

## The enigmatic Mesozoic insect taxon Chresmodidae (Polyneoptera): New palaeobiological and phylogenetic data, with the description of a new species from the Lower Cretaceous of Brazil

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With 10 figures

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**Abstract:** The morphology of the enigmatic, Mesozoic, aquatic insect family Chresmodidae is redescribed and its phylogenetic affinities among the polyneopterous orders discussed. Study of the complete venation of both fore- and hind wings observed in some specimens from the Spanish Barremian, permit us to postulate the hypothesis that the family belongs to the Archaeorthoptera, thus to the orthopteroid lineage rather than to crown-group Phasmatodea or to the more inclusive group Holophasmatodea (*sensu* GRIMALDI & ENGEL, 2005). New specimens from Spain, Lebanon, Brazil, and Germany permit a new re-description of some chresmodid body structures with concomitant implications for the phylogenetic position of the family. *Chresmoda neotropica* n. sp. is described from the Aptian-Albian of the Crato Formation (northeast Brazil). The functional morphology proposed for some of their specialized structures suggest a new hypothesis of *Chresmoda* palaeobiology, and related to this some implications for the localized palaeoenvironment as well as global palaeoclimate.

The problematic *Sternarthron* spp. from the Upper Jurassic of Solnhofen were described as probable palpigrades (Arachnida: Palpigradi), based on type material originally thought to be fossil insects. The affinities of *Sternarthron* HAASE, 1890 have been questioned. Our restudy of HAASE's types clearly confirmed earlier assumptions that these fossils represent nymphal specimens of chresmodids. Consequently, *Sternarthron* has to be considered as an invalid junior synonym of the fossil insect genera *Propygolampis* WEYENBERGH, 1874 and *Chresmoda* GERMAR, 1839.

**Key words:** Insecta, Polyneoptera, Archaeorthoptera, Sternarthronidae, Chresmodidae, Palpigradi, Functional Morphology, Phylogeny, Paleocology, Mesozoic, Crato Formation, Solnhofen Lithographic Limestones.

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### 1. Introduction and historical context

Chresmodids are large fossil insects with a water-strider-like habitus. They have short and thick antennae and prognathous chewing mouthparts with strong mandibles, and large compound eyes. The legs are extremely prolonged with very long femora, shorter tibiae, and long, multi-segmented, flagellate

tarsi with more than 40 tarsomeres (Fig. 7.2), a feature which is unique within Insecta (NEL et al. 2004). The forelegs are usually directed anteriorly, while the middle and hind legs are directed latero – posteriorly. They have two pairs of membranous wings with a slender forewing with long and parallel longitudinal veins and a broad anal fan in the hind wings, typical of polyneopterous insects (Figs. 6.3, 8). There are long,