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Samuel O'Dell

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BOOK REVIEWS

Bumble Bees of North America. Paul H. Williams, Robbin W. Thorp, Leif L. Richardson, and Sheila R. Colla. 2014. Princeton University Press, Princeton, New Jersey, USA. 208 pages. \$24.95 (paper), \$14.72 (eBook). ISBN: 978-0-691-15222-6.

Bumblebee identification is generally considered straightforward, yet mistakes often are made due to the degree of similarity between the color patterns of different species. *Bumble Bees of North America* aims to improve the accuracy of identifications by both casual observers and professionals through the use of intuitive diagrams, descriptions, and the more technical dichotomous keys. In addition to providing the first complete field guide to North American bumblebees, the authors make efficient use of the reader's attention by summarizing taxonomic history, favored food plants, and environmental issues concerning bumblebees.

Bumble Bees of North America is organized into three distinct sections. The first section of the book details the collective knowledge regarding bumblebees, delving into issues such as taxonomy, conservation, parasites, and host plants. The authors begin by introducing readers to the cultural and economic value of bumblebees, and follow by informing readers of evidence for population decline and extinction in certain bumblebee species. This combination almost perfectly explains why a scientist might study bees, and subsequently why they need to be able to differentiate bumblebee species (i.e., in order to effectively study bees, scientists have to be able to tell them apart). Next, the authors supply a condensed summary of historical publications on North American bumblebees. Unfortunately, some of the historical sources cited in this summary are not included in the "Additional Resources" section at the end of the book, leaving the readers to intuit the titles of those publications if they are interested in reading these historical resources. Salient features of the introduction include eye-opening figures illustrating global and North American bumblebee diversity, the intensity of bumblebee collection on the continent, and finally, the life cycle of bumblebees.

Following the introduction to bumblebees, readers are provided with a number of brief subsections, most of which have functional importance. The first three are of particular interest as they describe how to observe and attract bumblebees; the authors even list plants attractive to bumblebees according to ecoregion. There are also subsections discussing the seasonal activity of bumblebees, decline and conservation, environmental stressors, parasites, predators, and mimicry. In particular I found the subsection on mimicry to be informative and relevant to the remainder of the book which is dedicated to species accounts and keys. Here, the authors detail examples of insect species that mimic bumblebees, but more importantly they showcase examples of *Müllerian*

mimicry among bumblebee species, where several different species may have convergent color patterns. The authors' examples of *Müllerian mimicry* are important in that they demonstrate the uncertainty of on-the-wing identifications, and provide an effective segue to the second major section of the book, the species accounts.

Species accounts are the core of this book, and each account begins with the scientific and common name of the species, along with two or more color photos that illustrate both female and male bumblebees. Often the photos depict live specimens on flowers, which provides a pleasant and practical touch. Following the photo plates, users are provided with morphological characters that are useful for identifying bumblebee species in the field and characters useful for identifying bumblebees under the microscope. These utilitarian character descriptions complement the diagrams that display the variation in color-patterns for each caste, allowing users to quickly select potential species. Of course, identifications using the color-pattern diagrams are perfunctory at best and should be corroborated by examining specimens for characters in the species accounts or by working them through the dichotomous keys at the back of the book, both of which require the use of a microscope. The next component of the species account, titled "Occurrence", describes the distribution, degree of rarity, habitat, food plants, relevant behaviors, and potential parasitism (by other bees) of each bumblebee species. In addition to the description of each species' range, the species accounts feature maps of occurrence, which not only display individual data points, but also depict the potential distribution of a species according to climactic suitability. A final touch to each species account is a histogram showing seasonal patterns in the abundance of queens, workers, and males. In short, the highly informative graphics alone are worth the price of admission, yet the well thought out text on the identification and biology of bumblebees proves the essence of each species account.

Despite the positive aspects of the species accounts, I was slightly irritated by the order in which the species were presented. Species are arranged first into morphological groups (e.g., square or long-cheeked bees with a rounded angle on the midleg), and then into smaller groupings with similar color patterns. The non-alphabetical order within groups makes quickly locating a particular species a frustrating task.

The third and final section of *Bumble Bees of North America* contains identification keys for both male and female bumblebees. Each key is presented with images of important morphological features on preserved specimens. Unfortunately, many of the images presented in the keys are too small and dark, making them difficult to use and a potential source of user error. The key to females makes heavy use of color patterns along with a few more technical characters, and is therefore relatively straightforward. On the other hand, the

key for males relies largely on characteristics of the genitalia, assuming they are exposed. While this may pose an issue for some users, it is important to recognize that these sorts of characters are commonly used to distinguish species within the order Hymenoptera because they offer distinction when there may be few obvious differences between species.

In conclusion, *Bumble Bees of North America* has not only provided casual observers and professionals with a comprehensive treatment of North American bumblebees, it has delivered utility while preserving aesthetics.—*Samuel O'Dell, Zoologist, U.S. Geological Survey, Northern Prairie Wildlife Research Center, Jamestown, North Dakota 58401, USA.*