

by villagers for the commercial side of IFTA's activities provided distributional data unusual for a Third World country.

This book covers an area of PNG, the Bulolo-Wau Valley, which is only about 350 km<sup>2</sup> in extent, although it includes the well-known Mt. Kaindi (2388 m) and other mountains. Remarkably, 373 species of butterflies and skippers have been recorded from the area. The author points out that this represents about half of the species known to inhabit the whole of PNG, including the Islands. The area also includes the IFTA headquarters, the Bulolo Forestry Institute and, of course, the Wau Ecology Institute.

The book is well organized, with a map of the Bulolo-Wau Valley and another showing the Melanesian Region and major sub-regions. The author has crammed a great deal of useful information into his Introduction, and has struck a good balance between giving help to the beginner and inexperienced, and providing up-to-date scientific information for the specialist. It is good to see the Comstock-Needham scheme of venation preferred to the esoteric and old-fashioned numerical system still favored by some lepidopterists. The narrow pages of the book have very wide margins (more than a third of the width of the page) but this does allow for the inclusion of some text figures. Those of resting attitudes of representatives of the families are particularly helpful, and indicate that the author is an expert field lepidopterist.

The main part of the book is an account of each species recorded from the Bulolo-Wau Valley. There are helpful aids, such as diagrams of wing-pattern and genitalia drawings, for distinguishing closely related species. The size range of both sexes of each species is given, essential in a book in which the figures of butterflies have been, disconcertingly, reproduced to a standard size. The information provided for each species is excellent and thoroughly up-to-date, but it demonstrates how much work still remains to be done on the fauna of even this part of New Guinea. There is a short and rather selective glossary, a list of food plants, a good bibliography, and a comprehensive index.

It is perhaps captious to mention any omission in a text so full of sound and interesting information. However, I would have liked to see a short section on the relationships between local people and the butterflies of the region—what one might call ethno-lepidopterology. Certainly in some parts of PNG there is local knowledge of butterflies, including their larvae ("sneks" in pidgin), while birdwings (*Ornithoptera priamus* in most cases) are used for personal adornment. Perhaps, however, this does not occur in the Bulolo-Wau Valley.

This is a book which will be indispensable to anyone studying the butterflies and skippers of New Guinea. Unlike many more lavish and expensive texts, it is based on intimate knowledge of the species in the field. The comments on status and behavior are therefore particularly authoritative and valuable. Moreover, the excellent balance among utilization, conservation, and science is a notable feature. I hope this book will stimulate more work on these three interrelated aspects of butterflies, not only in the Bulolo-Wau Valley, or even PNG, but more widely in southeast Asia.

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INSECTS OF PANAMA AND MESOAMERICA: SELECTED STUDIES, by Diomedes Quintero and Annette Aiello (editors). 1992. Oxford University Press, 200 Madison Avenue, New York, New York 10016. 720 pp., 1268 illustrations. Hardcover, 23 × 28 cm, ISBN 0-19-854-018-3. \$195.00.

The slender and sinuous shape of the Isthmus of Panama belies its biological importance, which stems from the tenuous and geologically recent link it provides between North

and South America. For nearly three million years the Isthmus has provided a continuous land corridor between the continents, resulting in the mixing of their faunas, and has served as a center for speciation and biological diversification. Not surprisingly then, Mesoamerica (the region from southern Mexico to Colombia), with the Isthmus as its crooked spine, boasts one of the highest diversities of insect species in the world.

In a remarkable series of beautifully illustrated volumes published between 1879 and 1915, F. D. Godman and O. Salvin compiled the first comprehensive inventory of this rich fauna in *Biologia Centrali-Americana*. During the intervening century, the rate of tropical forest destruction in Mesoamerica and elsewhere has accelerated relentlessly. Today, the Pacific lowland forests of Panama have been virtually extirpated, along with many of the species originally described in *Biologia Centrali-Americana*, and other forests in the region are threatened. Thus, it was with a sense of great urgency that the work reviewed here was prepared. *Insects of Panama and Mesoamerica: Selected Studies* was written with the hope of stimulating more interest in this biologically rich region by assembling and publishing as much information as possible about the insects of these endangered Central American forests.

The result is a large and impressive volume comprising many different kinds of studies, of varied duration, and conducted at a broad assortment of sites within the region. Written for students and interested general readers as well as for entomologists, this book has 42 chapters written by 52 biologists from 11 countries. This diversity of coverage is both its strength and weakness. The contributors offer a wide variety of viewpoints, writing about behavioral ecology, morphology, systematics, taxonomy, ecological diversity, and biology, but the coverage of the different insect groups is wildly uneven. Of the 30 insect orders (including Collembola; the book follows the arrangement in N. P. Kristensen, 1981, *Phylogeny of insect orders*, *Ann. Rev. Entomol.* 26:135–157), only 21 are included: 13 are dealt with fairly completely, or at least include a checklist to species for the area covered in the chapter, and 8 are treated incompletely, with focus on only one or a few groups; 9 are not covered at all.

The book is well organized and beautifully produced, in keeping with the excellent series of publications on natural history to come from Oxford University Press during the past several years. To provide an evolutionary context, there are two introductory chapters: "Geological Setting and Tectonic History of Mesoamerica" and "Biogeography of the Panamanian Region, from an Insect Perspective." [No, the author of the latter chapter does not have six legs!] The remaining 40 chapters are grouped by Order, proceeding phylogenetically from Collembola to Diptera. The text is augmented by more than 1260 line drawings, distribution maps, and black and white photographs, in addition to numerous data tables, dichotomous keys, and species checklists. Reference sections at the end of the book include a set of abstracts in English and in Spanish (resúmenes), a taxonomic index, and a subject index.

Of interest to lepidopterists are the five chapters in the Lepidoptera section. These are an eclectic mix: three chapters concern butterflies that act like butterflies, one chapter treats butterflies that act like moths, and the remaining chapter deals with moths that act like butterflies. A better introduction to the deceptive complexities of tropical Lepidoptera could hardly be found. Let's start with the butterflies that behave as they are supposed to, all of which happen to be in the Nymphalidae.

Many of the most familiar Central American butterflies are members of the Nymphalinae (Nymphalidae), for which Gerardo Lamas M. and the late Gordon B. Small, Jr., present an annotated list of the Panamanian species. Their chapter on this subfamily includes notes on distribution, type locality, depositories of type material, synonyms commonly encountered in frequently used literature, and references to published illustrations. A chapter by Annette Aiello explores the ecology of two members of the Nymphalidae in some detail, contrasting their different responses to a severe dry season: *Anartia fatima* (Nymphalinae) contracts its range and persists only in wet Atlantic forest refugia, whereas *Pierella luna luna* (Satyrinae) appears to survive the dryness in pupal diapause. Such contrasting life history strategies contribute to the ecological and behavioral diversity of butterfly communities, adding yet another layer of complexity to the already bewildering taxonomic diversity that characterizes tropical forests. The third chapter on Nym-

phalidae, by Julian Monge-Najera, is a guide to the clicking butterflies (*Hamadryas*) of Panama, and includes a checklist and descriptions of species, an illustrated key to their identification, and a discussion of their biology and behavior, with emphasis on sound production.

In a chapter profusely illustrated by photographs, drawings, charts, and graphs, Neal G. Smith has assembled a wealth of natural history information on *Urania fulgens* (Uraniidae) (the moth that acts like a butterfly). Smith's comprehensive chapter discusses this diurnal moth's ecology, reproductive behavior, developmental biology, and migration in great detail, contrasting its Central American and Panamanian populations with what is known of the Cuban species, *U. boisduvali*.

Finally, we get to the butterfly that acts like a moth. Veterans of the tropics are familiar with the crepuscular habits of species in the genera *Brassolis*, *Dynastor*, *Opisphanes*, and *Caligo* (all Nymphalidae: Morphinae), which rest during the day and night and become active only for a short period at dawn and dusk. Other than these creatures of the twilight and a few Satyrinae with similar behaviors, all other butterflies are active only during the day, right? Wrong, says Annette Aiello, who describes the nocturnal habits of little-known family Hedyliidae, previously thought to be moths in the family Geometridae and only recently recognized as butterflies, a conclusion based primarily on morphological and behavioral characters of the immature stages (see M. J. Scoble, 1986, *Entomol. Scand.* 21:121-158). Aiello lists nine species of Hedyliidae reported from Panama, providing brief descriptions of wing color and pattern and references to published photographs of adults. Most importantly, she presents previously unpublished details of the life history and larval behavior of *Macrosoma semiermis* (Hedyliidae), a common Panamanian "nocturnal butterfly."

Lepidopterists will be hard put to justify spending almost \$200 to purchase a book that devotes less than 7% of its 700 pages to butterflies and moths, but entomologists in general and tropical ecologists in particular will find this valuable compendium a bargain in spite of the price. Certainly, this volume should be on the shelves of all research libraries so that it is readily available to those with an interest in the ecology and conservation of that fragile and priceless treasure—the tropical rainforest.

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BUTTERFLIES OF THE FLORIDA KEYS, by Marc C. Minno and Thomas C. Emmel. 1993. A Mariposa Press Edition by Scientific Publishers, P.O. Box 15718, Gainesville, Florida 32604. 168 pp., 29 color plates, 52 color figures and line drawings. Hardcover (ISBN 0-945417-88-8; \$31.50) or Softcover (ISBN 0-945417-87-X; \$18.95), 22 × 28.5 cm. Order from publisher (add \$2 postage per copy; \$3.50 outside USA.)

*Butterflies of the Florida Keys* is more than just another "Butterflies of . . ." It is a well written and beautifully illustrated natural history guide, bursting with butterfly trivia. The main body of the text, a 103-page section/chapter appropriately entitled *Butterflies of the Florida Keys*, is preceded by a 32-page introductory chapter. The Introduction includes numerous maps, graphs, and beautiful color photographs accompanying sections on Climate, Historical Perspective, Vegetation and Plant Communities, The Keys Butterfly Community, Conservation, Precautions, and Note on Species Accounts. All of the graphs are crisp and clear and most of the photographs have been reproduced beautifully. This portion of the text is in an easy reading style and nicely subdivided into the major sections listed above. A detailed table on butterfly monthly occurrence, descriptions (and photographs) of plant communities, a brief review of Caribbean bioge-