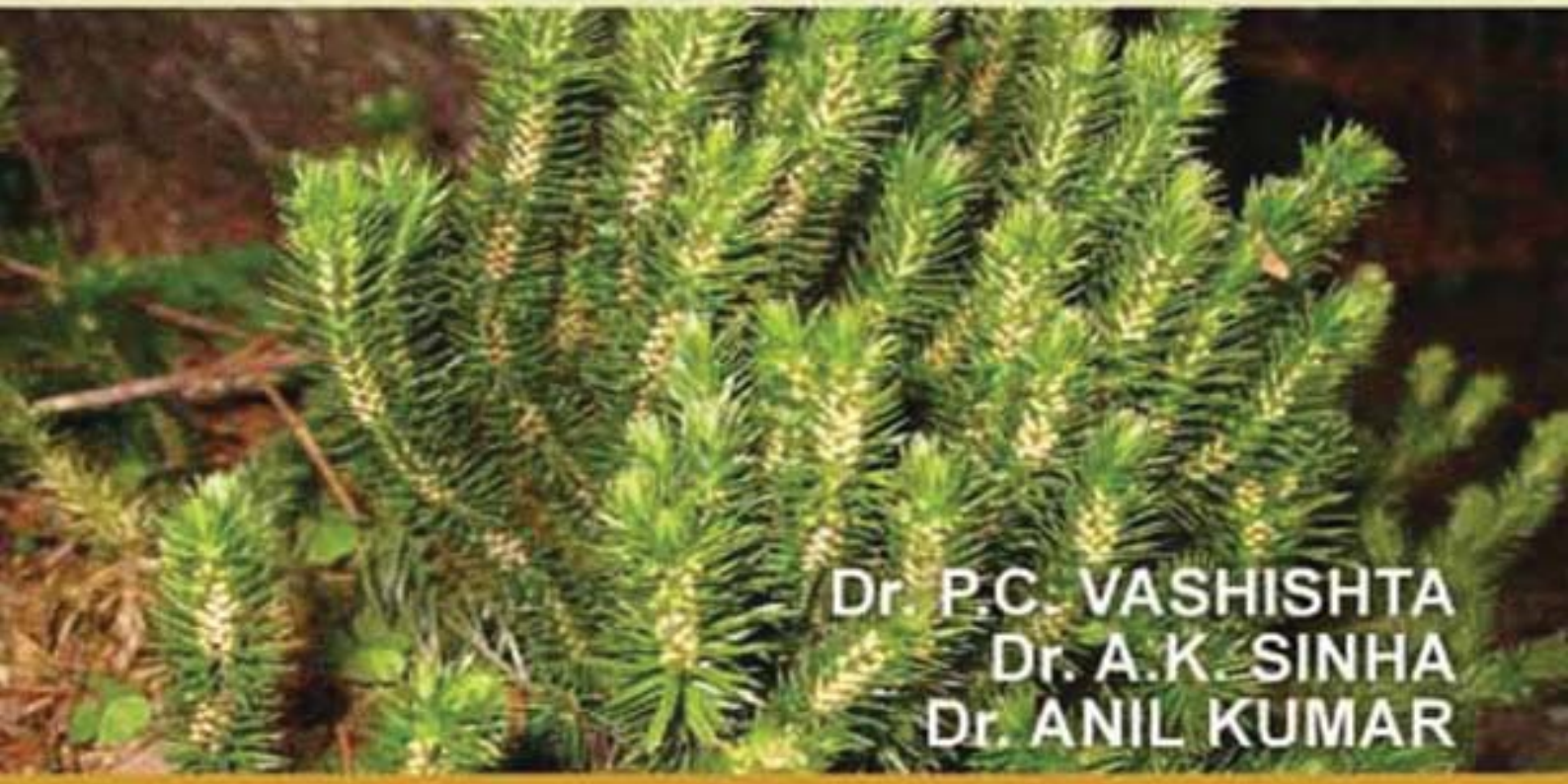
BOTANY
FOR DEGREE STUDENTS
PTERIDOPHYTA
(Vascular Cryptogams)





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S. CHAND

MULTICOLOUR ILLUSTRATIVE EDITION

Botany for Degree Students

Pteridophyta

(Vascular Cryptogams)

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Preface to the Revised Edition

We take pleasure to present this thoroughly revised and improved multicoloured edition of the popular book ***Botany for Degree Students–*** **'PTERIDOPHYTA'** by **Dr. P.C. VASHISHTA** for the benefit of both undergraduate students as well as those pursuing post-graduate courses. While the original format of the book remains unchanged, efforts have been made to make the book examination oriented, student friendly and more useful by adding the topics generally asked in the university examinations.

The book has been thoroughly revised re-read and improved. In chapter 1, we have added a brief account of recent advances in Pteridology. A new chapter under the heading '*General Discussion*', has been added. In this chapter, a few fossil pteridophytes, not described in earlier chapters, have been described. In addition, topics on Biotechnology and tissue culture studies in pteridophytes, Economic importance and Diversity and distribution of Pteridophytes have also been added. All the diagrams have been redrawn and several new and accurate diagrams have been added. As per the new format of question papers, all the three types of questions—essay type, short answer type and objective types—have been added.

During the course of the revision of this book we have been guided, assisted and helped by a large number of university and College professors. A few undergraduate and post-graduate students too offered their suggestions for the improvement and usefulness of the book. We have tried to incorporate all these suggestions. To each one of them, we offer our most sincere gratitude and thanks.

We are grateful to Shri Ravindra Kumar Gupta, Managing Director, Shri R.S. Saxena, Advisor, Shri Navin Joshi, General Manager (S & M), Dr. (Mrs) Swati Lohani, (Freelance Editor) and Mr. Shishir Bhatnagar, Senior Coordinator, S. Chand & Co. Ltd., New Delhi for their help and Cooperation in bringing out the book in the present form.

We hope that this revised and multi coloured improved edition of the book will prove much more useful to all its users. Suggestions and Criticisms for the improvement of this book will be gratefully acknowledged and included in the next edition.

A. K. SINHA
ANIL KUMAR

Preface to the First Edition

The study of vascular cryptogams forms an essential part of our syllabi for both undergraduate and post-graduate students. It is an interesting assemblage of plants that inhabited land for the first time and became established to a terrestrial mode of life. Their study reveals a striking array of characters that speak of their antiquity as early land plants. This book is designed so as to acquaint the students with the structure and reproduction of these remarkable vascular, but seedless plants.

The book, in its present form is meant for the degree students and covers the syllabi of most of the Indian Universities. It was decided to give a detailed account of the structure and reproduction of the representative types of vascular cryptogams so as to equip the undergraduates with a thorough information about them. Without such an information it is impossible to follow a comparative account and a generalised treatment of the subject at advanced levels. With this idea in mind the author deviated from the trend of giving brief life history descriptions that do not satisfy the inquisitive students. Tremendous amount of research has been carried, during the past twenty-five years or so, on the various aspects of these lowly organised vascular plants and many new and interesting facts have been brought to our knowledge. With the increase in the knowledge of the fossil history of the group some newer interpretations regarding the conquest of land and origin of vascular cryptogams have been advanced. Most of these hypotheses have been dealt with in Chapter One. Lot of experimental work has been done and is being done on the problems of apospory and apogamy. Interesting results have been obtained as a result of studies on tissue culture in India and abroad. A brief discussion on these topics has been included in the first chapter. Such an information is necessary for the students so as to equip them with modern trends in the subject. These valuable informations are given in the research papers that are not easily available to the students. Their brief description in the book will certainly go a long way to enhance the horizon of knowledge of the students in the colleges. Lot of additional information is incorporated in the chapters dealing with the life histories of representative types. This has added to the volume of the chapters concerned. The author has also deviated, at certain places, from old text book versions of some topics. This was necessitated on account of some recent work on these topics and newer interpretations. The authority and the year of publication have been quoted in all such cases.

This book is not an outcome of author's original research but is a compilation work incorporating the researches of the pteridologists in India and abroad. The matter has been compiled from standard texts, reviews, monographs and research journals in a manner suitable to the degree students. The language of the book is

simple and easily understandable. It is profusely illustrated. Most of the figures have been redrawn or adapted from standard books, journals, monographs and research papers. Sources of all such figures have been duly acknowledged in their legends. Some figures have been drawn from actual specimens and prepared slides. These were drawn with the help of Camera Lucida or otherwise, by the author himself.

A short bibliography has been given at the end. It includes some of the recent publications; but is in no way a complete and a comprehensive compilation as is not needed for such an elementary type of book. To save space titles of papers have been omitted and only the names of the authors, years of publication and the names of journals have been given.

The author wishes to express his indebtedness to the authors and the publishers of standard texts, monographs, research journals and reviews from where the matter of this book has been compiled. The eminent among the authors who deserve special mention are D.H. Campbell; F.O. Bower; D.H. Scott; C.W. Wardlaw; Elizabeth, G. Cutter; I. Manton; P.N. Mehra; T.S. Mahabale; H.Y. Mohan Ram; D.W. Bierhorst; A. Arber; H.C. Bold; H.N. Andrews; G.M. Smith and K.R. Sporne.

My sincerest thanks go to Prof. B.R. Vasishta; Dr. S.S. Bir (Prof. of Botany, Punjabi University, Patiala). Dr. S.C. Verma (Reader in Botany, Punjab University, Chandigarh), Dr. D.S. Loyal (Reader in Botany, Punjab University, Chandigarh) and Dr. H.K. Palta (Lecturer in Botany, Punjab University, Chandigarh) who gave me all help in the form of suggestions and lending me some of their recent publications on the subject. To my class fellows Prof. R.P. Sood (Ramgarhia College, Phagwara), Prof. V.P. Chadha (Government College, Ludhiana), Prof. M.S. Sethi (Government College, Hoshiarpur) and Prof. B.N. Sood (G.M.N. College, Ambala Cantt.), I am indebted for many useful suggestions that they offered to make the book a success. I must thank my colleagues in the department, Shri P.S. Gill (Senior Lecturer in Botany) and Shri S.S. Sekhon for their thought-provoking discussions. I am grateful to my old student Shri T.N. Lakhanpal (Lecturer in Botany, Hans Raj College, Delhi) for going through a portion of the manuscript. Appreciation is also due to Shri Sarban Singh for undertaking the arduous task of typing the manuscript and to Shri Muni Lal Verma for taking great pains in drawing the figures. Last but not the least I offer my thanks to my publishers particularly Shri Shyam Lal Gupta and Shri Rajinder Kumar Gupta for bringing out this volume.

It is a sincere request to my colleagues all over India to point out the defects and give useful suggestions to improve the book.

Government College
Chandigarh,
January, 1971

P.C. VASHISHTA

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To Shri Muni Lal Verma of Amritsar, the author is grateful for taking keen interest in drawing sketches for this book. It is a pleasure to record my sincerest gratitude to late Shri Shyamlal Gupta, of S. Chand & Co. for bringing out the present edition in a new and attractive format.

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FERTILE SPIKES

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Introduction

The word cryptogams is a synthesis of two Greek terms ***kruptos*** meaning '***hidden***' and ***gamos*** meaning '***wedded***'. This single term encompasses all plants that reproduce by means of spores and, do not produce seeds. The algae, fungi, bryophytes and pteridophytes are all cryptogams. The pteridophyta are treated as vascular cryptogams as they have a well developed conducting system. They form the subject-matter of this book. The lower cryptogams (algae, fungi and bryophyta) have no conducting system. The term pteridophyta also has a Greek origin. ***Pteron***

means a "feather" and the name was originally given to this group because of their pinnate or feather-like fronds. ***Vascular cryptogams are, therefore, an assemblage of seedless vascular plants that have successfully invaded the land and reproduce by means of spores***.

The Pteridophytes formed a dominant part of earth's vegetation in the historic past (Two hundred eighty to two hundred thirty million years ago). In the present day flora, excluding the non-vascular plants, they rank only next to the spermatophytes. Although they have been largely replaced by the spermatophytes in the modern day flora, yet they occupy an important and a crucial central position in the evolutionary history of the plant kingdom. No doubt lesser in number, the pteridophytes lend a distinct charm and physiognomy to the landscape. The elegant tree ferns of the warm humid forests of eastern Himalayas, Pachmahri and Nilgiri hills, the epiphytic ferns and the hanging club-mosses of the tropical forests attract ones attention. The lithophytic and terrestrial forms that grow in comparatively larger numbers are also a source of great attraction because of their beautiful foliage. Some of them (about a dozen species) grow in water and form a luxuriant hydrophytic component of the lakes (***Salvinia***), ponds and pools (***Azolla***, ***Marsilea***). In India about five hundred species of fern allies have been reported. Dixit (1984) has raised the number to one thousand.

Salvinia

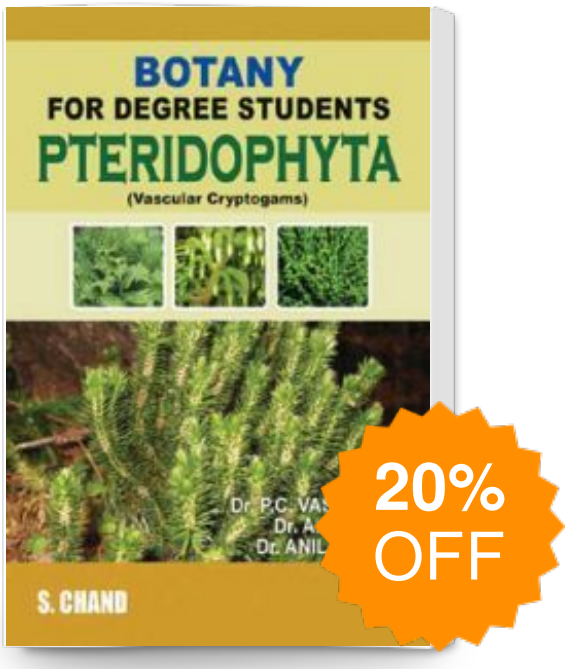
Azolla

The Pteridophyta have a long fossil history. Their first traces were recognised in the Silurian period of the late Paleozoic age (about 400 million years ago). They flourished well during Devonian, Mississippian and Pensylvanian periods of the late Paleozoic. ***Late Paleozoic can easily be regarded as the "Age of Pteridophyta."*** The tree ferns, giant horsetails and arborescent lycopods dominated the swampy landscapes of those ancient ages. The present-day lycopods (***Lycopodium***, ***Isoetes***, ***Selaginella***, ***Phylloglossum***) and Sphenopsids (***Equisetales***) are the mere relicts of the mighty lycopsid and sphenopsid group which once boasted of 120-foot ***Lepidodendron***, ***Sigillaria***, and the colossal ***Calamites.*** Only the present-day ferns have somehow managed to conserve the former stature, diversity and glory of their ancestors. ***Psilotum*** and ***Tmesipteris***, our two surviving remnants of ***Psilopsids*** retain the primitive features of the first land plants.

Lycopodium

Isoetes

Botany For Degree Students Pteridophyta



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