

PREFACE

From Linnaeus to Mendel to Darwin, studies of land plants have been crucial for elucidating basic biological principles. Plant species have been important, in particular, in advancing the study of evolutionary principles, both from classical and modern molecular studies. Despite nearly three centuries of study, there remain several gaps in our understanding of the evolution of morphology in land plants, associated with their prolific diversification over the last ~500 million years.

Current scientific knowledge of land plant morphology, phylogeny, evolutionary mechanisms, and genomic tools can now provide us with a more comprehensive theory for the evolution of plant form. Plant morphological evolution has been studied through paleobotany and phylogenetic analyses, and major morphological innovations in the land plants have been mapped onto phylogenetic trees. Questions about morphological evolution in land plants are being addressed, but there is still a divide between the classical morphologists (who know the questions) and the molecular geneticist (who has new tools to address these questions). Some of these tools include whole genome sequences, functional plant model systems, and knowledge of the transcription factors and regulatory networks underlying plant morphology. Population genetic studies in plants can also elegantly demonstrate how changes at the microevolutionary level lead to differentiation in form, separating plant species. However, to understand morphological innovations in the land plants as well as the molecular basis of morphological evolution in land plants, it is time for the integration of studies in population genetics, adaptation, phenotypic plasticity, ecology, modularity, and development.

Previous books on the evolution of plant form have either focused on morphological evolution in the angiosperms and/or on developmental genetics or population genetics as sole mechanisms of evolutionary change. This volume aims to bring together a range of plant biologists to provide a reference and inspiration for future studies in the evolution of plant form.

This volume covers land plant morphology, mechanisms of evolutionary change, as well as the tools available to help address the evolution of plant form. The first half of the book presents the classic questions on the evolution of plant form. Chapter 1 provides a phylogenetic reference for morphological evolution in the land plants as well as indicates the origins of major morphological innovations in the land plants. Chapters 2–6 provide a more in-depth analysis of morphological evolution within the major land plant groups: bryophytes, ferns, gymnosperms, and angiosperms.

Chapters 7–10 present a range of studies that address mechanisms of evolutionary change and the tools available to address mechanisms of evolutionary change. Chapter 11 provides a synthesis of plant morphology and evolutionary mechanisms to present a more inclusive theory for plant morphological evolution.

Barbara A. Ambrose and Michael Purugganan

