

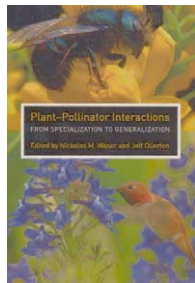


Debates enrich our understanding of pollination biology

Plant–Pollinator Interactions: From Specialization to Generalization edited by N.M. Waser and J. Ollerton. The University of Chicago Press, 2006. £31.50 pbk (488 pages) ISBN 0 226 87400 1

Shuang-Quan Huang

College of Life Sciences, Wuhan University, Wuhan 430072, China



It is notable that Darwin followed the *Origin of Species* with *On the Fertilisation of Orchids by Insects*, because it perhaps demonstrates that he viewed floral evolution, especially in response to pollinator-mediated selection, as an exceptional example of the principles of natural selection. The embodiment of pollination ecology with darwinian natural selection led to the develop-

ment of the pollination syndrome concept, referring to a suite of floral traits that is associated with the attraction and utilization of a specific group of animals as pollinators. However, ten years ago, Waser and colleagues wrote a controversial article [1] in which they focused attention on the importance of generalization in pollination systems rather than on the popular view that specialization is widespread in such systems. If pollination specialization represents a minor theme in floral evolution then the role of specialized pollinators as agents of natural selection becomes questionable [2,3].

In *Plant–Pollinator Interactions*, Waser and Ollerton bring together experts from different regions of the world to address how patterns of specialization and generalization in pollination systems vary across spatial and temporal scales. The chapters are mostly synthetic reviews that attempt comprehensive analyses of plant–pollinator interactions from individual species to the community level, using methods ranging from food-web theory to phylogenetic reconstruction to experimental manipulation.

Waser begins the book with an elegant historical perspective, concluding that there are two contrasting perspectives on plant–pollinator interactions. He argues that the dominant view of specialization in pollination systems was greatly influenced by the conviction that evolutionary change leads to floral specialization for pollinators, although the existence of generalized pollination systems was also recognized and studied. Thus, the ‘tension’ between the two views could show us where there are important unanswered questions in understanding pollination systems from evolutionary and ecological perspectives. The chapters sometimes succeed in developing this tension and exposing new and interesting questions.

For example, community studies of pollination systems show asymmetry, that is, most specialist insects visit generalist plants whereas most generalist insects visit specialist plants. The narrow view in some chapters that pollination specialization reflects a tight coevolution between plant and pollinator is less useful than recognizing that pollination specialization reflects an evolutionary response to convergent selective pressures mediated by pollinators [3]. Likewise, if generalized pollination systems are common in nature because several ecological factors prevent specialization, how could diverse forms of flowers evolve? In Chapter 2, Aigner reviews a model of floral specialization in fine-grained environments to speculate how special adaptations could arise without tradeoffs in floral traits. To develop his idea, he questions some classic examples of evolved co-adaptation between plants and pollinators, namely *Aquilegia* and *Mimulus*. Although a thought-provoking chapter, little empirical support is currently available.

Although Waser and Ollerton appeal for scientists to take a second look at generalizations in pollination, it should be appreciated that several chapters provide strong evidence for the utility of the pollination syndrome concept (for example, Chapters 3, 12 and 14). The discussion by Corbet (Chapter 14) focuses our attention on the delimitation of pollination systems not by taxonomic grouping of pollinators but by the selective pressures that they exert on the flower, a point made recently by Fenster *et al.* [3], and also by earlier workers (e.g. Loew 1895, cited in this chapter).

The discussions of biogeographical patterns of pollination systems (Chapters 12 and 13) convincingly illustrate variations of specialized relationships between plants and pollinators across regions. To demonstrate complex plant–pollinator interactions, the authors also emphasize community studies of pollination web systems, across seasons (Chapter 11) or throughout the whole life cycle of plants (Chapter 7). Yet some other detailed studies are ignored. For example, a consecutive 53-month study involving 270 plant species in lowland dipterocarp forest demonstrated a significant association between pollinators and flower characters where pollinators were assessed by observing body contact with stigmas and anthers [4]. Thus, the objective of community studies should perhaps include insights on the evolution of floral traits. However, the caveat with these food-web approaches and all pollination studies is that actual

Corresponding author: Huang, S.-Q. (sqhuang@whu.edu.cn).

pollinators, rather than lists of visitors should be used to describe the interactions. Some chapters (e.g. 5, 8 and 10) interweave notions of pollination specialization and generalization, exploring the utility of both, and are thus especially interesting. This is where *Plant–Pollinator Interactions* is particularly helpful.

Despite its internal heterogeneity, the focus on only a subset of pollination systems, some propensity to bias and the absence of some notable contributors, *Plant–Pollinator Interactions* is an important contribution to our understanding of plant–pollinator interactions. As Ollerton emphasizes in the last chapter, to characterize the nature of these interactions one should question their origin, maintenance and stability. By reading this book often along with the contrasting views [3], one will conclude that

pollination biology is undergoing a renaissance that will ultimately provide us with a deeper understanding of the evolutionary and ecological processes involved in this fascinating interaction.

References

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