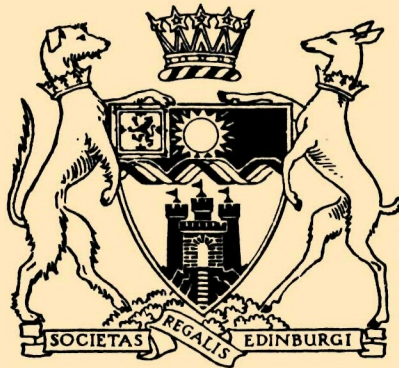


# THE ROYAL SOCIETY OF EDINBURGH



## PROCEEDINGS

Section **B** (Biological Sciences)

ISSN-0308-2113

PUBLISHED BY THE ROYAL SOCIETY OF EDINBURGH  
22 GEORGE STREET, EDINBURGH EH2 2PQ

1985

## EDITORIAL BOARD

W. W. FLETCHER  
University of Strathclyde

W. C. BOWMAN  
University of Strathclyde

J. MORTON BOYD  
Nature Conservancy Council

R. I. CURRIE  
Dunstaffnage Marine Research  
Laboratory, Oban Argyll

J. COOK  
Eastern General and Leith Hospitals,  
Edinburgh

G. J. F. DUTTON  
University of Dundee

A. E. H. EMERY  
University of Edinburgh

C. H. GIMINGHAM  
University of Aberdeen

J. C. GOULD  
Central Microbiological Laboratory,  
Western General Hospital, Edinburgh

R. M. S. SMELLIE  
*General Secretary*  
Royal Society of Edinburgh

J. HAWTHORN  
University of Strathclyde

D. M. HENDERSON  
Royal Botanic Garden, Edinburgh

G. D. HOLMES  
Forestry Commission, Edinburgh

F. T. LAST  
Institute of Terrestrial Ecology,  
Bush Estate, Penicuik

A. M. MACLEOD  
Edinburgh

P. S. MAITLAND  
Institute of Terrestrial Ecology, Edinburgh

R. J. ROBERTS  
University of Stirling

K. VICKERMAN  
University of Glasgow

A. C. WARDLAW  
University of Glasgow

W. H. RUTHERFORD  
*Executive Secretary*  
Royal Society of Edinburgh

PROCEEDINGS  
OF THE  
ROYAL SOCIETY OF EDINBURGH

PROCEEDINGS  
OF  
THE ROYAL SOCIETY  
OF EDINBURGH

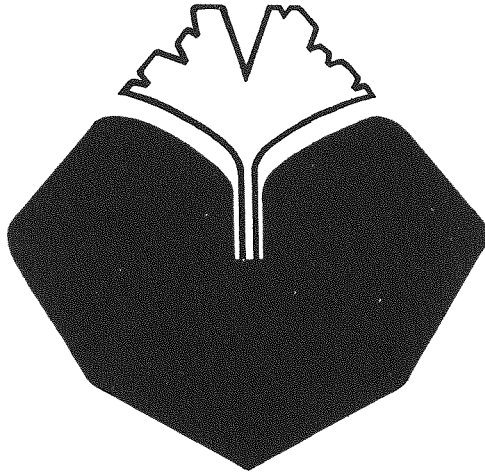
Section B (Biological Sciences)

Vol. 86

1985

PUBLISHED BY  
THE ROYAL SOCIETY OF EDINBURGH  
22 GEORGE STREET  
EDINBURGH EH2 2PQ

1985



# BIOLOGY OF PTERIDOPHYTES

Edited by A.F. DYER & C.N. PAGE

Proceedings of the Symposium held at Edinburgh , Sept. 12 - 16 , 1983 .

## Contents

Foreword by A. F. DYER	xi
<b>Pteridophyte Biology—the Laboratory Approach</b>	
Introduction: the essential role of the Pteridophyta in the study of land plants by P. R. BELL	1
Cytology of germination of spores of homosporous ferns by V. RAGHAVAN	5
Photocontrol of spore germination and elementary processes of development in fern gametophytes by MASAKI FURUYA	13
Genetics of gametophyte development by LESLIE G. HICKOK	21
Gametogenesis: the playground of the developmental cytologist by C. C. J. MILLER, J. G. DUCKETT and B. KIRKHAM	29
Physiology and biochemistry of pteridophytes by JOHN A. RAVEN	37
<b>Cellular Aspects of Reproduction</b>	
Cellular aspects of the initiation of aposporous outgrowths in ferns by E. SHEFFIELD	45
An investigation of the molecular events during spermatogenesis in <i>Marsilea vestita</i> (synopsis only) by K. P. VONDY, P. R. BELL and J. S. HYAMS	51
A light and electron microscopic study of microsporogenesis in <i>Azolla microphylla</i> by Y. R. HERD, E. G. CUTTER and I. WATANABE	53
Some aspects of agamospory in ferns—the Braithwaite system by TREVOR G. WALKER	59
Mutations, apical cells and vegetative reproduction by EDWARD J. KLEKOWSKI, Jr	67
Action and phylogeny of antheridiogens by H. SCHRAUDOLF	75
<b>Environmental and Biotic Interactions</b>	
Water relations and xylem anatomy of ferns by A. C. GIBSON, H. W. CALKIN, D. O. RAPHAEL and P. S. NOBEL	81
Towards an appreciation of fern edaphic niche requirements by RAYMOND L. PETERSEN	93
Spores of myrmecophytic ferns by ALICE F. TRYON	105

Spore filaments in the ant-fern <i>Lecanopteris mirabilis</i> —an alternative viewpoint by TREVOR G. WALKER	111
Rusts and other fungal parasites as aids to pteridophyte taxonomy by ALAN P. BENNELL and DOUGLAS M. HENDERSON	115
Interaction between bracken and its insect herbivores by J. H. LAWTON and M. MACGARVIN	125
Evidence of pteridophyte-arthropod interactions in the fossil record by A. C. SCOTT, E. G. CHALONER and S. PATERSON	133
Distribution and ecology of early ferns by ANDREW C. SCOTT and JEAN GALTIER	141
<b>The Biology of Economic Ferns</b>	
The edible fiddlehead- <i>Matteuccia struthiopteris</i> (Ostrich fern) (synopsis only) by P. VON ADERKAS	151
Studies on the physiology and propagation of the ostrich fern, <i>Matteuccia struthiopteris</i> by ROBERT K. PRANGE	153
Advances in Chinese research on <i>Azolla</i> by THOMAS A. LUMPKIN	161
Solar-powered N <sub>2</sub> fixation in ferns: the <i>Azolla-Anabaena</i> symbioses by G. A. PETERS, D. KAPLAN and H. E. CALVERT	169
Recent studies on the biology of bracken and the mode of action of herbicides used in its control by R. C. KIRKWOOD and ANNE HINSHALWOOD	179
Recent studies on the potential for biological control of bracken using fungi by M. N. BURGE and J. A. IRVINE	187
<b>Cellular Aspects of Development: Germination and Cell Division</b>	
Mobilisation of storage reserves during fern spore germination by A. E. DEMAGGIO and D. A. STETLER	195
Mobilisation of carbohydrates during germination of spores of <i>Onoclea sensibilis</i> L. by LESLIE R. TOWILL	203
Asymmetric cell division and differentiation; fern-spore germination as a model I. Physiological aspects by JOHN H. MILLER	213
Asymmetric cell division and differentiation; fern-spore germination as a model II. Ultrastructural studies by ALIX R. BASSEL	227

Photoresponses in cell regulation by MASAMITSU WADA	231
The apical cell of fern roots and shoots: an appraisal of its functional role in development by ERNEST M. GIFFORD	237
<b>Ecology and Diversification</b>	
Observations on the ecology of hybridisation in the clubmosses (Lycopodiaceae) by BENJAMIN ØLLGAARD	245
Geography and ecology of Indian clubmosses by P. S. PANDEY	253
Speciation and hybridisation in North American quillworts by W. CARL TAYLOR, NEIL. T. LUEBKE and MARY B. SMITH	259
Ecology and geography of hybridisation in British and Irish horsetails by C. N. PAGE and MARIAN A. BARKER	265
Evidence for interspecific hybridisation in pteridophytes with subterranean mycoparasitic gametophytes by W. H. WAGNER, Jr and F. S. WAGNER	273
Nucleic acid comparisons as a tool in understanding species interrelationships and phylogeny by DIANA B. STEIN	283
Diversification of early ferns by JEAN GALTIER and ANDREW C. SCOTT	289
A Malesian viewpoint by R. E. HOLTUM	303
Population dynamics of woodland <i>Dryopteris</i> in Britain by A. WILLMOT	307
Pteridophyte evolutionary biology: the electrophoretic approach by CHRISTOPHER H. HAUFLER	315
Speciation in relation to edaphic factors in the <i>Asplenium adiantum-</i> <i>nigrum</i> group by ANNE SLEEP	325
Hybridisation in Costa Rican <i>Polystichum</i> by DAVID S. BARRINGTON	335
Ecological aspects of distribution and speciation in Old World tropical ferns by B. S. PARRIS	341
Ecology of some neotropical hybrid pteridophytes by LUIS D. GÓMEZ-P.	347



Fern speciation and biogeography by ROLLA TRYON	353
<b>Pteridophyte Biology—the Field Approach</b>	
Independent fern gametophytes in the wild by D. R. FARRAR	361
Life-history studies of ferns: a consideration of perspective by MICHAEL I. COUSENS, DEBORAH GRIMM LACEY and EUGENE M. KELLY	371
Altitudinal zonation of pteridophytes in Papuaia by R. J. JOHNS	381
Adaptive strategies of African pteridophytes to extreme environments by JAN KORNÁS	391
Anti-predation strategies in pteridophytes—a biochemical approach by GILLIAN COOPER-DRIVER	397
Factors limiting the contribution of pteridophytes to a local flora by J. P. GRIME	403
Pteridophyte success and past biota—a palaeobotanist's approach by B. A. THOMAS	423
Conservation of pteridophytes by LUIS D. GÓMEZ-P.	431
Conservation of pteridophytes: a postscript by DAVID R. GIVEN and A. CLIVE JERMY	435
Epilogue—pteridophyte biology: the biology of the amphibians of the plant world by C. N. PAGE	439

*(Issued 31 May 1985)*