

Book Reviews

Carbon Partitioning: Within and Between Organisms

C.J. Pollock, J.F. Farrar & A.J. Gordon (eds). Bios Scientific Publishers Ltd, Oxford. 1992. xiv+258 pp. Hardback, £43.00. ISBN 1-872748-95-3.

The content of this book is based on a meeting organized by the Environmental Physiology Group of the Society for Experimental Biology, held in April 1992. However, the book is not a mere collection of camera-ready papers. It is properly typeset, contains good quality figures and photographs, and includes a useful index. The reason that the book is reviewed rather late is not delay in publication, since the book was published shortly after the meeting. The delay in reviewing was due to colleagues borrowing the book too often to allow proper reading by me.

The first chapters deal with photosynthetic carbon metabolism and phloem loading. S.C. Huber and colleagues describe the regulation of sucrose synthesis in leaves, especially focusing on the regulation of the activity of sucrose phosphate synthase. Williams and Cobb describe the peculiar phenomenon of chloroplasts in animals: certain marine molluscs acquire and retain functional algal chloroplasts within their digestive cells. In this review the authors present a comparison between the metabolism of the chloroplasts within the alga and within the animal host.

Pathways and mechanism of phloem loading are discussed by van Bel, focusing on minor vein structure and the mode of phloem loading, apoplastic and/or symplastic. In the final chapter of the book the same author, in cooperation with Oparka, suggests a uniform terminology for phloem loading and unloading. Their main point is the discrimination between phloem (un)loading, referring to the whole pathway between mesophyll and sieve element-companion cell (SE-CC) complex, and SE-CC (un) loading, describing the transfer of assimilates between the SE-CC complex and contacting cells only.

Carbon metabolism is described in several chapters, each focusing on a specific aspect or plant organ: the potato tuber, legume nodules, the synthesis of starch. Together, they present an up-to-date overview of many aspects of this crucial physiological process.

According to the title of the book, attention is also paid to the carbon partitioning between organisms: this topic is worked out in four chapters, including the above-mentioned description of chloroplasts in animals, and carbon metabolism in legume nodules.

In the other two chapters carbon exchange between parasitic angiosperms and their host is described, as well as the exchange between a biotrophic fungus (powdery mildew) and its host. The latter chapter would have had a greater impact if the authors had also included other fungal infections, rather than dealing only with their own experimental system.

Regulation of shoot-root ratios in whole plants is modelled by Farrar. His modelling is based on the assumption that sucrose plays a central role in the regulation of shoot-root ratios. Since carbohydrates can have a major effect on water relations of cells and organs, a chapter is devoted to the role of sucrose in water relations.

The book is completed with a description of the advantages of ^{14}C to study assimilate movement in whole plants.

Considering the massive amount of literature on the possible role of hormones in the regulation of assimilate partitioning, it is surprising that the editors did not include a chapter on this topic. Even if it is thought that hormones do not play a major role in the carbon partitioning, as suggested by Farrar, it would have been better to disprove the literature on this topic, rather than omitting the subject.

The book is certainly worth the money for those interested in carbon partitioning in plants.

D. VREUGDENHIL

Principles of Plant Pathology

J.G. Manners. Cambridge University Press, Cambridge. 1993. xii+343 pp. Hardback, £45.00, ISBN 0-521-43402-5. Paperback, £16.95, ISBN 0-521-43564-1.

As the author states in the preface, 'the object of this book is to provide an insight into the principles underlying the study of plant pathology, rather than to act as a manual for the identification and control of specific plant diseases'. To this end, the book is arranged in five parts: the causes of plant diseases, physiology of host-parasite relationships, genetics of host-pathogen interaction, epidemiology, and plant disease control. The subjects are treated in a classical way with particular emphasis on host-pathogen interactions, which take up more than half of the book. Little space is devoted to the disease-causing organisms themselves. For instance, the description of fungi and their life cycles is restricted to only eight pages. This information is hardly sufficient to appreciate the properties of the pathogens in the examples given in later chapters, and it is assumed that the reader has some knowledge of the major groups of

plant pathogens and of the biology of some of the more important diseases of crop plants. In contrast, the infection process, pathogenesis and resistance are described in substantial detail and the author has succeeded here in condensing an enormous amount of information into well-integrated chapters, even though examples are drawn almost exclusively from fungal infections. A glossary of technical terms and an extensive reference list are included. There are relatively few illustrations, for instance only three in the chapter on disease symptoms, and captions are not always sufficiently detailed to be easily understood.

The book provides a wealth of information on the biology of fungal exploitation of host plants. Compared herewith, the treatment of viral pathology is meagre and the insights gained from the more recent application of molecular-biological techniques are hardly considered. Thus, it is disappointing to find in a book on principles of plant pathology ample discussion of phytoalexins but no mention of pathogenesis-related proteins, and in the chapter on plant disease control by non-chemical methods, no reference is made to biotechnological approaches now being taken in many laboratories. The book has merit in treating conventional subjects of plant-fungal interaction in a balanced way, but this second edition has missed the opportunity to integrate the recent developments and to grasp the excitement of applying the new insights to better protect plants from disease.

L.C. VAN LOON

The Africa–South America Connection: Oxford Monographs on Biogeography No. 7

Wilma George and René Lavocat (eds). Clarendon Press, Oxford. 1993. xvii+165 pp. Hardback, UK£35.00, ISBN 0-19-854577-0.

This book contains a number of contributions by different authors on various aspects of the geological history and biogeographical relationships of Africa and South America. The problem addressed is how the distribution of many taxonomic groups in both Africa and South America can be explained.

The first introductory contribution (by Albert E. Wood), dealing with the scientific history of the problem, begins by describing five possible relationships of South American organisms to those on other continents, depending on the geological age. The next two chapters describe the palaeogeography and palaeoclimatic history of the expanding South Atlantic. The fourth contribution (by Simon J. May, Kew, an aroid specialist) is the one that hints at recent methodological developments in biogeogra-

phy, which are lacking in almost all the other chapters. He states that for any historical biogeographic results to be testable, distribution patterns over at least three areas should be considered. However, as the phylogeny of the aroids is so far incompletely known, the author has to restrict himself to comparing generic transatlantic distributions with those across other oceans. The fifth chapter, dealing with acridians, and the eighth, on the origin of the New World monkeys, in particular are examples of traditional biogeography, in which much information, based on higher level taxonomic groups without specified phylogenetic relations is compiled and the data are analysed without any clear explanation of the methodology used. In the next two contributions vertebrate fossil taxa found in both continents are treated. Contribution 9, by Wilma George, is an attempt at a more quantitative analysis including phylogenetic relationships. She deals with the problem of vicariance vs. dispersal and concludes that inevitably dispersal has to be accepted as the underlying mechanism. The last chapter, by the junior editor, summarizes the ideas put forward by various authors, adding his personal conclusions. This book has been published after the death of the senior editor. Her contribution (No. 9) was available, but initially no trace could be found of the planned introductory contribution on the history of the problem. Only after Wood had submitted his manuscript was George's manuscript discovered. It is included as an Appendix.

On the whole, the problem addressed in this book is approached by a dispersalist point of view, concentrating on the existence of migration routes through geological time and on the dispersal capacities of the organisms. Hardly any attention is paid to modern developments in the methodology of historical biogeography. In my opinion the lack of a clearly indicated methodological approach greatly diminishes the value of this volume.

MARCO ROOS

East Africa's Grasses and Fodders: Their Ecology and Husbandry

Joseph G. Boonman. Kluwer Academic Publishers, Dordrecht. 1993. xv+343 pp. Hardback, Dfl. 375.00; US\$236.00; UK£149.50. ISBN 0-792-31867-6.

This is an extensive review of the main grasses and fodders of East Africa. The author worked in Kitale, Kenya, from 1966 to 1979, and amassed a wealth of information about actual use, husbandry, ecology and improvement of grasses in particular. Early as well as recent research data, local empirical

knowledge and opinions are brought together. Focus is on the tropical zone between 15°N and S latitude, mainly E Zaire, Uganda, Kenya, Tanzania, Rwanda and Burundi, with less detail on Ethiopia, Malawi and northern Zimbabwe.

Tropical grasslands turn more carbon dioxide into carbohydrates than forests do, and have long been maintaining soil fertility if used judiciously. Mixed farming integrated closely with grazing livestock is possible, fallows under grass can restore productive capacity. The reader will be astonished to see that the commonly accepted practice of green manuring, admittedly taken from arable cropping, does not fulfil its promise in grassland either natural or sown, at least not in East Africa. The main reason that legumes are not popular is that populations of legume species decrease over the seasons after introduction in a grass sward, so little dividend is seen from sowing. Legumes need special grazing regimes, application of phosphates and extra care, according to the author. Many grassland scientists will be surprised by this rather negative point of view and may argue that the roles of legumes are certainly more important than quoted by Boonman. Legumes are usually good phosphate miners and lack of inoculation is not a problem, since natural *Rhizobium* populations are usually sufficient.

The seed trade is a good yardstick to measure popularity: only a few tonnes of legume seeds are sold annually in Kenya against 500 tonnes of grass seed. Natural percentages of legumes in tropical grasslands have never been high according to the author. In monoculture or cutting regimes legumes are more reliable and perform well as fodder crops. Boonman is right to say that first results from nurseries are usually optimistic, while results in mature grass- or hayland are not always so positive if reported at all. It is true that, generally speaking, native forage species do not give an economic return if soil fertility is increased. Poor soils need species that can grow there, and legume species can produce nitrogen-improving performance of native or introduced pasture grasses. *Stylosanthes*, for instance, is actually used profitably in the dry tropics of Thailand.

Grazing areas are in demand; overstocking with livestock (and wild herbivores) is a fact. Cultivated grasses in mixed farming take pressure off natural farmland.

Whether the reader is willing or not to reconsider his opinions on the intense academic interest legumes receive from the agricultural scientific community as a whole, Boonman's data are ample and worth considering. Plain rethinking is called for if the inputs through legumes would not pay in grassland ecologies. The general improvement of pastures in Africa, but also in other tropical regions of the world,

may benefit by the debate clearly displayed in this book.

Although American spelling prefers joined words, Elephantgrass, Guatemalagrass and rowwidths are still uncommon and not often seen in print. Perhaps the introduction was deliberate. Certainly space is saved and retrieval of single words from computers would be simpler! 'Bye-products' escaped the proof-readers.

The price of the book is quite high, but one should consider the long experience gathered in its chapters. The bibliography is quite valuable, but a reference to the Leguminosae volumes of *Flora of Tropical East Africa* is missing. As the book is not illustrated except for its informative graphs, more botanical references might have been useful.

L.J.G. VAN DER MAESEN

Plant Structure: Function and Development

J.A. Romberger, Z. Hejnowicz & J.F. Hill.
Springer-Verlag, Berlin. 1993. xix + 524 pp.
Hardback, DM298.00. ISBN 3-540-56305-9.

This book is a product of many years of cooperation between the renowned authors. Numerous questions concerning functional systems of the vascular plant body are described and discussed from a physiological-anatomical perspective. Besides cell and tissue differentiation, morphogenesis and systems controlling growth, reproduction and competition, are dealt with. To cite the authors: what are the structural bases for functional processes in plants, how do these structures develop, and what types of control and integrating systems impose organ- or organism-centred attributes and constraints on differentiating cells? What can be learned about function by studying the details of structure and its genesis? What can be deduced about condition in the past by interpreting anatomical details recorded and preserved in wood, in herbarium specimens, or in fossils?

The authors have chosen the arborescent growth form as the most suitable for their task: to describe the dynamics of spatial and temporal processes in vegetative plant parts.

In the comprehensive text a wealth of data from the fields of anatomy and morphology is integrated in chapters dealing with functional systems: protection, absorption, support, photosynthesis, storage, transport, secretion and excretion, aeration, movement, and intra-organismal communication. Over 65 pages of references and key words conclude the book.

The most critical remark I can make is that illustrations are a bit meagre in number and quality.

In contrast to many other books in this field, it is not primarily meant for young students but—as is explicitly stated in the preface—for those who have already studied the anatomy and development of plants. Notwithstanding the numerous cross-references between the chapters, the reader must be sufficiently familiar with the various botanical disciplines to understand what is being explained.

In my opinion, the book is a must for all advanced students, teachers and researchers in plant sciences for whom it is intended.

J. KOEK-NOORMAN

Photosynthesis: Photoreactions to Plant Productivity

Yash Pal Abrol, Prasanna Mohanty & Govindjee (eds). Kluwer, Dordrecht. 1993. xiii + 607 pp. Hardback, Dfl.300.00; US\$187.00; UK£102.00. ISBN 0-7923-1943-5.

This book contains 25 contributions on various interesting topics, which are arranged in six chapters. The first chapter by Tyagi and colleagues deals with the chloroplast genome with the emphasis on gene organization and gene expression. Attention is given to light regulation of gene expression, and the primary receptor systems involved therein. The second chapter on photosystems has basic and fundamental contributions on Photosystem I (Hoshina and Itoh), the Photosystem II oxygen-evolving complex (Govindjee, Coleman) and on the proton-electron stoichiometry of photosynthetic electron transport (Ivanov). The chapter on coordination and regulation comprises six contributions. These deal with (i) structural and functional properties of D1-PSII reaction centre protein (Sopory *et al.*, van Rensen, Karapetyan), (ii) interactions between electron transport and carbon assimilation (Foyer), and (iii) chloroplast structure and membrane architecture in relation to external factors (Grover and Mohanty, Critchley and Russell). New insights into particular aspects of carbon assimilation and partitioning are outlined in six contributions in the fourth chapter. The reader will find thorough papers on Rubisco (Sachmar *et al.*), C₄ photosynthesis and C₃-C₄ intermediacy (Raghavendra and Rama Das), carbon and nitrogen metabolism (Kumar *et al.*), assimilate partitioning (Sicher), source-sink relationship (Surma Mitra *et al.*), and on photosynthetic characteristics of fruits (Randhir Singh). A separate chapter is devoted to stress and CO₂ enrichment. Two contributions therein deal with effects and mechanism of water stress (Lawlor and Uprety) and effects of heavy metals (Sheoran and Randhar Singh). There is also a review on the protective role of carotenoids against photoinhibition (Sharma and Hall). Two contri-

butions dealing with the effects of CO₂ enrichment on growth (Sengupta and Aruna Sharma) and on allocation patterns of carbon and nitrogen (Stulen *et al.*) supplement this chapter. The final chapter deals with genetic variation and productivity. General patterns for improving crop yield in wheat (Bansal *et al.*), rice (Ishii) and other varieties (Medrano and Vadell) get attention. This chapter also contains a most valuable theoretical analysis on the significance of light-limiting photosynthesis to crop canopy carbon gain and productivity (Long).

This book is of interest to students and researchers in the field of basic and applied plant sciences. It is highly valuable in particular with respect to the wide area that is covered ranging from the molecular and subcellular structures to the crop canopy organizational level. It gives a good overview of the concepts and the present state of the art in the covered field.

W.J. VREDENBERG

Arboles y Arbustos de los Andes del Ecuador; AAU Report No. 30

Carmen Ulloa Ulloa & Peter Møller Jørgensen. Aarhus University Press. 1993. xx + 263 pp. Paperback, 80DKK; US\$13.50; ISBN 87-87600-39-0.

Biologists and conservationists who work in tropical countries are often faced with the enormous task of learning to identify the plants of an extremely diverse flora. In a time when regional Floras are still scarce, researchers of the Ecuadorian forests in the Andes should greatly appreciate the publication this year of two comprehensive works of reference: a field guide to the families of woody plants of northwest South America by Al Gentry, and the present book in which the authors confine themselves to the trees and shrubs of Ecuador above 2400 m altitude. While the two publications show some overlap, they are complementary to a large extent. Gentry provides valuable family keys, incorporating vegetative characters to be used in the field and many illustrations. The value of the work by Ulloa & Jørgensen lies, in particular, in the listing of all species. Even though descriptions of the species are omitted, the extended bibliography is helpful in the verification of species. Aspects of the history, biogeography and phytogeography are also treated and characteristic elements of various altitudinal forest formations are identified.

While the number of 1566 listed woody species is likely to increase with further exploration and taxonomic treatments, it shows the richness of the Andean flora. This book will greatly facilitate future

research on Andean ecosystems and, in agreement with the authors, I can only hope that it will contribute to their protection.

JAN WOLF

Neotropical Montane Forests, Biodiversity and Conservation; AAU Report No. 31

Henrik Balslev (ed.). Aarhus University Press. 1993. 111 pp. Paperback, 78DKK; US\$13.00. ISBN 87-87600-40-4.

This book comprises the abstracts of a Neotropical Montane Forest Symposium, held at The New York Botanical Garden on 21–26 June 1993. As stated in the introduction, lowland rain forests in the Neotropics have received a great deal of attention during the last decade, particularly in the debate concerning biodiversity and its conservation. Lowland forests are repeatedly mentioned as examples of extremely high diversity ecosystems. However, indications are that moist and wet montane forests may be richer in (plant) species, due to a greater beta-diversity, and more threatened since most population centres are found in the cordilleras. Therefore, there was good justification for making montane forests the focal point of the symposium. Its purpose was to document the biological and ecological diversity of montane rain forest in comparison with other neotropical areas. The symposium was organized at The New York Botanical Garden and, not surprisingly, the emphasis was on plants. Most papers considered vascular plants, but bryophytes (six papers), lichens and fungi were not disregarded. Floristic inventories of montane forests throughout Central and South America showed that montane forests are typically rich in plant species, many of which are endemic. Mosses and liverworts in particular are abundant in the mountains. In addition, these inventories demonstrated the importance of scale. In altitudinal transects, species richness of woody plants decreases with altitude. However, when attention is paid to the montane forests in a large area such as Ecuador, more species were encountered in the montane forests than are known from the (Amazonian) lowland rain forest in that country, presumably due to a greater beta-diversity in the Andes. In many papers emphasis was on the biological diversity and related aspects such as the evolution, the diversity, the (palaeo)biogeography, the ethnobotany, and the phytogeography, of the forests. Ecological diversity on the other hand was hardly considered. Conservation issues also received a great deal of attention. A recent disturbing development is the threat to montane forests in Colombia, posed by the illegal cultivation of opium. To any reader interested in current research and developments on biodiversity of neotropical montane forests, this compilation of

abstracts is recommended. Since the contributions are arranged alphabetically by author and there is no contents list some patience is required by the reader interested in a particular topic.

JAN WOLF

Die Züchtung der Sonnenblume (*Helianthus annuus* L.): Fortschritte der Pflanzenzüchtung, No. 14

Walter H. Schuster. Paul Parey Scientific Publishers, Berlin. 188 pp. Hardback, DM78.00. ISBN 3-489-53310-0.

This compact manual of sunflower breeding is written in German. Legends to figures and tables are in German and English. The numerous figures are more practical than pretty, but they illustrate every step of the presentation and indicate where it may be important to decipher the German text in detail. This is further facilitated by a very clear lay-out. Key-words signalling the topic of each paragraph are in bold print (sometimes with English translation in brackets). There are numerous references to the original literature. Even without being able to follow the German, a reader will see that there is more to the book than is suggested by the short English summary. There are ten concise and fact-filled chapters of varying length: History and Dispersal (6 pp.), Economic Importance (5 pp.), Systematics and Cytology (5 pp.) Morphology and the Variability of the Characters (28 pp.), Flowering and Fertilization (11 pp.), Regulation of Sex Expression (6 pp.), Methods for Selfing and Crossing (9 pp.), Breeding Aims (40 pp.), Breeding Methods (36 pp.), Cultivar Development and Outlook (2 pp.). The manual is aimed at the practical breeder and its main features are the detailed and thoroughly illustrated descriptions of character states and breeding methods, which will facilitate comparisons between published data and new results. There is virtually no coverage of recent work on sunflowers using molecular techniques.

KONRAD BACHMANN

Disease Management in Cocoa: Comparative Epidemiology of Witches' Broom

S.A. Rudgard, A.C. Maddison & T. Andebrhan (eds). Chapman & Hall, London. xvii+249 pp. Hardback, UK£49.50. ISBN 0-412-58190-6.

Witches' broom is the name of a highly destructive disease of cocoa in South America, caused by the fungus *Crinipellis perniciosa*. Under very wet conditions, dead tree parts may be full of small (2 cm diameter) pink basidiocarps liberating infectious

basidiospores profusely. The disease causes great concern to the industry, which in 1985 took the highly commendable initiative to establish an International Witches' Broom Project. This multi-authored book presents the results in a compact form.

Chapter 1 describes the international collaborative project, set up with pump priming money from the cocoa-processing industry and with funds from EC and producing countries. Interested scientists from UK and Florida (USA) took the lead and many national scientists participated. The research was rather fundamental and led to several M.Sc. and Ph.D. theses.

Chapter 2 briefly reviews the knowledge of the pathosystem, indicating its remaining white patches. Chapters 3-4 describe the international studies, aimed at comparative epidemiology experiments, disease gradient studies, and comparative phytosanitation experiments. Comparative experiments were established at ten sites in six countries, using strict protocols for description and observation. Chapters 5-10 contain country reports on these experiments. Chapters 11-13 discuss the aggregated results from comparative epidemiology, disease gradients and comparative phytosanitation, respectively.

The specific situation in one of the largest production areas, Bahia, Brazil, where the disease first appeared in 1989, is sketched in Chapter 14. Chapter

15 provides recommendations for disease management and chapter 16 discusses future prospects. The recommendations do not deviate fundamentally from those given by Stahel in 1915: selection for resistance, appropriate tree pruning, roguing the witches' brooms (phytosanitation), and chemical control with copper fungicides. Biological control was mentioned but not pursued.

The disease-dispersal gradients in chapter 12 are among the more surprising results. Young plants were used as spore traps. Spores were caught at over 300 m from their source, and gradient calculations suggest that considerable infection could occur over 1 km or more. Long-distance dispersal, such as led to the invasion of Bahia (2000 km), is probably the involuntary result of human action.

The final conclusion is that the disease is manageable but that control intensity depends largely on the price of labour on the expense side and the world price of cocoa beans on the income side. A major benefit of the programme is the availability of resistant breeding lines, to be planted wherever a new outbreak appears.

The book, well documented with a summary of disease management recommendations, clear tables and graphs, protocols, references and an index, perfectly reflects the 'state of the art' with respect to witches' broom.

J.C. ZADOKS