

Lauri Kaila (with contributions by Kazuhiro Sugisima) 2011. Elachistine Moths of Australia (Lepidoptera: Gelechioidea: Elachistidae). – Monographs on Australian Lepidoptera Series 11. CSIRO Publishing, Collingwood, Victoria, Australia; www.publish.csiro.au, 456 pages. ISBN 9780643103054. Hardcover, cloth bound, format 250 × 175 mm. Price AU\$ 150.00. E-book version available online for a similar price.

Biodiversity and its conservation have become biological, social, political, and even economic issues. Yet when we look beyond well-known flagship groups that engage the popular mind, vast spans of the world of six-legged and other unremarkable creatures remain sketchily known and barely catalogued. Elachistinae are such animals. They are small, drably coloured micromoths with leaf- or stem-mining larvae. With about 90% of the species feeding on monocotyledons, the group is one of the most successful lineages of Lepidoptera to exploit this class of plants. The known global diversity of elachistines is estimated at about 700. However, new species are discovered all the time, especially through surveys in suitable habitats in less well-explored parts of the world (a recent example in Sruoga & De Prins 2011 appeared after publication of the book). Kaila's book underscores the unaccounted diversity that may lie in such poorly studied groups: of the 148 species treated, no less than 128, or 86%, are newly described. The genus *Elachista* alone, one of three genera represented in Australia (the others are *Urodeta* and *Perittia*), comprises 143 of the total, a number that accounts for about 20% of the world fauna.

This book is a monograph at its best and a major landmark in Kaila's continued, high-quality work on the world fauna of Elachistinae. It gives comprehensive coverage of all known aspects of the morphology, taxonomy, biology and classification of the Australian fauna. The author's work on Elachistinae began about 15 years ago with a series of revisional papers comprehensively covering the Nearctic fauna, as well as several papers on the Palaearctic fauna and a review of the South American fauna. He also developed a phylogenetic framework for a global classification of the subfamily.

In spite of these impressive figures, the author describes the knowledge of the Australian Elachistines as "scanty" (p. 42). Most species are actually known from very few records, with about one-third of them known from a single record (a record being akin to a collecting event and may comprise several specimens). This is attributed in part to the strict habitat requirements of most species, which often occur only over certain microhabitats within the wider range of their host plants. In a brief, but eye-opening chapter on diversity, distribution and conservation, Kaila paints a disheartening picture of a fragile elachistine fauna which may already be critically imperiled in some parts of the continent due to excessive habitat fragmentation. A map shows a striking general distribution pattern where all elachistines occur at the periphery of the continent, in temperate, higher elevation, and humid areas.

In the methods chapter, the operational species concept is discussed in some detail, with reference to the peculiarities and limitations of the group under study. Species are treated as hypotheses subject to further testing with the addition of further data and observations. Taxonomy is not merely about observing similarities and differences and applying names and categories to the observed clusters. It must be subtended by a proper conceptual framework. This is something too rarely mentioned in taxonomic works, as if it went without saying. Of course, it is not necessary to expound one's operational concept in every paper that describes a few species. However, for large monographic works, this should be presented as a matter of course. There is often a big chasm between tacitly accepting, say, the biological species concept, and explaining how one applies it to specimens and incomplete morphological and biological observations to delineate species. Kaila is to be commended for clearly explaining his approach. He further stresses that in some groups the adults may not be reliably identifiable using morphology, or

even genetic traits, and that in those species-level distinctiveness comes from life history features. In the same chapter all technical aspects of studying these moths are presented with necessary details, including useful remarks on the particulars of genitalia preparation and rearing that apply to elachistines.

Following the introduction and methods is a chapter, co-authored with Sugisima¹, on the phylogeny, subfamily delineation, and generic classification. The cladistic analysis draws on more than 145 characters from both immature and adult stages and represents a significant revision of Kaila's (1999) previous analysis, rendered necessary by the discovery of so many new species. The characters and states used in the analysis are conveniently presented in an extensive table with alternatively white and shaded entries: the clarity of formatting makes it very easy to consult in conjunction with the phylogenetic trees that follow, a commendable quality for such data. Kaila is among the very few authors who have studied skeletal features of the lepidopteran thorax and used them in phylogenetic analysis. The overall impression is that the author studied the taxa in painstaking detail in an attempt to extract as much useful phylogenetic information as possible. Taking into consideration his earlier results on the phylogeny of Gelechioidea (Kaila 2004), there is also further testing of the monophyly of Elachistinae, which remains well supported although without unique synapomorphies.

There follows a chapter on morphology, abundantly illustrated and providing details for larvae, pupae, and adults. Genitalia figures show all the parts clearly labelled. The presentation sets the stage for the keys and descriptions of the taxonomic treatment in the following chapter.

Keys are provided for the Australian genera and for species within *Perittia* (3 species) and *Elachista* (143 species) (*Urodeta* includes only one named species and a second, unnamed species). The key to genera is for males only. Females of *Perittia* are unknown, thus precluding the presentation of a key to females, but the difference between females of *Urodeta* and *Elachista* is indicated. For the large number of species of *Elachista*, separate keys are given for males and females. The size of the keys can be daunting (129 and 94 couplets, respectively) and several of the differences are subtle. Although external features are used in some couplets, the vast majority refer to genital characters, making genital preparations a prerequisite for anyone attempting to identify these moths. There are no references to figures in the keys, and no indication of which page each species is located on. While this reduces potential clutter within the key, it makes it difficult to check characters on corresponding figures and to navigate to individual species treatments.

The large genus *Elachista* is divided into two subgenera (*Atachia* and *Elachista*), and hierarchically into further species groups, sections, and subordinate complexes within, reflecting the phylogeny. A diagnosis, description or presentation is given for each of these subdivisions. Each species treatment includes a description (with the subsections: wingspan range, head, colouration of thorax, colouration of abdomen, wing pattern, male genitalia, female genitalia, larva and pupa when known), diagnosis, biology, distribution, material examined, and, in several cases, remarks. Remarks mainly discuss species delineation issues. Navigation might have been enhanced by numbering species sequentially and applying the same numbers to the correspond-

¹ Contributing author Sugisima was a young, emerging Japanese systematist who had begun to publish carefully crafted papers on Gelechioidea in the early 2000s. As he explained in a kind of farewell letter to several corresponding colleagues, lack of funding and professional opportunities in systematics forced him in 2006 to exit science altogether in order to earn a living. It is most regrettable that such talented students are forced out of the field of systematics, a situation that has become more common in recent years, in a worrisome trend that parallels the worsening biodiversity crisis.

ing figures for each category of illustrations, as has been applied successfully in other series (Microlepidoptera of Europe by Apollo Books). Although several of the new names are evidently derived from some obvious aspect of the species (host, colour, patronym), many are not. It would have been nice to state their derivation, as recommended by the Code.

Immatures are presented as far as known, with nearly all data newly obtained by the author himself over the course of four visits to Australia totalling over 18 months, during which he conducted extensive fieldwork. Contributing author Sugisima also added significantly to this targeted effort in separate fieldwork. The combined result, the rearing of more than 70 species (42% of the recorded fauna), enabled to reach taxonomic conclusions for what Kaila terms “bewildering species complexes” where morphology alone did not provide answers. Larvae and pupae are described and illustrated in a standardized fashion, again something uncommon in microlepidoptera works.

A short section at the end of the taxonomic treatment treats six species that are newly excluded from Elachistinae. There are two appendices. The first lists all the taxonomic changes that were effected in the work, which amounts to a listing of new combinations and new species arranged taxonomically as they would be in a checklist. This arrangement is little unfortunate because it is difficult to locate any particular taxon name. An alphabetical listing would have been preferable. The second appendix is the data matrix used in the cladistic analysis. An index concludes the book, listing both animal and host plant names together, which is better than the frequent practice of separating the two. There is no overall synonymic checklist summarizing all taxa covered. This is provided under each taxon (genus), including generic synonyms and a list of species included.

The book is richly illustrated with photographs showing morphology, larvae, pupae, adult moths, genitalia, larval mines, and habitats. They are generally of high quality and show clearly what is intended or presented in the text. All have been digitally post-processed and cleaned, and offer uniform backgrounds as well as good contrast and sharpness. However, the placement and numbering of the figures is confusing. They are arranged in two ways: scattered throughout the text, or grouped after the main body of text before the references. Figures 1–49 (mostly morphology with one map and one graph) are found in the initial sections of the book from pages 22–42; figs 50–56 showing habitats are on pages 253–257; figs 57–94 showing larvae are distributed throughout the taxonomic section from pages 68–218, close to the species they illustrate; figs 95–438 are the genitalia photos, they are all grouped together, males followed by females, and begin on page 301 after the colour plates; the colour plates on pages 258–300 show adult moths, pupae, and larval mines, and are numbered 1–43, with individual photos numbered 1–x in each plate. It is unclear why photos of larvae were distributed within the main body of the text rather than being grouped together at the end.

Notwithstanding the mild criticism expressed over some organisational details, this is a very well produced book. The binding, cloth cover, and semi-glossy paper are of the same high quality that characterized previous volumes of this series. The book remains naturally flat-open from any page, a truly appreciable quality when one uses the keys.

This book is an outstanding example of the fundamental backbone that understanding and documenting biodiversity requires. It almost goes without saying that it is essential for anyone seriously interested in Elachistinae. But I would also recommend it particularly to any Lepidoptera taxonomist as an excellent model of monograph with a thorough conceptual and analytical footing, such as should be published more often nowadays. It also shows clearly that despite its comprehensiveness, much remains to be discovered before Elachistinae can be regarded as “well known”.

References

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Zeitschrift/Journal: [Nota lepidopterologica](#)

Jahr/Year: 2011

Band/Volume: [34](#)

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Artikel/Article: [Book Review Lauri Kaila \(with contributions by Kazuhiro Sugisima\) 2011. Elachistine Moths of Australia \(Lepidoptera: Gelechioidea: Elachistidae\) 111-114](#)