

Phylogenetic problems in the Insecta

Alexandr P. Rasnitsyn

The problems of the gross internal phylogeny of the insects are far from being resolved. As the most important issues, the basal pterygote dichotomy and the affinities of *Zorotypus* will be discussed here.

The main competing pterygote dichotomies are Palaeoptera/Neoptera (Martynov 1925 - Kukalova-Peck 1978-1992) vs. Scarabaeones/Gryllones (Rasnitsyn 1980). The former hypothesis infers that palaeodictyopteroids, dragonflies, and mayflies are symplesiomorphic in that their wings are unfoldable, lack jugal area, and bear convex MP. Neoptera are synapomorphic in possessing the alternative set of character states.

This inference raises numerous conflicts with morphological and functional observations and inferences. The most difficult problems implied are that (i) the permanently outstretched wings and wing pads limited mobility of an insect until it acquired elaborate flight ability, and (ii) a series of taxa exists to form a transition between the typical palaeodictyopterans and the paoliid-cacurgid assemblage that possesses wings that are the least advanced among the insects. This series is composed by the order Diaphanopterida, a typical palaeodictyopteroid group except for foldable wings, and by *Heterologopsis* Brauckmann, whose wings are also foldable, but with venation typical of Cacurgidae (including the concave MP). However, its body structure is typical of Dictyoneurida and Diaphanopterida, including thick sucking beak and elongate prothoracic winglets. We might consider this transition as exemplifying the evolutionary path from palaeoptery to neoptery (from a palaeodictyopteroid-like ancestor to a cacurgid-like descendant). However, this would mean a regression from the aerodynamically sophisticated palaeodictyopteroid wings to the most archaic paoliid wings. Additionally, this would mean that ALL the most ancient winged insects, however diverse they were in their wing structure, were highly and similarly specialised in having thick sucking beaks.

The hypothesis of Scarabaeones/Gryllones dichotomy seems to be less burdened with contradictions and homoplasies. It infers that Scarabaeones are paraphyletic while Gryllones are synapomorphic in acquiring the horizontal (flat instead of roof-like) repose position of their wings, with a wider hindwing area (all behind 1A=PCu) bent down when folded. The above palaeopteran plesiomorphies are considered here to be apomorphies that are independently acquired by mayflies + dragonflies and by palaeodictyopteroids. The transition between Paoliidae and Dictyoneurida is easily interpretable as exemplifying the possible origin of Dictyoneurida from a *Heterologopsis*-like cacurgoid ancestor via diaphanopterid-like intermediate stage.

Long discussion on the enigmatic genus *Zorotypus* has failed to reveal a correct position of the order Zorotypida (= Zoraptera) in the Martynov & Kukalova's system and cladogram. The alternative approach coupled with the new observations on the pterothoracic morphology of *Zorotypus* allows incorporation of the group into the insect system and cladogram as a member of the predominantly Paleozoic superorder Caloneuridea. Probably it is a sister group of the cohort Scarabaeiformes (= Holometabola).

Embryology and arthropod phylogenetics: cleavage, germ band formation and head segmentation

Gerhard Scholtz

Embryonic characters have always played an important role for the discussion of arthropod relationships. The assumption of arthropod polyphyly as well as the hypothesis of arthropod monophyly are largely based on the findings of comparative embryology. These contradictory views, however, result from different approaches to questions of homology and the reconstruction of relationships.



INTERNATIONAL SYMPOSIUM ON
THE RELATIONSHIPS OF MAJOR
ARTHROPOD GROUPS

Programme and Abstracts

17th – 19th April 1996

The Natural History Museum, London