trees in a spruce forest on podzolic soil in Quebec were concentrated at the base of the moss layer. He indicated that decomposing mosses enhanced the mineral nutrition of the trees by providing a collecting point for elements absorbed by the mosses from throughfall. Here is a field ripe for investigation: certainly there is no justification for ignoring bryophytes in studies of nutrient cycling, as has generally been done in the past.

In terms of energy flow, bryophytes contribute significantly to the net annual primary production of organic matter in many communities. Values above 100g $m^{-2} yr^{-1}$ dry weight have been recorded in poplar tundra, boreal coniferous forests, in mires and in some temperate deciduous forests, while in tropical forests the biomass of epiphytes alone may exceed 1,000g m^{-2} (Longton, 1984). Relatively little bryophyte biomass appears to be consumed by herbivores, and decomposition rates are often lower than in flowering plants. It would be rewarding to discover the reasons for, and implications of, this situation.

Moss capsules are eaten by some birds, but there is virtually no evidence that the gametophytes are regularly grazed by vertebrates, except locally in cold climates where animals such as reindeer, lemmings and geese may eat moss in quantity. Prins (1982) reported that some Arctic mosses contain an unsaturated fatty acid also present in animal cell membranes. He suggested that moss consumption may facilitate animal activity at low temperatures by increasing fatty acid concentration in cell membranes, a hypothesis worthy of rigorous testing. Elsewhere, some grazing of bryophytes by a variety of invertebrates is known to occur, and it may prove to be more extensive than is yet realized.

Although bryophyte biomass predominantly enters the decomposer pathway, a relatively low rate of breakdown has been reported in mires, coniferous forests and other habitats. Kilbertus et al. (1970) showed that Pseudoscleropodium purum decomposed much more slowly than the grass Brachypodium pinnatum in French pinewoods. They concluded that P. purum played a major part in humus formation at the study site, despite a relatively low productivity. We clearly need to establish whether this situation is widespread in view of the accepted importance of humus for soil water and nutrient relations. If it is, then there are clear implications for forest management and in other contexts.

Why should bryophytes be spurned by grazers and decomposers alike? Their energy content seems generally to be slightly lower than that of vascular plants resulting in a lower nutritive value, but the differences appear to be minor. Mechanical strength and chemical resistance of the cell walls have also been implicated, and low digestibility of mosses by herbivores demonstrated experimentally (e.g. Person et al., 1980). Gerson (1982) considers the inhibitory effect of secondary compounds known to occur in mosses to be an important defence against grazing. Banerjee and Sen (1979) reported antibiotics effective against bacteria in over half of some 140 bryophyte species screened. Antifungal activity has been reported from several species, and use is still made of the antiseptic properties of Sphagnum among native North Americans in treating nappy rash.

Thus we return to our first major topic. There could well be compounds of immense value waiting to be discovered in bryophytes. Yet the tropical floras, at least, seem likely to be decimated by habitat destruction before they have been documented morphologically, let alone biochemically. The need is obvious both for increased research on bryophyte secondary compounds and for strenuous efforts in conservation. We should aim to determine the most effective ways of storing bryophytes in gene banks and at the same time become more active in

promoting conservation of plants in the field. The most effective approach here may be for bryologists to work in concert with others in pressing for the identification and preservation of habitats with generally high biological diversity, on both utilitarian and aesthetic grounds, And let us not denigrate the latter: there is little point in creating economic prosperity at the expense of the environmental richness and diversity that enables life to be appreciated to the full.

On the same theme, I suspected that most of us have come across statements to the effect that bryophytes are "evolutionary failures". Underlying this assertion seems to be the fact that they have failed to become large, and generally dominant in the vegetation, perhaps for the genetic reasons discussed above, and by virtue of constraints imposed by their life history, combining as it does a partially parasitic sporophyte with motile sperm requiring water to achieve fertilization. But are bryophytes evolutionary failures? Liverworts and mosses date back at least to the late Devonian and Carboniferous, respectively, almost to the dawn of life on land. In the intervening period the fossil lycopods, the horsetails and their allies, the sphenophylls, grew big and waxed abundant, but the arborescent forms became extinct long ago. The seed ferns have come and gone, and so, more recently, have the Bennettitales. The cycads, ginkgos and even the conifers, appear to be on the wane, but not so the bryophytes. Mosses remain the second most important group of land plants in terms of number of species, after those newcomers, the flowering plants, with the liverworts and ferns in contention for third place.

Some failures! Bryophytes have persisted since the Palaeozoic era, and yet occur in sufficient abundance and diversity as to provide a rewarding area of investigation for many future generations of biologists. It can be predicted with confidence that the study of mosses and liverworts, with their unique life history and all that it implies, will continue to prove intellectually challenging, and there is reason to suspect that such work may increasingly yield results of practical significance. Indeed, bryology could make a vital contribution to human welfare simply by highlighting the fact that sustained growth and dominance within the ecosystem are not necessarily advantageous for long-term survival.

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References

Anon. (1983). Resolutions adopted during the World Conference of Bryology, Tokyo, May 1983. Bryological Times 21, 4.

Banerjee, R.D. & Sen, S.P. (1979). Antibiotic activity of bryophytes. Bryologist 82, 141-153.

Basile, D.V. & Basile, M.R. (1983). Desuppression of leaf primordia of Plagiochila arctica (Hepaticae) by ethylene antagonist. Science 220, 1051-1053.

Carothers, Z.B. & Duckett, J.G. (1979). Spermatogenesis in the systematics and phylogeny of the Hepaticae and Anthocerotae. In Bryophyte Systematics (ed. G.C.S. Clarke & J.G. Duckett), pp. 425-445. London.

Dillenius, J.J. (1741). Historia Muscorum. Oxford.

Duckett, J.G. & Carothers, Z.B. (1979). Spermatogenesis in the systematics and phylogeny of the Musci. In Bryophyte Systematics (ed. G.C.S. Clarke & J.G. Duckett), pp. 385-423. London.

Gardiner, J.C. (1982). A bryophyte flora of Surrey. J. Bryol. 11, 747-841.

Geissler, P. & Greene, S.W. (eds.) (1982). Bryophyte Taxonomy. Methods, Practices and Floristic Exploration. Beih. Nova Hedwigia 71, 1-558.

Gerson, U. (1982). Bryophytes and invertebrates. In Bryophyte Ecology (ed. A.J.E. Smith), pp. 291-332. London & New York.
Gradstein, S.R. (1979). Directory of bryologists and bryological research. Regnum Vegetabile 99, 1-81.
Hattori, S. (1980). Can we find the sporophyte of Takakia? Bryological Times 6, 2.
Hattori, S., Iwatsuki, Z., Mizutani, M. & Inoue, S. (1974). Speciation of Takakia. J. Hattori bot. Lab. 38, 115-121.
Katoh, K., Hori, H. & Osawa, S. (1983). The nucleotide sequences of 5S ribosomal RNAs from four Bryophyte-species. Nucleic Acids Research 11, 5671-5674.
Kilbertus, G., Mangenot, F. & Reisinger, O. (1970). Décomposition des végétaux. II. Étude aux microscopes électroniques des Pseudoscleropodium purum (Hedw.) Fleisch. Bull. Ecol. Natl. Sup. Agron. Nancy, 12, 62-67.
Longton, R.E. (1982). The biosystematic approach to bryology. J. Hattori bot. Lab. 53, 1-19.
Longton, R.E. (1984). The role of bryophytes in terrestrial ecosystems. J. Hattori bot. Lab. 55, 147-163.
Longton, R.E. & Miles, C.J. (1982). Studies on the reproductive biology of mosses. J. Hattori bot. Lab. 52, 219-240.
Longton, R.E. & Schuster, R.M. (1983). Reproductive biology. In A New Manual of Bryology (ed. R.M. Schuster), pp. 386-462. Nichinan.
Myers, N. (1979). The Sinking Arc. Oxford.
Neidhart, H.V. (1979). Comparative studies of sporogenesis in bryophytes. In Bryophyte Systematics (ed. G.C.S. Clarke & J.G. Duckett), pp. 251-280. London.
Person, S.J., Pegau, R.E., White, R.G. & Luick, J.R. (1980). In vitro and nylon-bag digestibilities of reindeer and caribou forages. J. Wildl. Managem. 44, 613-622.
Pócs, T. (1982). Hepaticological exploration in subsaharan Africa. Beih. Nova Hedwigia 71, 495-500.
Prins, H.H. (1982). Why are mosses eaten in cold environments only? Oikos 38, 374-380.
Richards, P.W. & Smith, A.J.E. (1975). A progress report on Campylopus introflexus (Hedw.) Brid. and C. polytrichoides De Not. in Britain and Ireland. J. Bryol. 8, 293-298.
Rieley, J.O., Richards, P.W. & Bebbington, A.D.C. (1979). The ecological role of bryophytes in a North Wales woodland. J. Ecol. 67, 497-527.
Schuster, R.M. (1966). The Hepaticae and Anthocerotae of North America. Vol. 1. New York.
Schuster, R.M. (1979). The phylogeny of the Hepaticae. In Bryophyte Systematics (ed. G.C.S. Clarke & J.G. Duckett), pp. 41-82. London.
Schuster, R.M. (1981). Evolution in Pellia, with special reference to the Pellia megaspora-endiviifolia complex (Metzgeriales), I. Taxonomy and distribution. J. Bryol. 11, 411-431.
Smith, A.J.E. (1978a). The Moss Flora of Britain and Ireland. Cambridge.
Smith, A.J.E. (1978b). Cytogenetics, biosystematics and evolution in the Bryophyta. Adv. Bot. Res. 6, 196-276.
Smith, A.J.E. (ed.) (1982). Bryophyte Ecology. London & New York.
Stark, L.H. (1983). Reproductive biology of Entodon cladorrhizans (Bryopsida, Entodontaceae). I. Reproductive cycle and frequency of fertilization. System. Bot. 84, 381-388.
Steere, W.C. (1982). Summary of contributions on mosses. Beih. Nova Hedwigia 71, 539-545.
Stewart, K.D. & Mattox, K.R. (1975). Comparative cytology, evolution and classification of the green algae with some consideration of the origin of other organisms with chlorophylls a and b. Bot. Rev. 41, 104-135.
Suire, C. & Asakawa, Y. (1979). Chemotaxonomy of bryophytes: a survey. In Bryophyte Systematics (ed. G.C.S. Clarke & J.G. Duckett), pp. 447-477. London.

Suire, C. & Asakawa, Y. (1982). Recent advances in the chemotaxonomy of liverworts. Beih. Nova Hedwigia 71, 39-58.

Tatuno, S. (1959). Chromosomen von Takakia lepidozioides und eine Studie zur Evolution der Chromosomen der Bryophyten. Cytologia 24, 138-147.

Weetman, G. (1968). The relationship between feather-moss growth and the nutrition of black spruce. In Proceedings of the Third International Peat Congress, Quebec (ed. C. Lafleur & J. Butler), pp. 366-370. International Peat Society, Quebec.

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THE BRITISH BRYOLOGICAL SOCIETY AND ITS FUTURE

by

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A discussion was held at the Diamond Jubilee Meeting in London, 16-18 September, 1983, on the future of the BBS. It was chaired by the author who presents here some background information on the Society in 1983, his report of the Discussion and some thoughts of his own on how the Society might develop in the future.

The Society to-day

Membership

The Society is a mixture of spare-time bryologists (mostly amateurs) and professional botanists, the exact numbers of each being unknown. There are small numbers of student and family members and 13 Honorary members, adding up to a total of about 500. About one-third of the members live abroad. A simple questionnaire is being introduced in 1984 to obtain more precise information about the composition of the Society and the interests of its members.

Management

The Society is run by a Council of approximately 15 unpaid Officers and six unpaid elected members all of whom are elected at Annual General Meetings. It has two Standing Committees, an Executive, and an Honorary Membership Committee. Ad hoc committees have been created infrequently, the most recent being a Policy Committee chaired by the author.

A number of new officerships have been created in the past seven years, viz: Conservation Officer, Membership Secretary, Bulletin Editor, Reading Circle Secretary and Publicity Officer. Detailed minutes are kept of every Council meeting and they extend back in an unbroken sequence to the foundation of the Society. They are not published, but important decisions are announced at Annual General Meetings and sometimes reported in the Bulletin.

Publications

The most important publication is the Journal of Bryology which contains reports of original research in many aspects of bryology. It currently comprises 650-700 (rarely up to 800) pages per year in two issues, four issues making a volume. Its Editor is supported by an advisory editorial board. A regular feature is a comprehensive list of recent publications compiled by the Society's Bibliographer.

The Society's other regular publication is the Bulletin of the British Bryological Society appearing every six months with around 40 pages per issue. It was started in 1963 and initially contained mostly domestic information about meetings, news of members' activities, etc. However, since 1974 the proceedings of the Society and new vice-county records have appeared in the Bulletin rather than the Journal and the Bulletin has carried short articles about bryophytes, bryologists and other topics.

Other publications include the Census Catalogue (Corley & Hill, 1981), which indicates the known vice-comital distribution of all British and Irish bryophytes. The Biological Records Centre of the Natural Environment Research Council recently published for the Society a Provisional Atlas of the Bryophytes of the British Isles (Smith, 1978). The report of a meeting on bryophyte systematics, held in Bangor in 1978 jointly with the Systematics Association, was published by Academic Press for the two Societies (Clarke & Duckett, 1979). The Society has never published a flora, text book or a popular work on bryophytes.

Meetings

Society meetings follow a regular annual pattern of spring and summer field meetings followed in the autumn by a weekend paper-reading meeting (during which the Annual General Meeting is held) and a weekend taxonomic workshop in early winter. The spring meeting lasts a week and is usually held in England or Wales. The summer meeting is for a week or a fortnight, the shorter ones being held in northern England, Wales or southern Scotland and alternating with longer ones, which are held once in Scotland and then in Ireland. Occasional meetings are also held on the Continent.

The following figures show attendances at Society meetings over the last 7 years and are based on information kindly supplied by the Meetings Secretary, Dr. M.E. Newton.

	1976	1977	1978	1979	1980	1981	1982	Mean
Field Meeting								
Spring	33	37	31	37	30	32	30	33
Summer	11	12	) c.50*	20	?	18	c.25	17
Paper-reading Meeting	45	60	)	54	43	c.40	c.50	49
Taxonomic Workshop	30	28	15	18	30	18	14	22

* Combined figure for the two meetings

These figures suggest that the level of turnout has remained fairly constant in recent years, the paper-reading meetings being the best attended. In 1982 the Society introduced a programme of local one-day field meetings (Newton, 1982) at which attendance has been variable and less than expected.

Other activities

A refereeing service comprising a panel of specialists to whom specimens may be sent for identification or confirmation is organized by the Recorders for

mosses and hepatics. The names and addresses of the referees appear regularly in the Bulletin. The Society has an herbarium, and a library of approximately 200 books, some journals and several thousand offprints. There is a small amount of archival material. Members may borrow items from the herbarium and the library and a catalogue of books is available from the Librarian. Council recently announced a new policy for library acquisitions (Bulletin 42, 12, 1983). Through a Reading Circle, members may obtain contents lists of foreign bryological journals, and copies of pages of interest. The Society has an active interest in bryophyte conservation and has issued a Code of Conduct. Data are being collected for a Red Data Book on the threatened species.

The distribution of British and Irish bryophytes is being recorded in two ways, i.e. by the long-established vice-comital recording system, which is co-ordinated by the Recorders for mosses and hepatics, and in greater detail by methods based on 10 x 10 km squares of the National Grids for Great Britain and Ireland, co-ordinated by the Mapping Secretary. A comparison of the two methods will be found in Corley & Hill (1981). Voucher specimens supporting all new vice-county records are maintained in the herbarium. The initial phase of the mapping project ended in 1982 after 20 years (Smith, 1982) and has undoubtedly been most successful. A series of maps has appeared in the Journal and a list of these and the additional 100 species published in the Provisional Atlas (Smith, 1978) will be found in Corley & Hill (1981). An Atlas is being prepared incorporating all the records so far available.

A project on the reproduction of selected British bryophytes was started recently (Longton, 1983).

Report of the discussion

The Chairman opened the Discussion by reminding participants of a comment made by P.W. Richards at the conclusion of his lecture (p.8), namely that bryology in the British Isles is entering an insecure phase due to the possibility that reduced funding may lead to its decline in teaching and research programmes within British Universities with a fall in the number of trained bryologists. As a result the BBS may become increasingly responsible for keeping a "flag for bryology flying" in the British Isles. Agreeing with Prof. Richards the Chairman said that in considering how to respond to this challenge, the following points should be borne in mind:

(i) Objective 1 of the BBS, which reads: "To promote and advance all branches of the study of bryophytes, especially in relation to those of the British Isles"

(ii) The need to satisfy the interests of the different groups that make up the Society if their support is to be maintained or increased. In addition to private members, many Institutions subscribe to the Journal. The following figures give an indication of the levels of support in 1982.

	Totals	Percentage	Income
Members			
Resident in U.K.	320	64.5	c.£3,200
Resident abroad	176	35.5	c.£1,760
	496	100.0	£4,960
Institutions subscribing to Journal of Bryology	250	-	c.£6,000

Thus Institutions provide over 50% of the Society's subscription income with a further 16% coming from members resident outside the United Kingdom. These figures leave little doubt that the quality of the Journal of Bryology is the

most significant factor in attracting financial support.

(iii) The need for realism when considering new activities in view of the limitation of financial resources and the time people can devote to what, for many, is a hobby.

The meeting was then thrown open for general discussion.

An educational role

G.C.S. Clarke commented that the Society, quite reasonably, puts its main effort into providing services for members. He suggested that if it were to accept responsibility for keeping a "flag for bryology flying", the Society also needs to inform people not already committed to a study of the group how interesting bryophytes can be, and how information about them can help in understanding the nature of plant communities and, hence, the importance of their conservation. Thus the Society should develop an educational role and become more outward looking.

Miss J. Ide supported this view. She thought many people were put off bryology because they were unable to recognize even the major groups, owing to a lack of suitable introductory literature. She also thought that efforts should be made to provide material suitable for school children and advocated more courses such as those run by the Field Studies Council.

Publications

The Chairman pointed out that there were no "coffee table" books on bryophytes, nor any recent popular books discussing their principal features, life histories or habitats, although such works had been common in this country in the last century. M.C.F. Proctor agreed that there was a need for popular books which might direct the beginner towards more advanced literature and Miss J. Ide mentioned the success of such publications in Japan. C.R. Stevenson thought a range of books was needed, some written for students and teachers and others for the wider public, and wondered if pictures of bryophytes, as seen through a hand lens or microscope, might be an interesting addition to the standard types of illustrations. Mrs A. Kelham and B.J. O'Shea both thought the junior market should be catered for since if stimulating material were available childen could become very enthusiastic.

M.C.F. Proctor suggested that some members found parts of the Journal very off-putting. K.J. Adams' idea that a set of detailed drawings of bryophytes be published in the Journal, a small number at a time, drew support from A. Eddy and D.G. Long, but A. Eddy noted that the British bryoflora would be covered more rapidly if the drawings were published as a series of booklets. D.G. Long suggested linking the drawings to a biological flora of bryophytes, an idea supported by P.W. Richards.

There was also support for T.L. Blockeel's suggestion that portraits of bryologists, particularly those of the 19th century, should be published. E.V. Watson suggested adding pen-pictures, like that of John Nowell of Todmorden (Foster, 1980). A.R. Perry pointed out that the Society had a large number of photographs of early members of the Moss Exchange Club that could well be published. G.A.M. Scott supported these ideas, but S.R. Edwards thought that more effort should go into producing portraits of bryophytes rather than bryologists, as they were "so much more beautiful"!

Publicity

Ideas about making the public more aware of the value and rewards of studying bryophytes raised the question of publicity and the Society's image. C.R. Stevenson suggested that the Society's activities could be publicised by a widely-circulated quarterly news sheet to Natural History Societies, local

Naturalists' Trusts, etc. The Chairman said that some members held the view that the name "The British Bryological Society" was too formal, and that it should be replaced with something simpler, such as the British Moss Society: alternatively a name such as the latter could be used informally in the way the British Museum (Natural History) has found it worthwhile to use "Natural History Museum" on occasions as an alternative title. A clear feeling was expressed by the meeting that no change should be made in the Society's title.

Meetings

The meetings were considered to be a major strength of the Society, many members joining especially for the field excursions. Nevertheless, attendance was sometimes disappointing, leading to the suggestion that the scope of some should be broadened, e.g. by including more taxonomy in the paper-reading meetings. But Miss J. Ide pointed out that the latter were the only occasions where the non-taxonomic study of bryophytes was discussed. She thought the taxonomic workshops were much appreciated, and that other types of workshops might be considered, perhaps on cytological or ecological methods, preparation techniques, reproductive biology or photography of bryophytes.

Projects

The meeting was reminded that the Society currently had two projects, a mapping scheme and a study of reproductive biology. Should the mapping scheme be replaced, and if so, by what? Should the Society initiate additional projects?

A discussion ensued on the merits of vice-county recording versus the use of the system based on the metric National Grid. Both R. Walker and F.H. Brightman thought that vice-county recording was the more interesting. E.W. Jones suggested that the enthusiasm of amateurs was more likely to be maintained by studying the bryophytes of a well-known area, such as a county or the Chiltern Hills, rather than the floras of 10 km squares. R.G. Woods pointed out that much of the value of detailed recording on a metric basis is in the conservation field while C.D. Preston said that as some 10 km squares extend into more than one vice-county, the two recording systems needed to be run in parallel. The Chairman observed that if records within a county or vice-county were collected on a metric grid basis, the benefits of both methods would be obtained. It was suggested that vice-county recording is so popular because one of the easiest ways of getting one's name in print is by publishing new records. The clear impression emerged that both systems of recording should be continued.

P.W. Richards then spoke persuasively about the possibility of preparing a biological flora of British bryophytes pointing to the success of the British Ecological Society's scheme for vascular plants. M.C.F. Proctor supported the proposal and said much could be achieved with a minimum of equipment: for example, detailed studies of distribution over a limited area could give useful information on habitat requirements, and valuable data could be obtained by recording periods of growth in the field.

Report to Council

The author has prepared a detailed report on the Discussion for Council. It includes the points sent in by members for debate, but not raised because of shortage of time.

The author's view of the way ahead

Is it reasonable for the BBS to accept a major responsibility for fostering bryological studies in Britain (p. 67)? To do so would be fully consistent with the Society's stated objectives, so the question becomes how should the Society respond to this challenge? Certainly the Society of the future must continue to provide for the interests of its members as its first priority and

maintain its traditional strengths in taxonomy and floristics, but as P.W. Richards points out (p. 7) "the view that bryology is wider than merely the classification and identification of bryophytes" must be encouraged. The paper-reading meetings and the Journal offer such encouragement by providing a forum for discussing new advances and ideas, and by publishing papers of scientific merit. The author considers that, in addition, efforts should be made to interest more members in research projects and that the Society should adopt the outward-looking, educational role advocated during the Discussion (p. 68).

Projects

Well-devised projects can add significantly to knowledge and give participants a sense of satisfaction at a worthwhile achievement. Projects which collect biological data about bryophytes could be particularly worthwhile, not only because of the dearth of this type of information, but also because the rewards from simple field observations could be great.

Now that the first phase of the mapping scheme has come to an end decisions are necessary as to its future development. A shift in emphasis from mapping as an end in itself towards data banking on a matrix basis, as discussed by R. Schumacker (p. 31 ff), might be the best option. It could encourage the collection of a variety of data relating to habitat, reproductive performance, associated species etc., using specially designed recording cards. Collecting the data on a grid basis would allow both numerical and graphical presentation of results, and the production of maps on a metric or vice-county basis as required.

The project on reproductive biology (Longton, 1983) could be expanded to incorporate additional species, or to investigate the frequency of the three main reproductive cycles known to occur among British mosses (Greene, 1960). The applicability of Zehr's (1979) scheme for American hepatics to British species could profitably be tested. Such refinements would assist in establishing how closely the life cycle strategies discussed by H.L.K. Whitehouse (p. 43 ff) correlate with habitat, phylogeny, phytogeography, etc. Initiation of a biological flora project (p. 69) would also be of great value. Its objectives would be to compile information on many aspects of the life and growth of individual species, e.g. phenology, dispersal mechanisms including the role of spores and vegetative propagules, range of habitats, and susceptibility to grazing. Such data could profitably be incorporated into the data bank mentioned above.

These projects are complex and would rely for their success on a corporate effort by the membership. But it is important to emphasize that valuable information could also be accumulated from simple observations, each within the capacity of the amateur. Many "solo" projects could also be suggested, suitable for individual members with simple equipment. Working out the seasonal reproductive cycle of one species is an example. The study of "moving mosses" is another, whereby changes in the shape and position of individual colonies could be recorded by repeated photography over a period of years. If this were done with a wall-top moss such as Grimmia pulvinata or Homalothecium sericeum it would soon become apparent that colonies move about on their substrate as shoots on one side continue to grow actively while other shoots remain unchanged or die. The extent of such changes and their frequency are unknown, as indeed is the normal life span of a colony. Information of this type is not currently available for any British bryophyte, yet it could easily be obtained and is likely to yield fascinating results.

The same technique could give equally interesting results if focussed on events within a colony, as demonstrated by Collins (1976) in Antarctic populations of Polytrichum alpestre. For example, comparison of sequential photographs could

be expected to show that some shoots vanish (die?) while others appear (new shoots or branches?) Thus data about the rate and amount of shoot turnover and the pattern of shoots remaining sterile or entering a reproductive phase could be collected - again, data which are unavailable for any British species. Such studies would be particularly valuable in the case of rare bryophytes as the information, in addition to distribution data, would be essential in making decisions about land management policies designed to ensure survival of habitats and ultimately of species. There is thus the potential for a variety of corporate or solo projects.

Links with Institutions

In some projects results can only be obtained by extensive mathematical analysis. For these a "division of labour" approach is worth considering. Thus data might be collected by one or more members and passed on for analysis by another with more time or facilities, for example a member working in a University or other Institution. Indeed, there is no reason why members should not participate in University-based projects, if full recognition is given to their contributions. Traditionally research students have collected and contributed field data, but many research staff might be prepared to train BBS members to do such work. This could open up a whole new range of interests to members by bringing amateur and professional botanists into closer contact to their mutual benefit.

Educational role

A serious attempt to make the general public more aware of the interest and value of studying bryophytes represents a challenge that the Society should not shirk, and the comments in favour of such a course made during the Discussion seemed eminently sensible. A suggestion by A.D. Banwell, but not raised during the debate, is that the Society might provide an information service to local authorities, the Nature Conservancy Council and others who regularly require species lists, evaluations of local rarities and other relevant information for planning application hearings, etc. Similarly, a service offering advice on projects that could be carried out in schools might be of value.

The Society should publicise its activities and services through Naturalists' Trusts, Museums, etc., by means of posters, newsheets and other appropriate publicity material. Illustrated talks could be offered and members could act as leaders of bryophyte walks, as some do at present. Also, advice could be given on the setting up of nature trails by helping with the naming of bryophytes and writing handouts describing the bryophytes likely to be seen. The adoption of such approaches would involve a commitment by members to spending time passing on information, as well as acquiring it. An educational role would also mean greater use of the Society's library, archives and herbarium, as well as the data bank of bryophyte records - all good reasons for strengthening these activities and services. A simple roster system could ensure that no one spent undue time on advisory work.

Publicity at the national level could also be valuable, e.g. through articles in magazines and the national press, reviews on the "State of the art" in journals such as the New Scientist, and contributions to television natural history programmes. The Society should also become more involved in collaborative ventures with other scientific societies, as occurred during the successful symposium on bryophyte systematics at Bangor in 1978, and the training course in bryophyte taxonomy at Manchester, 1983, both organized in collaboration with the Systematics Association. There is no shortage of suitable topics for further joint meetings, and other Societies are likely to co-operate with the BBS, provided the mutual benefits are clear. The proceedings of such meetings when published would spread an awareness of Society activities among the scientific community. Reciprocal participation in conversaziones, as well as the organization of symposia at meetings such as the

British Association for the Advancement of Science, might also be expected to give worthwhile results.

Publications

Any attempt to interest the public in the study of bryophytes without being able to direct them to suitable types of books and other informative literature is likely to meet with limited success. There is a need for well-illustrated popular, but authoritative works written for different groups of readers. Introductory booklets which provide general information, rather than concentrate only on morphological variation and identification, could stimulate a lot of interest, for example, field guides to the bryophytes of habitats such as base-rich wall tops, bogs and acid woodlands. Handbooks on such practical matters as cultivation, microscope technique and photography could also be helpful, as could illustrated annotated keys, with clear, simplified diagnoses of genera, and lists of their common species. They could guide the user towards the standard floras or other more advanced literature. The keys might usefully be linked to the refereeing system re-organized on a two-tier basis, comprising referees working at the generic and specific levels respectively.

Can the Society's existing publications be made more attractive? For example it was suggested in the Discussion that the Journal should include non-technical review articles and first-class drawings of British bryophytes. The suggestion that portraits and biographies of British bryologists should be published aroused considerable interest. The British Ecological Society has recently begun to produce short profiles of new officers and similar articles might be appreciated by BBS members. Certainly the introduction of photographs and illustrations into the Bulletin would increase its appeal.

Meetings

Diversification in the scope of Society meetings could increase their appeal. A long prevailing view is that the number of meetings must be limited so that everyone can have a reasonable chance of participating in each. It was against this background that the the taxonomic workshops were started in 1974. The recent organisation of local meetings by Dr M.E. Newton represents a further relaxation of this attitude. A further change might be the introduction of meetings in parallel, i.e. two or more taking place at the same venue at the same time, each dealing with different topics. For example, it was suggested during the Discussion that workshops on photography, preparation techniques, etc., would be appreciated. Perhaps they could be run simultaneously with a few sessions common to all participants; members attending would then get more stimulation than under the present scheme. Similarly, paper-reading meetings might include concurrent sessions on taxonomy, ecology, physiology, etc. as well as some common sessions. Of course, the inevitable clashes of interest that arise with these schemes make them unpopular, but it would be one way of giving members a larger choice of programme without more time or cost being involved.

Another potentially useful approach would be to set aside, from time to time, part of a meeting for an open discussion on some topic of general interest as a way of getting the views of the membership on policy matters, a proposed new project, etc.

Management

A broadening of the Society's interests will require more member participation and make additional work for a Council which is increasingly having to deal with topics requiring technical, legal and financial expertise at levels not previously necessary. So some thoughts on how new activities could be accommodated may not be out of place.

There seems to be little doubt that more people will need to become involved in

the activities of Council. But it is often said that Council is already too large and functions too much in isolation. Perhaps the membership is partly responsible for the isolation, since requests for nominations for officers and elected members rarely bring any response, resulting in Council's nominees being elected unopposed. The normally brief disclosures of Council's deliberations, combined with the natural desire of most Chairmen, and indeed of many participants, to get Annual General Meetings over as quickly as possible, minimize contacts and interchanges of views.

One way of increasing contact could be through the publication of a Council newsletter in the Bulletin. This would include abstracts of minutes of Council meetings, thus informing members of what was being considered and the decisions reached. A suitable feedback system would encourage members to propose items for discussion by Council.

The recent decision that periodic policy reviews should be undertaken of all activities and services, to establish clear-cut objectives and priorities and that they should be published, shows that Council is willing to take steps to make the membership more aware of its activities. Already a policy for the Library has been developed, in full consultation with the Librarian, as reported in the Bulletin (42, 12, 1983). An increase in such procedures would be welcome and should enable members to appreciate what officers are trying to achieve and encourage wider participation in Society activities.

Advocating the involvement of more people in the activities of Council may seem to be arguing for its size to be increased. But this need not happen if a suitably-structured committee system were evolved, the number and size of the committees and their duration being related to the nature of their jobs. Already the Editor of the Journal of Bryology has a board of 8 people to assist him and from time to time he reports their views to Council of which he alone is a member. It is suggested that more committees of similar composition would allow more members to contribute ideas and views for Council's consideration and so utilize a greater range of the talents and expertise of the membership than happens at present.

It is hoped that some of the suggestions embodied in this paper may help to stimulate and clarify ideas and so lead to the formulation of new policies and organization appropriate for the future. The challenge is great. New activities could lead to a larger, more active outward-looking Society, with a keen desire to create an awareness among the public of the value and rewards that can be found in the pursuit of bryology. It could also lead to a substantial increase in our knowledge of the taxonomy, biology and distribution of British bryophytes. Truly "the flag" would be flying high!

Acknowledgements

I would like to express my gratitude to all who contributed to the Discussion during the Jubilee Meeting and to the others who took the trouble to write to me with ideas and suggestions. I am also grateful to the many colleagues who discussed with me their views on the BBS during the period of my Presidency and who, in one way or another, have contributed to the development of my views.

It is a pleasure to thank Drs H.L.K. Whitehouse and R.E. Longton for permission to report decisions taken in Council and Dr M.E. Newton for information regarding Society meetings. To Professor P.W. Richards, Dr G.C.S. Clarke, Dr H.L.K. Whitehouse, and particularly Dr R.E. Longton, who all read a draft of this paper and offered valuable suggestions, I am especially grateful. Finally I wish to thank my Secretary, Mrs Julia Johnstone, who graciously gave up a Saturday to take notes during the Discussion and who helped me to get this manuscript into a publishable form.

References

Clarke, G.C.S. & Duckett, J.G. (eds.) (1979). Bryophyte Systematics. London. Systematics Association Special Volume 14.

Collins, N.J. (1976). Growth and population dynamics of the moss Polytrichum alpestre in the maritime Antarctic. Oikos 27, 389-401.

Corley, M.F.V. & Hill, M.O. (1981). Distribution of Bryophytes in the British Isles. A Census Catalogue of their Occurrence in Vice-counties. British Bryological Society, Cardiff.

Greene, S.W. (1960). The maturation cycle, or the stages of development of gametangia and capsules in mosses. Trans. Br. bryol. Soc. 3, 736-745.

Foster, W.D. (1980). Famous bryologists I. John Nowell of Todmorden (1802-1867). Bull. Br. bryol. Soc. 35, 13-20.

Longton, R.E. (1983). Reproductive biology of selected British mosses. Bull. Br. bryol. Soc. 42, 46.

Newton, M.E. (1982). A new series of local meetings. Bull. Br. bryol. Soc. 39, 23-25.

Smith, A.J.E. (ed.) (1978). Provisional Atlas of the Bryophytes of the British Isles. Natural Environment Research Council, Biological Records Centre, Abbots Ripton.

Smith, A.J.E. (1982). BBS mapping scheme, final request for records. Bull. Br. bryol. Soc. 40, 17.

Zehr, D.R. (1979). Phenology of selected bryophytes in southern Illinois. Bryologist 82, 29-36.

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ABSTRACTS OF EXHIBITS AT THE CONVERSAZIONE

compiled by

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Seventeen exhibits were displayed at the conversazione held at Bedford College, London, on 17 September 1983 during the Diamond Jubilee meeting of the British Bryological Society. Abstracts describing 14 of the exhibits are presented below. The other contributions were : BBS Library Sales, by K.J. Adams, North East London Polytechnic; Souvenirs of the Tokyo Bryological Congress, by P.W. Richards and A. Richards; Photographs of BBS Members, by E.C. Wallace, Sutton, Surrey.

M. E. NEWTON (Department of Botany, University of Manchester): **Manchester Bryophytes.**

Representative species of selected habitats within the county of Greater Manchester were displayed as pressed specimens. Their distributions in the region were mapped using the national 10 km square grid, and attention was drawn to points of interest.

L.T. ELLIS (Department of Botany, British Museum (Natural History), London): **Going, going, gone!**

Herbarium specimens and illustrations of some of the mosses which are presumed extinct, or in danger of extinction, in the British Isles were exhibited. Discovered in Britain in the nineteenth century, such rare species as Anomodon attenuatus, Grimmia elatior, Helodium blandowii, Neckera pennata, Paludella squarrosa and Rhynchostegium rotundifolium have fallen victim to habitat destruction or over-collecting.

R.G. WOODS (Nature Conservancy Council, Newbridge on Wye, Powys): **A Red Data Book on Brecknock Bryophytes.**

This internal report of the Nature Conservancy Council contains an introduction and summary of the habitat requirements and conservation measures necessary to conserve the 129 species of mosses and liverworts considered to be either nationally rare or rare within Brecknock vice-county. The habitat requirements, current distribution, conservation measures afforded and possible threats to each species are considered in turn. About 50% of the rare bryophyte species are afforded some degree of protection under the Wildlife and Countryside Act 1981. The county is shown to be particularly rich in riparian bryophytes. Special conservation measures are considered necessary to conserve some of these species.

A.J. HARRINGTON (Department of Botany, British Museum (Natural History), London): **Mosses by the skinful.**

W.R. Sherrin (1871-1955), a founder member of the British Bryological Society, was employed as an articulator in the Zoology Department of the British Museum (Natural History) from 1895 to 1928. During the course of his work he found a number of interesting exotic mosses amongst the material used as temporary stuffing for mammal skins. These were identified by H.N. Dixon, who included some of the records in his publications on Asian mosses. The specimens on display were selected from Dixon's herbarium which is housed in the Cryptogamic Herbarium of the British Museum (Natural History).

G.A.M. SCOTT (Department of Botany, Monash University, Clayton, Victoria, Australia): **Colour Photographs of Australian Bryophytes.**

A set of eight colour enlargements (30 x 40 cm) of close-up photographs of some mosses and liverworts, with some Higher fungi, were displayed. These were all taken with a 35 mm single lens reflex camera, in wet forest mostly in the Dandenong Range, east of Melbourne, by Bruce Fuhrer, who also processed the prints. He is a professional photographer attached to the Department of Botany, University of Monash, and is himself a keen botanist with a wide knowledge of plants. His colour photographs have been the subject of several books on the plants of Victoria, fungi, marine algae and especially flowering plants. He has recently completed a set of black and white photographs to illustrate a manual of liverworts.

A.R. PERRY (National Museum of Wales, Cardiff): **A New Moss Wall Chart.**

A moss wall chart, in process of being painted by the Botanical Artist in the National Museum of Wales, Miss Dale E. Evans, was displayed. It will eventually feature about 80 species of British mosses and, it is hoped, will be completed for publication during 1985.

S.R. GRADSTEIN (University of Utrecht, Netherlands): **Gottsche, Icones Hepaticarum Ineditae.**

The bombing of the Berlin herbarium in 1944 destroyed the huge bryophyte herbaria, including many hundreds of types, of the German muscologist C.M. Mueller and the hepaticologist C.M. Gottsche. Also destroyed were several thousands(?) of liverwort illustrations - partly in colour - by Gottsche, his "Icones Hepaticarum Ineditae". It has been little known, however, that a set of approximately 100 originals of the Icones - exotic species of Frullania -

escaped destruction. Some of them represent types of species for which voucher specimens are presumably lost, e.g. Frullania madagascariensis Gott. 1882 and F. rutenbergii Gott. 1882 from Madagascar (leg. Rutenberg). Representative examples were displayed, in a few cases with a fragment of the holotype specimen glued on the plate.

H.L.K. WHITEHOUSE (Department of Applied Biology, University of Cambridge): **Photographs of moss protonema-gemmae.**

Colour prints were shown at magnifications of x 210, x 330 or x 830 of the protonema-gemmae of 44 British species of mosses. The gemmae were grouped into four categories: (1) resembling rhizoid gemmae; (2) of different morphology from rhizoid gemmae, which occur in the same species; (3) similar to gemmae found on leaves or in leaf-axils; and (4) not known to occur other than on the protonema. A striking feature of protonema-gemmae, evident from the photographs, is their diversity of morphology, size and cell-wall thickness. Evidently some are of transitory existence, while others are probably capable of surviving for many years.

P.J. WANSTALL and T. UDDIN (School of Biological Sciences, Queen Mary College, London): Protonemal gemmae of Leptodontium gemmascens (Hunt) Braithw.

Cultures of this rare British moss collected at Wortham Ling, E. Suffolk (v.-c. 25) and grown on Parker's agar medium were demonstrated. The cultures showed young leafy shoots with leaf-tip gemmae and the grape-like clusters of protonemal gemmae arising from short protonemal branches near the periphery of the cultures.

J.G. HUGHES (Department of Biological Sciences, University of Aston in Birmingham): Penetration by rhizoids of Tortula muralis into well cemented oolitic limestone.

By means of microscope slides and photographs the rhizoids of T. muralis were shown to penetrate to a depth of 2-3 mm into well cemented oolitic limestone. This highly structured and rigid substratum allowed study of the extent and morphology of the subterranean system of rhizoids. There is a felt of rhizoids up to 0.5 mm thick anchoring shoots of T. muralis to the surface of the stone. There are hollows on the surface where ooliths have been lost by weathering and rhizoids occupy these hollows. Entry into the stone, and the preferred pathway through it, is through the relatively soft ooliths. Within the ooliths the rhizoids are much branched and embrace the mineral contents to create a crumb-structure. In the crystalline matrix the rhizoids are little branched. The morphology of the subterranean system of rhizoids is moulded by the structure of the stone.

W.G. CHALONER (Bedford College, London): Two noteworthy fossil Bryophytes.

Bryophytes are not a prominent feature in the fossil record of plants. Their structure, typical habits of growth and habitats all militate against their becoming fossilized in any of the "conventional" preservation states of plant fossils. None the less, over the last two decades our knowledge of fossil bryophytes has increased enormously and their fossil representatives now make a significant contribution to our picture of the evolution of this group.

Two very different fossil bryophytes were demonstrated - one a moss, one a liverwort. The moss was Protosphagnum nervatum Neuburg, from the Upper

Permian of the Kuznetsk Basin, USSR. The specimen demonstrated was from an oil boring. This moss has leaves with two types of cells comparable to those of living Sphagnum (some apparently dark - ?chlorophyllous cells, others paler). These, as in Sphagnum, were formed in groups of three producing a Sphagnum-like lattice appearance. But the areolation lacks the regular ratio of one hyaline cell to two chlorophyllous cells, typical of the living genus. The Permian moss also differs from Sphagnum in having a nerve in the leaf. This fossil seems to carry the record of the Sphagnales back some 200 million years. However, as Watson (1964) has aptly remarked "how far the leaf cell pattern is exactly that of Sphagnum, and how far it is something superficially very like it but fundamentally rather different, may be a matter for debate".

The liverwort, Naiadita lanceolata Buckman, was preserved in a Triassic freshwater limestone outcropping near Bristol. It was long believed to be a Lycopod, until Harris (1939) demonstrated its bryophytic character, showing that the leaves were only one cell thick, lacking stomata and that the plant bore archegonia from which liverwort-like sporophytes developed. Harris showed that Naiadita shared significant features with the living Riella. Naiadita is unique among fossil bryophytes in showing well-preserved detail of both generations of the life-cycle, and expressly, the presence of archegonia. Although it shows similarity to living Sphaerocarpales it is significantly different from any living form.

References

Harris, T.M. (1939). Naiadita, a fossil bryophyte with reproductive organs. Ann. bryol. 12, 57-70.

Watson, E.V. (1964). The Structure and Life of Bryophytes. London.

R. GROLLE (Sektion Biologie, Friedrich-Schiller-Universität, Jena): Three fossil hepatics in Baltic (Samlandic) Amber.

Micrographs were displayed showing three species of fossil hepatics embedded together as a taphocoenosis in a piece of Baltic (Samlandic) amber about 35 million years old. The species were Lejeunea latiloba Caspary, L. pinnata Caspary (Holotype) and Radula sphaerocarpoides Grolle. The specimen of amber is preserved in the Palaeontologisches Museum Berlin (Slg. Kuenow, no. 471). The micrographs were prepared by Dr L. Lepper of Jena, and submitted by Dr R. Grolle.

A.R. PERRY (National Museum of Wales, Cardiff): Some leaves from the BBS Photograph Album.

Photographic portraits were displayed of 50 notable British bryologists, including Robert Braithwaite (1824-1917), William Ingham (1854-1923), David Angell Jones (1861-1936), Hugh Neville Dixon (1861-1944), Miss Eleanora Armitage (1865-1961), William Edward Nicholson (1866-1945), William Robert Sherrin (1871-1955) and Edmund Frederic Warburg (1908-1966). These form part of the BBS photographic archive. Historic shots of the Moss Exchange Club bryologizing near Dolgellau in 1922 on the eve of its transformation into the British Bryological Society and of the gathering of the BBS on the steps of the British Museum (Nat. Hist.) in 1946, the occasion of the 50th anniversary of the founding of the Moss Exchange Club, were amongst a series of photographs taken up to 1980 showing bryologists "in the field".

S.W. GREENE (Department of Botany, University of Reading): **The International Association of Bryologists.**

A wall chart summarized various activities of the Association, i.e. its objectives, its publications and the types of meetings it organises. Examples of its serial publications were displayed, e.g. recent issues of the Bryological Times, the Bulletin of Bryology and the first volume of the Advances in Bryology. Copies of Proceedings of symposia held in Boulder, 1973, Leningrad 1975, Geneva 1979, Vancouver 1980 and Sydney 1981, were also shown, as were other works such as a Guide to Bryological Herbaria of the World (1976), the Directory of Bryologists and Bryological Research ed. 2 (1979) and the biennial supplements to Index Muscorum and Index Hepaticarum which are published in Taxon.

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PHOTOGRAPHIC COMPETITION

by

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The entry was disappointing in numbers, but included some attractive and interesting pictures. Colour slides accounted for the majority of the entries, but there were some pleasing colour prints. William G. Stewart's beautiful print of Buxbaumia aphylla from Canada must surely have aroused pangs of envy in many British bryologists! The fine black-and-white micrographs of Tertiary liverworts preserved in amber, taken by Dr Lepper and sent in by Professor Grolle, though less immediately arresting, will have given many of us pause for thought, and astonishment at the beautiful preservation of this fossil material.

For the most part the colour slides and the remaining prints covered a rather limited range of subject matter - 'portraits' of relatively large and striking bryophytes, mainly mosses, with Polytrichum spp., Grimmia pulvinata and big Sphagnum spp., as obvious favourites. However, these included some technically competent and very pleasing slides. Colour slides are such an ideal medium for recording the general appearance of bryophytes in the field that one might have hoped to see a wider range of subjects and treatment; the possibilities open to a photographically-inclined bryologist are near-endless. Undoubtedly the most intriguing slide submitted was F. Verdonk's close-up of Daltonia angustifolia growing on the back of a weevil from the New Guinea rain forest.

RESULTS:

Slides:

1st	Polytrichum commune	N. Bamforth, Manchester.
2nd	Orthothecium rufescens	R. Walker, Kendal.
3rd	Daltonia angustifolia on weevil	F. Verdonk, sent in by Dr R. Gradstein, Utrecht.

Prints:

1st	Buxbaumia aphylla	William G. Stewart, St Thomas, Ontario.
2nd	Polytrichum juniperinum	T.H. Shepherd, Oxford.
3rd	Fossil hepatics in amber	Dr L. Lepper, sent in by Prof. R. Grolle, Jena.

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FIELD EXCURSION TO BOX HILL, SURREY, 18 SEPTEMBER 1983

by

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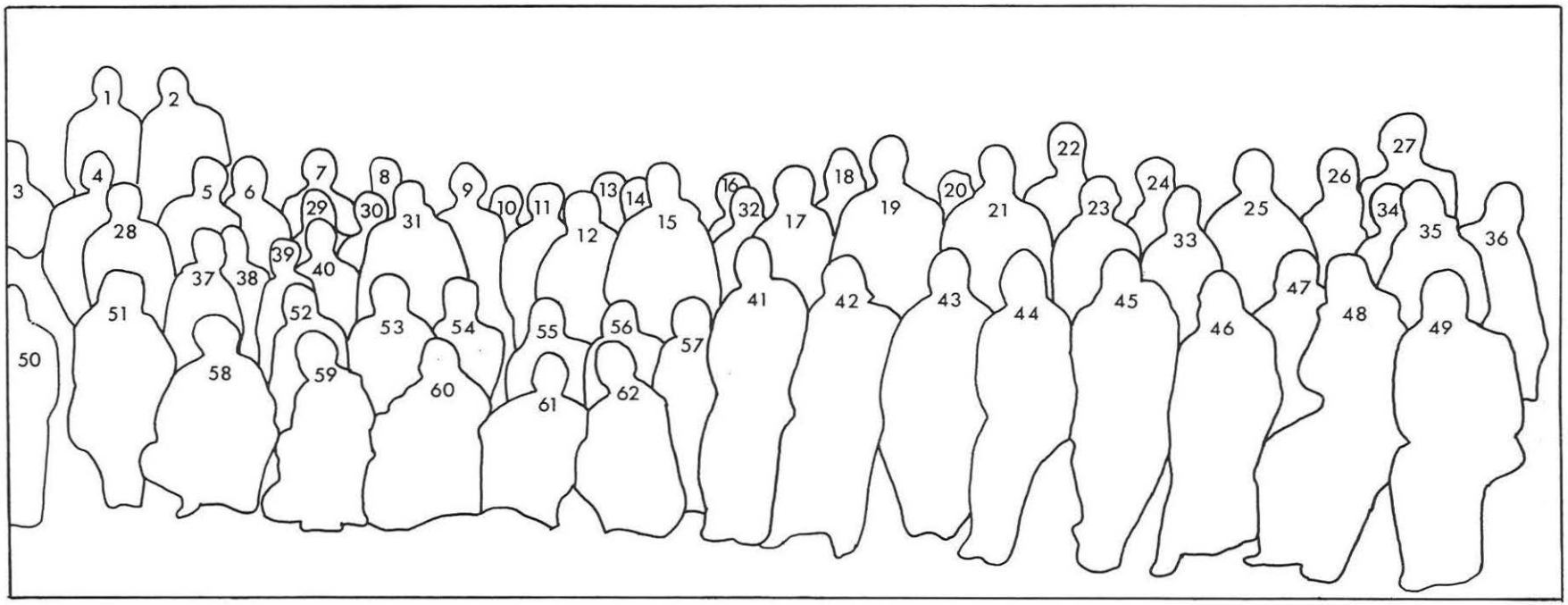
Well over 60 members attended this excursion to Box Hill, which began from the car park at Burford Bridge soon after 11 am with slight rain falling. This, however, eased off by midday, so that photographs were taken during lunch at the summit. So many had wished to take part that the party was split into three groups, the author being assisted by Alan Eddy and Alan Harrington as group leaders. The groups made their way by various paths and met for lunch near the indicator on the south side of the hill. Members had been provided with a hand-out describing the area and the most interesting species likely to be seen.

Those who went along the bank of the River Mole saw epiphytes on tree boles by the water and also Hyophila stanfordensis in two places on the river banks. On the lower part of the river cliff the chalk rubble had some interesting species including Lejeunea lamacerina. The groups that went up the Zigzag valley by various ways saw a little Scapania aspera, Frullania tamarisci, Tortella tortuosa and T. inflexa on lumps of chalk. The wood at the valley head was difficult to work because of the many fallen branches but the Lejeunea was again seen with Dicranum tauricum and D. montanum, whilst in the turf above Thuidium delicatulum was found; it occurred only sparingly owing to an increase in the grass Brachypodium pinnatum.

After lunch we made our way through the beech woods covering the clay of the plateau towards Juniper Top, seeing by the way Orthodontium lineare in abundance on tree boles. Juniper Top is a wide open expanse of chalk turf with views to the north of Mickleham Downs woods, Juniper Hall down in the valley and Norbury Park behind. Frullania tamarisci was in poor condition doubtless because of the recent drought, but there were many spikes of the orchid Spiranthes spiralis and flowers of Campanula glomerata dotted about. The wall in Headley Lane carried as usual some beautiful patches of Porella platyphylla and here was seen Oxystegus sinuosus. All enjoyed an excellent repast at tea in Juniper Hall; and so ended a most pleasant day.



1. R.C. Stern: 2. E.C. Wallace: 3. C.D. Preston: 4. P.E. Jackson: 5. J. Cowan: 6. D.G. Long: 7. C.R. Stevenson: 8. P.J. Wanstall: 9. R.W.M. Corner: 10. R. Beckett: 11. E.W. Jones: 12. S.W. Greene: 13. P. Martin: 14. D.T. Streeter: 15. : 16. P.W. Richards: 17. E.V. Watson: 18. H. Bischler: 19. R. Schumacker: 20. A. Causse: 21. G.C.S. Clarke: 22. P.J. Lightowlers: 23. G.G. Geyman: 24. G. Bloom: 25. M.W. van Slageren: 26. R.E. Longton: 27. R.N. Gutteridge: 28. : 29. M.A.S. Burton: 30. J.A. Paton: 31. R. Walker: 32. : 33. M.E. Newton: 34. J.D. Gutteridge: 35. A. Kelham: 36. A. Conolly: 37. Cowan child: 38. Cowan child: 39. Cowan child: 40. Mrs J. Cowan: 41. M.C.F. Proctor: 42. M. Rejdali: 43. H.L.K. Whitehouse: 44. A.E. Newton: 45. B.J. O'Shea: 46. V. Williams: 47. P.J. Port: 48. P.H. Pitkin: 49. J.D. Sleath: 50. R.P. Libbey: 51. J. Watson: 52. G.A.M. Scott: 53. F.J. Rumsey: 54. C.J. Miles: 55. K.M. Cocking: 56. J. Ide: 57. A. Richards: 58. S.R. Gradstein: 59. Mrs S.R. Gradstein: 60. A. Harrington: 61. A. Eddy: 62. (Photograph courtesy S.L. Jury.)

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MEMBERS AND GUESTS ATTENDING THE JUBILEE MEETING

It was gratifying that over 100 members and guests were present at the Jubilee Meeting. The Society was particularly pleased to welcome a number of special guests representing our hosts, Bedford College, and related botanical societies. Also present were five Honorary Members of the BBS (who were also Past Presidents), Mrs J. Appleyard, Dr E.W. Jones, Prof P.W. Richards, Mr E.C. Wallace and Dr E.V. Watson, three other Past Presidents, Mrs J.A. Paton, Mr A.C. Crundwell and Dr S.W. Greene, and eleven visitors from overseas.

Special Guests
Mrs M. Briggs, Botanical Society of the British Isles
Prof and Mrs W.G. Chaloner, Bedford College, London
Dr D.F. Cutler, Linnean Society of London
Prof J. Dodge, British Phycological Society
J. Laundon, British Lichen Society
Dr S.J. Waters, Bedford College, London

Members and Guests
Dr K.J. Adams, North East London Polytechnic
R.W. Alexander, Trinity College, Dublin
Mrs J. Appleyard, Wells, Somerset
Prof L.J. Audus, Bedford College, London
A.D. Banwell, Nottingham
Dr J.W. Bates, Imperial College Field Station, Silwood Park
R. Beckett, University of Bristol
B.G. Bell, Institute of Terrestrial Ecology, Penicuik
Dr H. Bischler, Laboratoire de Cryptogamie, Paris
G. Bloom, Abingdon, Oxfordshire
F. Brightman, West Dulwich, London
Dr M.A.S. Burton, East Malling, Kent
R. Carpenter, Ryde, Isle of Wight
A. Causse, Paris
Dr A. Christie, Southport, Merseyside
Dr G.C.S. Clarke, British Museum (Natural History), London
Mrs K.M. Cocking, Stockport, Cheshire
Miss A. Conolly, University of Leicester
Mrs A.S. Corley, Faringdon, Oxfordshire
M.F.V. Corley, Faringdon, Oxfordshire
Dr R.W.M. Corner, Penrith, Cumbria
Dr J. Cowan, King's College, University of London
A.C. Crundwell, Headley Down, Hampshire
A. Eddy, British Museum (Natural History), London
Mrs S.E. Edwards, Manchester
Dr S.R. Edwards, Manchester Museum
G. Een, Stockholm, Sweden
Mrs P. Een, Stockholm, Sweden
L.T. Ellis, British Museum (Natural History), London
R.J. Fisk, Tarporley, Cheshire
O.B.J. French, Ashtead, Surrey
J.C. Gardiner, London

G.G. Geyman, Woodford Green, Essex
M.M. Grace, Epping, Essex
Dr S.R. Gradstein, Utrecht, Netherlands
Mrs S.R. Gradstein, Utrecht, Netherlands
Dr S.W. Greene, University of Reading
Mrs J.D. Gutteridge, Caterham, Surrey
R.N. Gutteridge, Caterham, Surrey
Dr A.J. Harrington, British Museum (Natural History), London
Dr R.C. Hayter, Liverpool, Merseyside
Mrs R.C. Hayter, Liverpool, Merseyside
Dr M.O. Hill, Institute of Terrestrial Ecology, Bangor
Mrs M.O. Hill, Bangor, Gwynedd
Dr J.G. Hughes, University of Aston in Birmingham
Miss J. Ide, Eltham, London
Dr P.E. Jackson, Stamford, Lincolnshire
Dr E.W. Jones, Kirtlington, Oxford
M.P. Jones, Chelsea College, London
Dr S.L. Jury, University of Reading
Mrs A. Kelham, Witcombe, Gloucester
Prof D.H. Lewis, University of Sheffield
R.P. Libbey, King's Lynn, Norfolk
P.J. Lightowlers, Institute of Terrestrial Ecology, Penicuik
Dr D.W. Lindsay, Maldon, Essex
D.G. Long, Royal Botanic Garden, Edinburgh
Dr R.E. Longton, University of Reading
Miss S.V. McAdam, University of Aberdeen
M.G. McFarlane, Hastings, Sussex
P. Martin, Bristol
C.J. Miles, University of Reading
Mrs M. Milnes-Smith, London
Miss A. Newton, Yetminster, Dorset
Dr M.E. Newton, University of Manchester
B.J. O'Shea, London
Mrs J.A. Paton, Truro, Cornwall
V.S. Paton, Truro, Cornwall
R.J. Perkins, Carlton, Nottinghamshire
A.R. Perry, National Museum of Wales, Cardiff
Dr P.H. Pitkin, Nature Conservancy Council, Edinburgh
P.J. Port, Kington, Herefordshire
Dr C.D. Preston, Institute of Terrestrial Ecology, Huntington
Dr M.C.F. Proctor, University of Exeter
M. Rejdali, University of Reading
Prof P.W. Richards, Cambridge
Mrs S.A. Richards, Cambridge
Dr F. Rose, Petersfield, Hampshire
F.J. Rumsey, University of Reading
Prof R. Schumacker, University of Liège, Belgium
D.J. Scott, Peterborough
Dr G.A.M. Scott, University of Monash, Australia
J.D. Sleath, Watford, Hertfordshire
A.C. Smith, Diss, Norfolk
Mrs J.E. Smith, Esher, Surrey
Mrs M.A. Stanley, Cambridge
Dr P.E. Stanley, Cambridge
R.C. Stern, Arundel, Sussex
C.R. Stevenson, King's Lynn, Norfolk
Dr D.T. Streeter, University of Sussex
C.T.W. Tipper, Hemel Hempstead, Hertfordshire
Dr M.W. van Slageren, Utrecht, Netherlands
M.D. Vickers, Skye, Scotland

Mrs M.E. Vickers, Skye, Scotland
R. Walker, Kendal, Cumbria
E.C. Wallace, Sutton, Surrey
M. Walpole, Loughborough, Leicestershire
Mrs M. Walpole, Loughborough, Leicestershire
P.J. Wanstall, Queen Mary College, University of London
Dr S. Watkinson, University of Oxford
Dr E.V. Watson, Goring on Thames, Berkshire
Mrs J. Watson, Goring on Thames, Berkshire
Dr H.L.K. Whitehouse, University of Cambridge
H. Williams, Ontario, Canada
Mrs V.A. Williams, Abergavenny
R.G. Woods, Nature Conservancy Council, Newbridge on Wye, Powys
Mrs M.F. Youlten, London

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SYSTEMATICS ASSOCIATION TRAINING COURSE IN BRYOPHYTE TAXONOMY

by

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and

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A training course in bryophyte taxonomy, sponsored by the Systematics Association and organized for the British Bryological Society by the authors, was held at Manchester University from 2 - 9 September 1983 as part of the BBS Diamond Jubilee programme. It was gratifying that 23 students participated in the course, a figure close to our upper limit of 25. The students included a fair mix of amateur bryologists and professionals from universities and museums. Several were from overseas, and a number of other foreign applicants were unfortunately unable to attend either because of problems of funding or because of excessive postal delays.

We were most fortunate in having Dr A.J.E. Smith, University College of North Wales, Bangor, and Dr M.O. Hill, Institute of Terrestrial Ecology, Bangor, as our principal guest tutors. They enabled us to cover almost all the major aspects of bryophyte taxonomy and Dr Hill's considerable field experience was much appreciated during an excursion to Monk's Dale. We were also grateful to Mr C.V. Horie and Mr C.W.A. Pettitt for their valuable contributions on herbarium techniques and data banking.

The course evolved somewhat as it progressed. The final programme is indicated in Table 1 which shows the wide range of topics covered. The day-time sessions were essentially practical and were held in laboratories in the Department of Botany. The evening sessions consisted of lectures at Hulme Hall, a University residence where most of the students were staying. In addition to the topics indicated in Table 1, the course also featured

TABLE 1: The programme.

Day	Time	Topic	Instructors
Friday	Evening	Introduction. Collection of bryophytes	SRE
		Dissection and preparation of material for identification	MEN/SRE
		Identification	MEN
Saturday	Morning	Field excursion to Ashworth Valley, Lancashire.	MEN/SRE
	Afternoon	Dissection, with emphasis on sectioning and its role in bryophyte systematics	MEN/SRE
	Evening	Herbarium curation	SRE
		Conservation of collections	CVH
		Data banking for herbaria	CWAP
Sunday	Day	Identification of mosses and liverworts	MEN/SRE
	Evening	Taxonomic revision	MEN/SRE
		Cytology in bryophyte systematics	MEN
Monday	Day	Field excursion to Monk's Dale, Derbyshire	MOH/MEN/SRE
	Evening	Numerical techniques	MOH
Tuesday	Day	Taxonomy and identification of Sphagnum	MOH
	Evening	Experimental taxonomy and bryophyte nomenclature	AJES
Wednesday	Morning	Axillary hairs and other under-utilized sources of taxonomic data	MOH
	Afternoon	Construction and use of keys	AJES
	Evening	The moss peristome as a source of systematic data	SRE
		Isozymes as markers in bryophyte systematics	MEN
Thursday	Day	Taxonomy and identification of liverworts	AJES
		Variation among moss bulbils	MEN
	Evening	Bryophyte photography	SRE
		Distribution mapping	AJES
		Concluding discussion	

cytological demonstrations (MEN) and visits to the Manchester Museum Computer Cataloguing Unit (CWAP) and Herbarium (SRE), presented to the students in small groups.

We formed the impression that the students gained much useful experience and information from the course, and recommend that comparable courses be organized in the future, perhaps at five- or ten-year intervals.

We wish to thank Manchester University for providing laboratory facilities, and the Systematics Association for generous financial support, including the provision of a number of student bursaries