

Book review

N. P. Kristensen (ed.) 1999. *Lepidoptera, Moths and Butterflies. Vol. 1: Evolution, Systematics, and Biogeography*. x + 491 pp. – In: M. Fischer, *Handbook of Zoology 4. Arthropoda: Insecta*, part 35. – Walter de Gruyter, Berlin & New York. Price: 214,00 €. ISBN 3-11-015704-7.

N. P. Kristensen (ed.) 2003. *Lepidoptera, Moths and Butterflies. Vol. 2: Morphology, Physiology, and Development*. xii + 564 pp. – In: M. Fischer, *Handbook of Zoology 4. Arthropoda: Insecta*, part 36. – Walter de Gruyter, Berlin & New York. Price: 248,00 €. ISBN 3-11-016210-5.

Since Linnaeus (1758) described the first taxa of Lepidoptera, countless scientific results have been published about this insect order, which is one of the most speciose animal groups on earth. While a large amount of knowledge about Lepidoptera has been published before the middle of the 20th century, research in Biological Systematics became revolutionised particularly by the theory and method of Phylogenetic Systematics by Willi Hennig (1950). Subsequently, the knowledge about systematics and evolution of the Lepidoptera increased significantly. However, at the same time specialisation in science increased considerably and it became more and more important to summarise the scattered knowledge. In this regard, Malcolm Scoble's book "The Lepidoptera – Form, Function and Diversity", published in 1992, was a milestone and served as *the* standard reference for Lepidoptera for more than a decade. However, Malcolm had only about 400 pages to treat the many subjects and the many taxa of Lepidoptera, and thus, a more comprehensive compendium remained still in need. For such a purpose, the *Handbook of Zoology* series is an ideal platform to combine so many subjects like systematics, evolution, biogeography, morphology, physiology and development of these insects, still leaving molecular biology, genetics and cell physiology aside. The *Handbook of Lepidoptera* became a long-lasting project, which already started in the mid-1980ies, when Niels Peder Kristensen took over the editorship for the two volumes on Lepidoptera. During this time, numerous outstanding Lepidopterists contributed to the *Handbook*, not all of them continued up to the end, resigned or deceased before it became published. Finally, 56 authors are still listed who completed the two volumes opus.

In 1999, the **first volume** appeared, mainly dealing with systematics and evolution of the Lepidoptera. It comprises 21 chapters, each written by one or several specialised authors, giving a historical introduction of principal pre-1900 contributions to the foundation of contemporary Lepidopterology, an overview of the lepidopteran groundplan, the phylogeny above superfamily-level, palaeontology, a classification and keys to higher taxa, followed by treatments of the non-glossatan groups, the homoneurous Glossata, the monotrystian Heteroneura, the Tineoidea and Gracillarioidea, the Yponomeutoidea, the Gelechioidea, the Zygaenoidea, the cossoid/ sesioid assemblage, the Tortricoidea, the smaller microlepidopteran-grade superfamilies, the Pyraloidea, the Axioidea and Calliduloidea, the butterflies, the drepanoid/ geometroid assemblage, the Bombycoidea and their relatives, the Noctuoidea, and it is concluded by two chapters about the evolution of larval food preferences and biogeography of the Lepidoptera. Within the volume, the phylogenetic relationships of the taxon Lepidoptera, its basal lineages and its 46 recognised superfamilies constitute a focal issue. This is mostly not aimed at presenting a neatly resolved classification (which would inadequately simplify the subject) but includes to some extent the discussion of different phylogenetic hypotheses and the character conflicts behind. Each of the 16 chapters treating the large groups of Lepidoptera, from the non-glossatan groups to the Noctuoidea, gives an overview of the group treated and its taxa down to family-group level, comprising the

relevant autapomorphies (so far known) and detailed descriptions of immatures and adults, as well as general information on life history, species numbers and biogeography. Each chapter includes at least one plate illustrating the range of general appearance of the adults in that group. The text is supported by numerous figures of the head, the wing venation, the legs, male and female terminalia, the larvae, pupae and other features. All chapters close with a comprehensive list of references, and the entire volume with an index of scientific Lepidoptera names, comprising 24 pages.

The **second volume** has been published in early 2003 and completes the *Handbook* on Lepidoptera. It treats the morphology, physiology and development of the Lepidoptera, in a total of 19 chapters about the lepidopteran integument, 'hairs' and scales, coloration patterns and their morphogenesis, skeleton and muscles of adults and immatures, digestive and excretory systems, respiratory system, circulation and thermoregulation, nervous system, sensilla and proprioceptors, auditory and sound producing organs, eyes and vision, exocrine glands for chemical communication and defense, labial glands producing silk and saliva, endocrine glands and hormones, reproductive organs, karyology and sex determination, eggs, and embryology. The text of each chapter is supported by numerous figures and completed by a comprehensive list of references. Near the end of the volume, a cladogram for the superfamilies and higher taxa is given again, together with a list of the adopted Lepidoptera system. The volume closes with an index of the generic names mentioned in volume two, with assignment to the family-groups, and relevant chapter numbers in the systematics section of volume one.

Like volume one, the second volume is full of information on the various aspects treated. Characters are discussed also in context above ordinal level to ensure that homologous or at least morphologically identical entities are treated. This is of special importance, because entomologists developed terminologies often independently for different insect orders, especially with regard to taxonomic literature. As a result, the same term is sometimes used for non-homologous structures. For Lepidoptera, examples are the structure in male genitalia called 'aedeagus', which in the morphological sense indeed is a phallus in most Lepidoptera (Kristensen, p. 103–105) and in female genitalia the 'ovipositor', which is a well-defined structure of the insect ground-plan and absent in Lepidoptera (Kristensen, p. 113). With the comprehensive and detailed chapters 'skeleton and muscles: adults' and 'reproductive organs' written by Niels Peder Kristensen, the so far standard source for lepidopteran genitalia by Klots (1970), which is outdated since a long time, is finally much more than well replaced.

The space available here is by far too much limited to give examples of the many well written chapters. The two-volumes opus on Lepidoptera fulfils the highest standards of a handbook. It is comprehensive, though its editor, Niels Peder Kristensen, stated in his privileged diplomatic personality "The accumulated knowledge about larger animal groups such as the Lepidoptera has now reached such a magnitude that no manageable 'Handbook' account can be comprehensive in the strict sense of the word." This in the perfect sense will certainly never be achieved.

The books are published in A4-size and the text is written in very concise style, so the volumes are filled with densely packed information. Each chapter closes with a comprehensive list of references, enabling a perfect embarking on the subject treated. The *Handbook* on Lepidoptera gives extensive insights into the various aspects of Lepidoptera dealing with systematics, evolution, biogeography, morphology, physiology and development. Most Lepidopterist's will even learn about new facts on the group(-s) they are specialised in. The *Handbook* will undoubtedly serve as a standard source for students and scientists working on Lepidoptera, independently of the subject they are specialised in, e.g., ecology, genetics, morphology, systematics or others. Of course, the books are expensive, but they are worth their money. All authors did a very good job and many of them were prompted to undertake substantial

research for the preparation of their contributions and thus the books became really innovative. Niels Peder Kristensen should be expressively acknowledged here. He acted not just as an editor of the *Handbook*, which alone occupied him for many years. Altogether, Niels wrote five chapters on his own, and co-authored 11 further ones. During decades, he published outstanding results about systematics and morphology of Lepidoptera, e.g., about the early evolution of Lepidoptera (e.g., Kristensen 1967, 1984, 1997; Kristensen & Nielsen 1979), which well qualified him for this project. Congratulations to Niels and all other authors to this two volumes opus. I hope it will obtain the attention it deserves, and will be extensively used by the lepidopterists community.

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