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Lepidoptera phylogeny and systematics: the state of inventorying moth and butterfly diversity

NIELS P.KRISTENSEN[1], MALCOLM J. SCOBLE[2] & OLE KARSHOLT[1]

[1]*Natural History Museum of Denmark, University of Copenhagen, Universitetsparken 15, DK-2100, Copenhagen Ø, Denmark; npkristensen@snm.ku.dk; okarsholt@snm.ku.dk*

[2]*Department of Entomology, The Natural History Museum, Cromwell Road, London SW7 5BD, UK; M.Scoble@nhm.ac.uk*

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Abstract

The currently recognized robust support for the monophyly of the Lepidoptera (and the superorder Amphiesmenoptera comprising Lepidoptera + Trichoptera) is outlined, and the phylogeny of the principal lineages within the order is reviewed succinctly. The state of the taxonomic inventory of Lepidoptera is discussed separately for 'micro-moths', 'macro-moths' and butterflies, three assemblages on which work has followed historically somewhat different paths. While currently there are about 160,000 described species of Lepidoptera, the total number of extant species is estimated to be around half a million. On average, just over one thousand new species of Lepidoptera have been described annually in recent years. Allowing for the new synonyms simultaneously established, the net increase in species numbers still

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exceeds 800/year. Most of the additions are foreseeable in the micro-moth grade, but even for butterflies ca 100 species are added annually. Examples of particularly interesting new high-rank taxa that have been described (or whose significance has become realized) since the middle of the 20th century include the non-glossatan lineages represented by *Agathiphaga* and *Heterobathmia* and the heteroneuran families Andesianidae, Palaephatidae, Hedylidae and Micronoctuidae. Some thoughts on how present and future systematic lepidopterology might be prioritised are presented.

Key words: Lepidoptera, phylogeny, taxonomy, species numbers

Introduction

A combination of features has conspired to render the Lepidoptera one of the most studied groups of organisms. The order is species-rich and occurs in nearly all regions and a wide variety of habitats. The dense covering of scales on the wings not only gives the order its scientific name, but also forms the basis for the attractive colour patterns present in many species. The resultant conspicuousness of a variety of Lepidoptera explains much of the attention these insects have received. That attention, as we note below, has resulted in taxonomic work that while extensive exhibits much variation in quality. The state of Lepidoptera taxonomy, therefore, is partly a function of the visibility of these insects.

According to some newer estimates (Hammond 1992, T. Pape pers. comm. on Diptera , L. Vilhelmsen pers.comm. on Hymenoptera) the number of described extant species of Lepidoptera may be exceeded only by beetles and flowering plants. In the best known of all biota, those of NW Europe, Lepidoptera species numbers are also surpassed markedly by fungi, hymenopterans and flies, and the same observation will almost certainly prove to apply (at least in the case of the said insect taxa, likely also mites and nematodes?) on a global scale. Despite the unquestionable species richness of the Lepidoptera, they are far more homogeneous, structurally and ecologically, than the other larger insect groups: The point has been made repeatedly, that the most structurally diverse lineages, composed of the lower (non-ditrysian) grade in the order, account for only about 1-2 per cent of its total species number. The combination of a large number of species and little structural diversity can impede progress in the overall taxonomic treatment of an animal group.

The conspicuousness and attractiveness of such lepidopterans as butterflies, hawk moths and emperor moths, have made these insects popular 'beginners items' with amateur entomologists. And when advanced amateur lepidopterists seek challenges in groups other than those most easily accessible, they often proceed to less conspicuous lepidopterans rather than to other orders of insects. Paradoxically, the popular appeal of Lepidoptera may have adversely affected professional research on the order. A student of systematic entomology will often enter the field through working on the local fauna, and in some countries may then find it easier to make 'immediate new discoveries' by studying insects other than Lepidoptera. Also, the study of aesthetically pleasing insects sometimes elicits the charge of being *ipso facto* intellectually second-rate! Negative attitudes held towards allegedly 'philatelistic' butterfly workers (Paul R. Ehrlich (1960) mentioned the sometime influential insect morphologist/taxonomist G. F. Ferris as an instructive example) may well reflect adversely on lepidopterology as a whole. Faced with such an attitude from their superiors, it is hardly surprising that some potential lepidopterists have chosen to turn for their graduate studies to insect taxa that are judged to be more academically respectable.

The colourful vestiture of scales and hairs on the wings, body and appendages of Lepidoptera certainly often offers excellent diagnostic features at the lower taxonomic levels, but at the same time this vestiture conceals most of those exoskeletal traits found to be so useful in supraspecific classification, and which are more easily and routinely studied in insect taxa where the exoskeleton is exposed. Vestiture, thus, has invited literal superficiality in Lepidoptera taxonomy. Not only has this impeded taxonomic progress, but it may well have contributed to the aforementioned disdain for Lepidoptera studies within parts of the ‘establishment’ of systematic entomology, hence creating a vicious circle. Yet Lepidoptera have been used often as model organisms in a