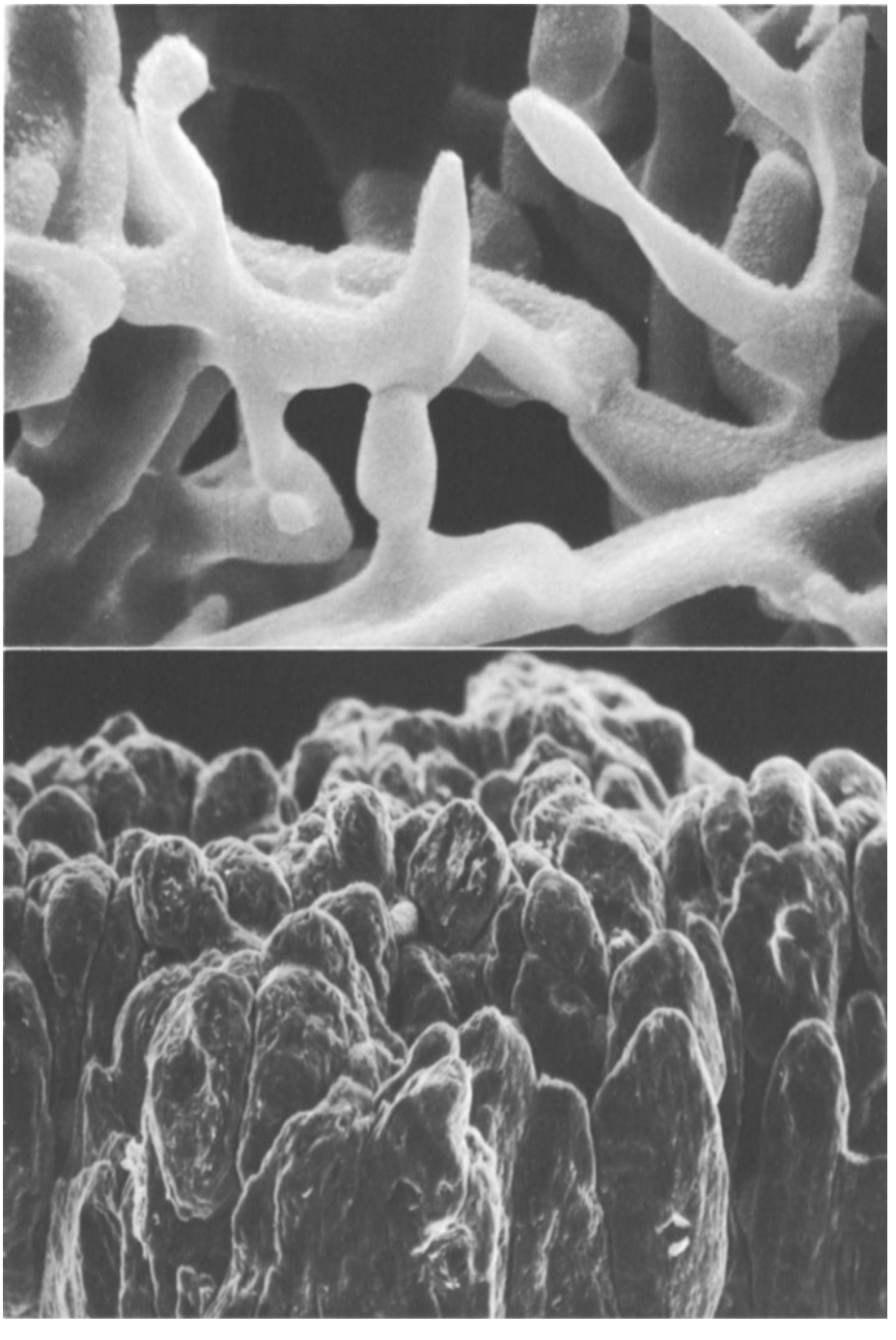
Advanced Series in Agricultural Sciences 6



Precambian fossil plants. Top: *Witwateromyces conidiophorus* (× 5000). Bottom: *Thuchomyces lichenoides* (× 70). (Courtesy of Dr. D. K. Hallbauer)

J. E. Vanderplank

Genetic and Molecular Basis of Plant Pathogenesis

Springer-Verlag
Berlin Heidelberg New York 1978

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With 3 Figures

ISBN-13: 978-3-642-66967-5 e-ISBN-13: 978-3-642-66965-1
DOI: 10.1007/978-3-642-66965-1

Library of Congress Cataloging in Publication Data. Vanderplank, J. E. Genetic and molecular basis of plant pathogenesis. (Advanced series in agricultural sciences; 6) Bibliography: p. Includes index 1. Plant diseases—Genetic aspects. 2. Plants—Disease and pest resistance—Genetic aspects. 3. Plant diseases. 4. Plant proteins. I. Title. II. Series. SB731.V26. 632. 78-7395.

Softcover reprint of the hardcover 1st edition 1978

2131/3130–543210

Preface

As befits a volume in the Advanced Series in Agricultural Sciences, this book was written with problems of practical agriculture in mind. One of the ways of controlling plant disease is by using resistant cultivars; and from the wide literature of genetics and biochemistry in plant pathology I have emphasized what seems to bear most closely on breeding for disease resistance. This has a double advantage, for it happens all to the good that this emphasis is also an emphasis on primary causes of disease, as distinct from subsequent processes of symptom expression and other secondary effects.

The chapters are entirely modern in outlook. The great revolution in biology this century had its high moments in the elucidation of the DNA double helix in 1953 and the deciphering of the genetic code in 1961. This book, so far as I know, is the first in plant pathology to be conceived within the framework of this new biology. Half the book could not have been written 20 years ago, even if there had then been available all the literature that has since accumulated on the genetics and chemistry of plant disease. The new biology is the cement this book uses to bind the literature together.

Another feature of this book is an emphasis on thermodynamics. Here too I have been fortunate in the timing. During the past decade or two there has been a quickened interest in the thermodynamics of protein polymerization, which is directly relevant to the substance of several chapters. As a result, biochemical plant pathology will, I believe, take a renewed interest in such old-fashioned topics as the effect of temperature on disease.

Proteins are at the center of many of the discussions. This is appropriate, because proteins are the prime link between genes and other molecules, the twin topics of this book. Within the phenotype, proteins are the great stores of mutational change and the governors of mutational effects; and in chapter after chapter proteins emerge as the substance of the discussion, simply as the logical consequence of the experimental evidence.

Variation in the disease resistance of the host and in the pathogenicity of the parasite feature largely, both as the expression of mutation and as the substance of disease control by plant breeding. Chapter 1 starts the discussion; correlated variation in host and pathogen is seen as the downfall of many resistant cultivars, and uncorrelated variation as a source of stability in resistance. Variation threads its way through the chapters that follow, until Chapter 9 knits the threads together in a

molecular hypothesis of resistance. The hypothesis is concise, precise, and simple. A great source of confusion about vertical and horizontal resistance has been the lack of a clear chemical explanation of their difference; that explanation is now available.

The final chapter is about biotrophic and necrotrophic processes in parasitism. Nearly a century ago de Bary divided fungi into saprophytes, facultative parasites, and obligate parasites. With various subdivisions and rearrangements, and with reference to necrotrophy and biotrophy, this has been a topic of discussion ever since, without great progress. The fundamental error, I believe, was to try to derive specialized parasitism in the shape of parasitic symbiosis from necrotrophy or from saprophytism. The evidence is, however, that biotrophy and necrotrophy have separate origins, and if this is accepted a fresh understanding of the scope of parasitism is gained. This is not just of academic interest; the choice of the sort of resistance to use in plant breeding is partly determined by biotrophy and necrotrophy.

I am greatly indebted to Dr. D. K. Hallbauer, of the Mining Technology Laboratory of the Chamber of Mines of South Africa Research Organization, for photographs of the precambrian fossil plants *Witwateromyces conidiophorus* and *Thuchomyces lichenoides*.

Pretoria, April 1978 J. E. VANDERPLANK

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