TROPICAL LEPIDOPTERA, 10(2): 80-82 (1999)

BOOK REVIEW

HANDBOOK OF ZOOLOGY. 35. Lepidoptera, Moths and Butterflies Volume 1: Evolution, Systematics, and Biogeography

edited by Niels P. Kristensen

1999. Walter de Gruyter & Co., Berlin. 487pp (21 x 30cm). DM 398.00 ($249.00) cloth. ISBN 3-11-015704-7.
(Vol. 4. Arthropoda: Insecta, in *Handbuch der Zoologie* series, Part 35)

The present *Handbuch* is the 35th volume in the long-running German-language series, started in the early 1900s. The first Lepidoptera treatment (by Zerny and Beier), in the original *Handbuch der Zoologie* series, was published in 1936-38. The current 1999 version, for the post-war second *Handbuch* series, is up-to-date as of the mid-1990s with some added changes up to 1997, and is the first part dealing with the evolution and classification of the order, to be followed by a second part on morphology and physiology. The old *Handbuch* series was in German. The current Lepidoptera volume is entirely in English: the only German in the book is in the dual-language title. Niels Kristensen, of the Zoological Museum, University of Copenhagen, Denmark, is editor and one of the specialist-authors of this volume. The authors are 29 specialists, mainly from western Europe (only from Austria (1), England (7), Denmark (1), France (2), Germany (1), Netherlands (1), and Poland (1)), but 10 are from North America, 4 are from Australia/New Zealand, and 1 is from South Africa: there are none from Russia, Japan, or South America, among other areas.

The book is divided into 21 chapters, mostly covering the various main superfamilies, plus chapters on the history of Lepidoptera studies, phylogeny, and classification and keys, plus two terminal chapters on larval food preference evolution and on biogeography. Each chapter has its own set of references listed, and there is an index to scientific names at the end of the book. There are keys to superfamilies and families, and a key to larvae by family. Following the more superficial, although well-done, treatments of recent years — Munroe (1982, in *Synopsis and Classification of Living Organisms*), Holloway *et al.* (1987, in *CIE Guides to Insects of Importance to Man*), and Scoble (1992. *The Lepidoptera*), as well as book chapters on mainly Australian Lepidoptera by Common (1970, in *Insects of Australia*) and Nielsen and Common (1991, in *Insects of Australia*, rev. ed.) — this new treatment of the world fauna is a welcome addition to the continuing elucidation of Lepidoptera families, notwithstanding some negative aspects of the work. The treatments of each family and superfamily include precise descriptions for known characters, including characters of immature stages when known. Each family also has some notes on known distributions and hostplant preferences, as well as known bionomics.

The only proviso for the reader is to remember that many of the family and higher classification parameters in this new work are the result of Hennigian regimental cladistics, a term I use for blindered cladism that ignores differential rates of evolution (which can present apparent paraphyly) and only concerns itself with finding dichotomous synapomorphies (or advanced characters) to segregate groups of taxa, without equally careful selection and interpretation of characters. The deception of completeness in the book, or the so-called "global consensus" as some researchers like to call it, thus, involves the bias of cladism: global consensus can hardly be involved, however, when one notes how many leading world specialists are missing even from author acknowledgements as reviewers of their chapter contents, let alone as co-authors for the book.

Not all the authors are as cladistics oriented as some, so the treatments vary as to the extent of cladistic analysis. What the reader must remember is the fatal flaw of cladistics when used to the exclusion of more traditional classification methodologies, in that the results depend on innumerable variables that each specialist can manipulate: if a computer program is used, then the results depend on the program used, the number and importance of characters used, and how the results are interpreted (the tree of clades can form families, subfamilies, or genera, etc., depending on where an author decides to draw the line for each taxonomic level). All this is relatively ignored by many taxonomists and certainly by fervent cladists. Cladistics, when used in conjunction with reliable characters for varying taxonomic levels and with other methodologies, can present useful views of possible phylogenies, but cannot in itself present the only possible picture: one gets the dichotomous trees but the subjective decision remains with the researcher as to where a genus begins, or a family begins, and so on. My own taxonomic studies have also used cladistic techniques for larger groups, but only as one viewpoint, not as the one key to all evolutionary lineages (DNA analyses likewise are being heralded by some as the new "key" to classification). Cladistics, as currently used, also does not envision differential rates of evolution in its methodology (a key element of evolution, where periods of explosive diversification are now proven in the fossil record), and thus, cannot allow families (like the highly advanced Hedylidae in Geometroidea) to be a more rapidly evolved sector (of geometroids, in this example) than supposed advanced groups (like primitive butterflies), thus, *ipso facto*, needing its own superfamily. It should be noted that the girdle-suspended pupae of Hedylidae, supposedly showing close relationship to an equal arrangement among some butterfly groups (e.g., Papilionidae), are also found in many otherwise typical Geometridae.

The real "key" to sound taxonomic classification is to use many different views — cladistic, evolutionary, molecular — and as many characters of family-level value as possible, to then decide on the most likely lineages of Lepidoptera families and subgroups. It can be noted that many cladistic analyses are also flawed to some extent by using too many characters of little value for higher level taxa: e.g., genital characters may have some value but they primarily are specific- and generic-level due to their selective plasticity in interspecific evolution among related species, and thus, they will not offer solid characters that only change over longer evolutionary periods as ought to be the case in family phylogeny for most groups (e.g., genitalia of many Immidae appear very similar to many primitive Noctuidae, yet Immidae are only closely related to Pyralidae, so adding genital characters to a cladistic analysis to see what families are related can obscure and skew the results). In the *Handbuch*, one finds many of the family classifications relying on single unusual characters as main autapomorphies, whether genitalic or even physiological (e.g., imbibing pyrrolizidine alkaloids for the Danainae, but some Arctiidae (possibly also Zygaenidae) do the same), as an excuse to combine or exclude groups, rather than taking a totality of family-level characters (including those from immature stages) to form the classifications: some chapters do this well, others do not.

As noted above, some of the authors have not been completely blinded by cladistics: fairly reasonable treatments are provided for primitive moths, Tineoidea (although Gracillarioidea are split off as a separate superfamily instead of as a section of Tineoidea), Bombycoidea (although several "superfamilies" are used), and Noctuoidea, and also butterflies except that three superfamilies are used (Hedyloidea, Hesperioidea, and Papilionoidea). In contrast, a particularly poor aspect of the proposed classification are the numerous monobasic superfamilies for groups that the authors cannot align cladistically with any other group: e.g., Choreutidae, "Simaethistidae," "Galacticidae," Schreckensteiniidae, Epermeniidae, "Whalleyanidae," Hedylidae, and Axiidae are each treated within their own monobasic superfamilies, three of which (in my parentheses) are doubtfully even families (actually subfamilies).

What is particularly ill-advised with these new monobasic "superfamilies" is that most of them are quickly erected merely for temporary convenience until the groups are known better, since the authors do not know where to place them — they differ from current families (according to these specialists), and thus, need a new superfamily but one which may be altered later once more data are discovered (many of the unusual groups are unknown biologically, thus, with unknown larval characters). All this brings continued confusion to the number of families in Lepidoptera. Some of this seems due to a European and Hennigian prevalence to extreme splitting for any odd group that exhibits different characters, rather than modifying an existing family definition to incorporate the new characters: better a "new" family than a new subfamily seems to be the motto (!). Examples include the elevation of Galacticinae to family level instead of as a subfamily of Urodidae, and the elevation of odd genera as "families" (Simaethistidae, Whalleyanidae, Oenosandridae, Doidae) instead of seeing their relationships within larger families. There are also reverse examples where credible differences are not acted upon, like retaining *Atteva* and relatives within Yponomeutidae instead of as Attevidae, and some families do require their own superfamily (viz., the unusual Immidae as Immoidea). One also has the conventional listing of all "slug caterpillar" families within Zygaenoidea: this has been perpetuated practically since the time of Linnaeus, since they all "look" and act the same, while ignoring more fundamental morphology demonstrating that some families (Chrysopolomidae, Cyclotornidae, Dalceridae, Epipyropidae, and Limacodidae) are cossoid and some (Heterogynidae, Megalopygidae, Somabrachyidae, and Zygaenidae and relatives) are zygaenoid, all similar due only to their evolutionary convergence on a common larval adaptation (the families noted do have some characters in common but not the more fundamental ones). Thus, certain characters are ignored: for example, the dorsal heart vessel, which demonstrates the cohesion of certain families and the divergence of others, as just mentioned, clearly shows an evolutionary phylogeny giving us today's fauna (see Heppner, 1998, *Classification of Lepidoptera*). One also continues to see the pre-Linnaean tradition of Sesiidae, Zygaenidae and relatives, and even Psychidae, Hepialidae, and Notodontidae, mixed in with the so-called "Bombyces" in recent European faunal works, thus maintaining the mythology that these families are all closely related, which is particularly detrimental for amateur entomologists when most field guides perpetuate this idea — at least the *Handbuch* clarifies the classification for these families.

The most extreme cladistic analysis is found in Gelechioidea, resulting in an incredible and unfortunate proposition, greatly rearranging the entire superfamily. Based only on a cladistic analysis, with its usual subjective decision on what constitutes a family and how the analysis was conducted, the results presented will take another 25 years to clear up once it creeps into the literature (all this also spurs on other workers who raise practically every gelechioid subfamily to family level), although it is unlikely that all the proposals will be adopted by many researchers. Again, instead of enlarging family definitions, the author has taken regimental cladism and drawn the line at a certain level, thus having no choice (in this methodology) but to elevate odd groups as families and recombine other well-known groups into supposedly non-paraphyletic lineages (particularly evident in the new ideas for Oecophoridae). The author for Gelechioidea obtained an interesting cladogram but rearranged the subfamilies from the previous 11 rather well established families into 15 families with considerable changes: e.g., oecophorids are basically renamed as Elachistidae, leaving the restricted Oecophoridae only as what was the subfamily Oecophorinae, while the distinct Scythrididae are submerged as a subfamily of Xyloryctidae (a group elevated from its former placement in Oecophoridae as the subfamily Xyloryctinae), among other changes. At least full details of the cladistic analysis used for Gelechioidea are presented, including the only synonymic list of family-group names in the book, so the proposed classification can be easily reconciled with older names and where all the subfamilies went to. The treatment of Gelechioidea in particular also demonstrates a lack of editorial control on the overall classification (possibly necessary to appease all contributing specialists), since an equivalent treatment for the entire order would require elevation of all subfamilies (possibly also many tribes) to family level and give us at least 312 "families": this is being attempted in Coleoptera, especially for scarabs and weevils, but hopefully greater sanity will reign for the classification of Lepidoptera.

Another example of cladistic blinders, which the economic literature will reel from for another generation, is the confusion of reverting to the use of Crambidae and Pyralidae that we had back even before 1885 when Meyrick split the Pyralidae into several families, even though the characters that divide the group were already amply handled by Munroe (1972) when he made a "series" category for these taxa between the family and subfamily levels, thus retaining Pyralidae as a broad yet cohesive family. There is nothing new in what is now being done in Pyralidae by some (begun even before the *Handbuch* appeared), it merely elevates the series subgroupings to family level, but to what advantage (?). All this is only due to the most iconoclastic cladists — since the "clades" (as they interpret them) require it and they will not use non-traditional subordinate taxa like groups or series — yet, it does nothing useful for a classification aspiring to be equally logical for all families and it only wrecks havoc for the family concept for other scientific disciplines such as economic entomology. The many family changes — where specialists cannot agree even among themselves as to what a family is (hardly a global consensus) — only continue to denigrate the image of taxonomists in the eyes of other scientists and do not help the stability of Lepidoptera higher classification.

The book also retains family name changes that have crept into the literature. Notably, once again we find Roeslerstammiidae used (mispelled in the book both as "Roeslerstammidae" [sic] and "Roeslerstamidae" [sic], plus the correct spelling, all on the same page), instead of the well-known Amphitheridae. Why? Because, when the genera for this group were revised by Kyrki (1983. *Ent. Scand.*, 14:321-329) he found the European genus *Roeslerstammia* also belonged among the Amphitheridae of tropical Asia, and being an older generic name, he changed the family name out of apparent ignorance of the Zoological Code which does not require the oldest genus to be the name-bearer for the family name, especially so for names already well-established in the literature. Ever since, others have blindly followed this usage (at least in Europe), although the correct name (and what the Code recommends for stability in such cases) is Amphitheridae. One can see the lemming-like "blindness" here by the fact that various authors using Roeslerstammiidae in recent works, also use the name Nepticulidae, instead of "Stigmellidae," even though the case is similar and *Stigmella* is an older generic name than *Nepticula* (in this case, *Nepticula* is now even a junior synonym of *Stigmella*!). Likewise, we have almost the identical situation with the use of Acentropinae for the aquatic pyralids, instead of the widely-used name Nymphulinae, the only difference here being that Nymphulinae are merely a more well-known group with a larger literature than Amphitheridae, and thus the resurrected name, Acentropinae (not used for over 100 years prior to its resurrection in 1981), is not accepted by most researchers. Let us have uniform treatment of names and retain recognized names as the Code recommends. Usage of various names for the same family (or subfamily) only causes undo confusion and is then perpetuated for many years: witness the continued sporadic use of Attacidae (mainly in French papers) for the Saturniidae, 45 years after Attacidae was first resurrected as the supposed correct name for the saturniids, and even nearly 20 years after Attacidae was officially suppressed by the ICZN (1981. Opinion 1170). Undoubtedly, we will have similar problems with the incorrect or ill-advised names currently afloat — Crambidae, Acentropinae, Roeslerstammiidae — just like the continued use of various butterfly subfamilies as family names. The latter is particularly troublesome as it is continually regurgitated in various field guides and greatly confuses amateur enthusiasts as to what the correct names should be: one book elevates practically all nymphalid subfamilies as families, for example, the next one has them all as one family, Nymphalidae, and so on year after year. For butterflies, the

Handbuch has 5 families (using Hesperioidea and Papilionoidea) — not to mention the inclusion of Hedylidae in Hedyloidea — yet, there are a number of cladistic irregularities: viz., Megathyminae are incorporated within the subfamily Hesperiinae (Hesperiidae), Riodinidae are placed as only a subfamily of Lycaenidae (this goes back and forth in every other book), Libytheidae are a subfamily of Nymphalidae (likewise going back and forth from author to author), Amathusiinae and Brassolinae are reduced to tribes within Morphinae, and Tellervinae and Ithomiinae are reduced to tribes within Danainae, all questionable treatments only resorted to because of the cladistics used by the current authors of the butterfly chapter.

Overall, the new *Handbuch* is still a landmark work of many current specialists and clearly will be consulted by all serious lepidopterists. Only a few spelling errors were noted. Items like the family keys and larval keys will require extended use to determine how well they work. One item lacking in the work is a comprehensive synonymic listing of all families, subfamilies and tribes (probably even subtribes) as envisioned by the authors (perhaps something that can be added as part of the introduction to Volume 2 of the Lepidoptera treatment) — subfamily and tribal names in many groups are particularly confused, or of differing rank, between American and European workers, especially in Geometridae and Noctuidae, and differ in each new work that comes out. The book, nonetheless, is a fine testament to Dr. Kristensen for the large job of editing the work of 29 specialists. One detriment to its easy availability, however, is the very high price of $249 for just this first part of the 2-volume Lepidoptera treatment. The publisher, unfortunately, is one of the most costly book publishers in the world: another of their *Handbuch* volumes is priced at about $1 per page (!), and this was already 15 years ago when the US Dollar was worth even more than now, and without any color plates: the current volume is only about 50¢ per page. Perhaps the high price has its unforeseen advantages: the extreme cladistic classification proposed in this *Handbuch* may in this way not become so well known or used.

J. B. Heppner
Florida State Collection of Arthropods, FDACS, DPI,
P. O. Box 147100, Gainesville, Florida 32614