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BOOK REVIEW

WAGNER D.L. 2025: MOTHS OF THE WORLD: A NATURAL HISTORY. Princeton University Press, Princeton, NJ, 240 pp. ISBN 978-0-691-24828-8. Price USD 29.95 / GBP 25.00.

David Lee Wagner is professor of ecology and evolutionary biology at the University of Connecticut. He is a renowned American entomologist, lepidopterist, and award-winning writer. He has authored dozens of prestigious research articles and several books, the most famous of which is *Caterpillars of Eastern North America: A Guide to Identification and Natural History* (ISBN 978-0-691-12144-4). *Moths of the World* (Fig. 1) is the second book, following *The Lives of Moths: A Natural History of Our Planet's Moth Life* by Andrei Sourakov and Rachel Warren Chadd (ISBN 978-0-691-22856-3) from Princeton University Press, to discuss the diversity and natural history of moths worldwide.

Moths of the World opens, like *The Lives of Moths*, with a comprehensive *Introduction* that presents moths to readers through 11 subchapters covering general topics such as "*Diversity, classification, and evolutionary history*", "*External anatomy*", "*Internal anatomy*", "*Life cycle and metamorphosis*" (Fig. 2), "*Economic importance of moths*", "*Moths and plants*", and "*Moth behaviour and ecology*". In contrast to *The Lives of Moths*, where the authors introduce selected moth species from various world biomes in the second section, *Moths of the World* continues with a systematic section divided into three chapters representing the three main systematic groups of Lepidoptera. For each group, a general introduction describing diversity, morphology, and bionomics is provided, supplemented by a cladogram illustrating the evolutionary relationships among the depicted superfamilies.

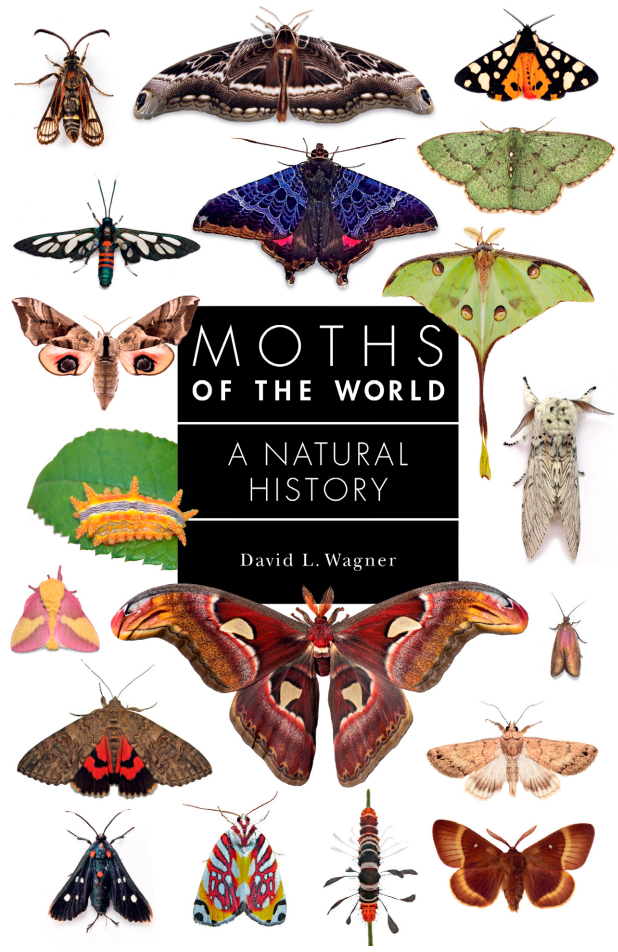
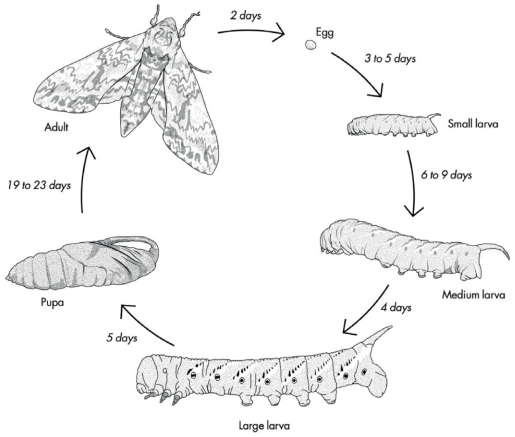


Fig. 1. The book cover (from Wagner, 2025).

The section begins with Non-ditrysian Microlepidoptera, represented by Micropterigoidea (Micropterigidae), Agathiphagoidea (Agathiphagidae), Heterobathmioidea (Heterobathmiidae), Eriocranioidea (Eriocraniidae), Acanthopteroctetoidea (Acanthopteroctetidae), Hepialoidea (Hepialidae), Mnesarchaeoidea (Mnesarchaeidae), Nepticuloidea (Nepticulidae), Adeloidea (Adelidae, Heliozelidae, Incurvariidae, Prodoxidae), Palaephatoidea (Palaephatidae), and Tischerioidea (Tischeriidae). It continues with Ditrysian Microlepidoptera, covering Tineoidea (Psychidae, Tineidae), Gracillarioidea (Gracillariidae, Bucculatricidae), Yponomeutoidea (Yponomeutidae, Heliodinidae), Gelechioidea (Xyloryctidae, Oecophoridae, Depressariidae, Coleophoridae, Momphidae, Cosmopterigidae, Gelechiidae), Alucitoidea (Alucitidae), Pterophoroidea (Pterophoridae), Carposinoidea (Carposinidae), Douglasioidea (Douglasiidae), Schreckensteinioidea (Schreckensteiniidae), Epermenioidea (Epermeniidae), Urodoidea (Urodidae), Immoidea (Immidae), Choreutoidea (Choreutidae), Galacticoidea (Galacticidae), Tortricoidea (Tortricidae), Sesioidea (Sesiidae), Cossoidea (Cossidae, Castniidae), Zygaenoidea (Epipyropidae, Lacturidae, Dalceridae, Limacodidae, Megalopygidae, Himantopteridae, Zygaenidae), Thyridoidea (Thyrididae), Hyblaeoidea (Hyblaeidae), Callidudoidea (Callidulidae), Pyraloidea (Pyralidae, Crambidae), and Mimallonoidea (Mimallonidae). The section ends with Macrolepidoptera, or macro-moths, comprising five major superfamilies: Drepanoidea (Drepanidae), Lasiocampoidea (Lasiocampidae), Bombycoidea (Apatelodidae, Eupterotidae, Brahmaeidae, Anthelidae, Endromidae, Bombycidae, Saturniidae, Sphingidae), Geometroidea (Sematuridae, Geometridae, Uraniidae), and Noctuoidea (Notodontidae, Nolidae, Noctuidae, Erebidae). Each family (in some cases, even subfamily or genus) is presented on a card (Fig. 3), beginning with a general introduction and accompanied by striking photographs of adult moths and, for most species, their larvae. At the bottom of each card, information is given on distribution, general morphological characteristics, habitat and host plant associations, and the most important genera are listed.

The book concludes with an *Epilogue* titled "*The sixth extinction, nature, and moths*", in which the author takes the example of an extinct species, outlines major threats to lepidopteran diversity, and highlights how remarkable moths are, including reasons why they deserve protection. The final chapters before the *Acknowledgements* and *Picture Credits* are the *Glossary* and *Additional reading and important resources*. The latter is clearly divided into three main categories: *Websites*, *Books*, and *Journal*

LIFE CYCLE AND METAMORPHOSIS



RIGHT | Life cycle of Tobacco Hornworm (*Manduca sexta*). Development times for all stages and instars are temperature dependent.

All moths and butterflies have four life stages: the egg, larva, pupa, and adult. While moth guides focus on the last of these, because the adult stage is the most conspicuous in habit, the early stages occupy most of a moth's life and have greater ecological and economic importance.

EGG

The smallest Geometridae (*Idaea*) with a wingspan as modest as 0.24 in (6–7 mm) may lay fewer than a dozen eggs. Giant ghost moths (Hepialidae) of Australia can produce more than 40,000 eggs, opting for a sweepstake strategy in which the female simply broadcasts eggs as she flies around seemingly suitable habitat. Something in the range of 40 to 200 eggs per female is typical. Moth eggs can be flat, discoidal, round, or spindle-like. Most are white to green in color, but many microlepidopterans have transparent eggs scarcely detectable to the human eye. A few are orange or red, many are black, and some degree of patterning occurs in many lineages. An egg's outer surface (the chorion) may be smooth or wonderfully ornate. Among the latter are those that can trap air in the interstices of the chorion when submerged, and in so doing allow the egg to "breathe" for months underwater. Such is commonplace for riparian and wetland moths, and represents a novel strategy to protect the eggs from desiccation, harsh weather, and the normal sweep of natural enemies that prey on eggs. Upon hatching, many moth caterpillars consume the chorion.

LEFT | Flightless female of Vapourer Moth (*Orgyia antiqua*) surrounded by her eggs.

BELOW | Shapeshifters. Moth caterpillars may change dramatically in form and color through their development, with most changes occurring during molts. The early (left) and last (right) instars of the Funerary Dagger (*Acronicta funeralis*) are scarcely alignable.

LARVA

While most moths are only known from their adult stage, it is the larval stage that is longer lived, that moves more nutrients to other organisms on the tree of life, causes more damage to our gardens, crops, and forests, and is more crucial for the success of conservation efforts aimed at rescuing a declining species. Caterpillars go through several instars as they grow and mature. Most species have five instars, but some have only three or four, whereas large species may pass through six or seven, with the number of instars sometimes varying by diet and sex (females sometimes have an extra instar). While the norm is for early, middle, and late instars to resemble each other, some caterpillars are shapeshifters that change dramatically in shape, color, and behavior over the course of their development. In the extreme, larval development is hypermetamorphic with the different larval forms specialized for entirely different lifestyles.

A caterpillar has a singular mission: to eat and not get eaten. Some will increase their mass 2,000-fold or more from first to final instar.

Fig. 2. Example of the Introduction subchapter (from Wagner, 2025).

BOMBYCOIDEA: ENDROMIDAE

GLORY MOTHS

This family is in a state of renaissance, with its contents changing as more molecular data are brought to bear on the phylogeny of the Bombycoidea. What until recently was thought to be a family with just one or two species has grown to include some 70 species. Recent molecular data indicate that endromids form the sister group to two small bombycoid families not treated in this work: Phiditiidae (23 Neotropical species) and Carthaeidae (one Australian species), which collectively are sister to Anthelidae (opposite).

Endromidae are one of the most morphologically heterogeneous taxa in the superfamily—no trait is known to unite its 16 genera.

Endromid larvae are fantastically diverse in form and habit. Larvae of several genera have fanciful lateral flanges, and many have a fleshy, medial horn on A8—words can scarcely do justice to these wonderful caterpillars.

TOP | The Kentish Glory (*Endromis versicolora*) is one of the most iconic moths across Europe and Asia. Its larva feeds on birch. Like many large moths, it is believed to be declining

RIGHT | *Andraca theae*, endemic to Southeast China and Taiwan, is gregarious through the early instars. It is sometimes a serious pest of tea.

DISTRIBUTION
Tropics and semitropics of Southeast Asia; several species extending into Palearctic

IMPORTANT GENERA
Andraca, Mustilia, Mustilizans, Oberthueria, Prismosticta, and *Smerkata*

HABITAT
Tropical and temperate forests and woodlands

HOST ASSOCIATIONS
Mostly polyphagous on woody plants

CHARACTERISTICS
- Medium-sized to large, thick-bodied moths; females with large abdomens—many resembling bombycoids in form and habit; others fold wings over abdomen in tentiform fashion
- Haustellum vestigial
- Larvae exceedingly diverse in form and habit; secondary setae short and usually inconspicuous; several genera with lateral flutes and fleshy horn on A8

Fig. 3. The family card of Endromidae (Bombycoidea) (from Wagner, 2025).

Articles and Book Chapters. Here the reader can find the most important sources of information, the most iconic guides to the moths of various continents, and references to general literature on the biology and systematics of Lepidoptera.

In conclusion, *Moths of the World: A Natural History* is an exceptional, engaging, and fact-filled publication written not only for professional entomologists but also for the general public and moth enthusiasts. The book offers a general introduction to moth biology and, compared to previous publications such as *The Lives of Moths*, also serves as an essential guide to the entire systematics of both micro- and macro-moths by describing and illustrating more than 70 moth families in fewer than 150 pages. Such a comprehensive publication, which is highly readable, filled with high-quality photographs, and available at a very reasonable price, is precisely what the market and readers have been lacking. I can only conclude that the author has managed to exceed all my expectations and that this book deserves a place in every natural history-oriented public or private library.

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