

That eliminates the two most prolific English and American authors in these areas. Of our Canadian colleagues, Posluszny is not cited, and Sattler is cited four times, but nothing of his is mentioned after 1978. So who is cited? What exactly is the coverage of this book? Reading between the lines, and looking closely at the “selected” references, reveals that it is primarily a summary of the work of Leins and Erbar. Leins is cited 47 times, and Erbar 37 times, as first author. This is wonderful work and well worth the treatment it receives here, but it is not the only work that has been done in these areas, nor should it be taken as the definitive view on these subjects. My difficulty is not that the authors have presented their own work. No one is better equipped to do this than they are. My problem is that they do not make their presentation bias explicit. They present much of the data as if it were all that there was know of these subjects, with only brief (or no) mention of taxa on which they have not worked.

Here is a specific example. On p. 82, in the chapter on the gynoeceium, the authors say, “The carpels arise from the floral apex as hemispherical to transverse-oval primordial (Figs. 15, 79a). The proceeding development is essentially determined by two processes, namely placation and peltation.” This statement only applies to superior ovaries with apocarpous gynoecea (the choricarpy of the authors), yet it is presented as if it had universal validity. Looking back a few pages, we find this error perpetuated from the beginning of the chapter. At the beginning of the chapter the carpel is compared to an “obliquely cut tube.” That is, apocarpous gynoecea are presented as if they were the only type of gynoecea. The illustrations support this definition. At the beginning of the chapter, they are all of apocarpous gynoecea. To be fair, the authors do turn to syncarpous (but not inferior) gynoecea (their coenocarpy) after six pages on apocarpous, but by then the equivalence of apocarpous with all “true(?)” carpels is set in the reader’s mind.

What can we expect a student to learn from this type of presentation? That all carpels are tube-like? That conation among carpels is rare? That there has been little work on taxa with inferior ovaries? This is an important question for a book that is clearly written with students in mind. As other reviewers have noted, the language is kept as simple as possible throughout the book, and the explanations (and especially the diagrams) are clearly presented (Schmid, 2011; Vrijdaghs, 2011). Terms are often defined in the text, and Greek and Latin roots

are sometimes even parenthetically given. It is precisely this clarity of presentation that makes the author’s lack of clarity on their bias surprising. Such a wonderful book should not be marred by consistent oversights in presentation. Floral form and function in the covered taxa is certainly interesting and important, but this information is best presented for what it is, not when it is used to represent all current knowledge about flowers and fruit.

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## ECOLOGICAL

### **Pollination and Floral Ecology**

- Willmer, Pat.  
2011.  
ISBN 978-0-691-12861-0 (Cloth US\$95.00)  
828 pp.  
Princeton University Press, 41 William Street,  
Princeton, New Jersey 08540-5237.

The theme of specialization and generalization is commonplace in plant-animal interactions and, indeed, the field of ecology (Graham and

Dayton, 2002). *Pollination and Floral Ecology* by Pat Willmer, professor of zoology at the University of St. Andrews, conforms to a more general work, examining the ecology and evolution of the form and function of flowers and their interactions with pollinators.

Voluminous treatments of floral and pollination ecology and evolution date back to Sprengel (1793) and Darwin (1841), and still regularly appear, but have been more specialized (e.g., Jones and Little, 1983; Waser and Ollerton, 2006). Notwithstanding other works and our gain in knowledge, a general, thorough book on pollination and floral ecology has not emerged in nearly three decades (Faegri and van der Pijl, 1979). Willmer sought to and successfully captured the advances in the field of the past 30 years in a single, general reference that will surely be a companion of any pollination ecologist in the foreseeable future.

*Pollination and Floral Ecology* contains over 600 pages of text that are broken into four main parts: “Essentials of Flower Design and Function,” “Floral Advertisements and Floral Rewards,” “Pollination Syndromes?,” and “Floral Ecology.” The first part, Essentials of Flower Design and Function, covers all the basics one needs to dive into the rest of the book, including floral design and function (Chapter 2); pollination, mating, and reproduction in plants (Chapter 3); and evolution of flowers, pollination, and plant diversity (Chapter 4). Much of the latter chapters were very readable and the figures were simple, clear, and drawn in the context of the text, which prevents distracting figures laden with labels. The evolution chapter was a bit abrupt, considering the role of evolution in co-shaping flowers and pollinators. Implicitly, coadaptation and cospeciation were discussed, but an explicit chapter on this material would aid the evolutionary and coevolutionary message of the book.

The second part, Floral Advertisements and Floral Rewards (Chapters 5–10), deals with advertisements, rewards, and the economics of pollination. The advertisement chapters discuss how plants have exploited animal pollinators’ sensory modalities to attract them for their pollination services through complex suites of visual signals (e.g., color, structure) and olfaction. Willmer highlights and exhibits the complexity of detecting and measuring attractants, which may be one of the axes of differentiation that researchers have yet to fully incorporate into their treatments of pollination syndromes. The rewards

and economics of pollination were physiologically based and seemed short on detail. However, later in the book (floral ecology part), the economics of pollination was more greatly expanded upon.

Throughout the book, but more specifically in the third part, *Pollination Syndromes?*, Willmer admittedly takes a more classic approach to plant-pollinator interactions by showcasing pollination syndromes. Ten of the 29 chapters of the book explicitly regard pollination syndromes, seven of which describe in detail syndrome classes (flies, butterflies and moths, birds, bats, bees, water and wind, and oddities). Willmer invokes van der Pijl (1961) to discuss syndromes as “classes with bad boundaries but a clear center.” This view has fallen out of favor in the past decade (e.g., Ollerton and Watts, 2000) but the arguments are given a fair and thorough discussion based on theoretical and empirical grounds (Chapter 20: Syndromes and webs: Specialists and generalists). The ultimate argument Willmer makes, however, is that the baby should not be thrown out with the bathwater because, although not all flowers conform to distinct, specialized syndromes, a syndrome-based approach can still be informative. The question is, then, how?

Lastly, the fourth part of the book is on floral ecology. Herein, the end of the book reads like most ecology texts, as many of them draw from the interactions of plants and pollinators because of their elegance and simplicity. Many of the aspects could be used in applied fields given the predictions of climate change affecting flowering timing and patterns (Chapter 21), pollinator populations, and the interactions of the two (Yang and Rudolf, 2010). Further, justice was done to the idea that interactions evolve to become less negative and how the evolution of pollination presumably shifts from parasitism to mutualism (e.g., Chapter 26). One chapter discusses community-level interactions (Chapter 22: Living with other flowers: Competition and pollination ecology), but it primarily focuses on the antagonistic effects of competition and excludes the importance of positive effects (facilitation), which could potentially increase the pollination service to the community by living with other flowers (e.g., Bruno, Stachowicz, and Bertness, 2003; Bronstein, 2009).

Willmer covers basic principles taught in undergraduate education, such as flower morphology and plant reproduction, to newer and more advanced ideas and tools such as network

analysis. The concision of Willmer's writing suits the demographic that the book was aimed at: advanced undergraduates to professionals. The readability will assist the former—beginners entering plant-pollinator research—and bring the latter researchers unfamiliar with the literature up to date. Further, the ultimate two chapters (Chapter 28: The pollination of crops; Chapter 29: The global pollination crisis) are likely to be of use to land managers and decision makers because economics and ecology need effective pollination for crops.

There is seemingly very little missing from this book. Nearly every page has a redrawn figure or table that aids the understanding of the text. Further, there are 40 pages of color plates (more than 300 photos) that exemplify the astounding diversity of flower morphologies and types. To see the array of diversity of flower forms in a single text brought out profound curiosity and the fantasy of rising from my chair and immediately go outside to study plant-pollinator interactions! Further, no part of the world seems to be left out, nor was there noticeable taxonomic over-representation.

In sum, the book should largely be used as a reference book, which, again, can be used by those with any level of experience. It is inexpensive relative to the amount of material covered. I commend Willmer for the presumably massive undertaking of the compiling of this vast subject into this relatively small volume. Like other reference books, the material will not become obsolete for many years, and it should be the companion of any pollination ecologist entering the field.

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#### EDUCATION

### ***Life of Earth: Portrait of a Beautiful, Middle-Aged, Stressed-Out World***

Rice, Stanley A.  
2009

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Prometheus Books, Amherst, New York, USA.

Evolution is an ongoing process. It occurs right before our eyes and is critical to understanding many aspects of population and community ecology. Evolution is not static or straightforward but is complex and unpredictable, making it challenging to teach and comprehend. *Life of Earth: Portrait of a Beautiful, Middle-Aged Stressed-Out World* by Stanley A. Rice offers an evolutionary history of our planet earth (which he calls Gaia). He uses many modern metaphors and examples to convey evolutionary developments, and addresses how humans are pivotal in determining the future