

Revision of the fossil ricinuleids

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ABSTRACT: The fossil ricinuleids are described, and their systematic relationships revised, based on a study of all British and American specimens. Phylogenetic analysis, utilising a new character set, indicates a probable basal dichotomy between the fossil and extant forms. The order is divided into two new suborders: Neoricinulei subordo, nov., for the extant genera, and Palaeoricinulei subordo, nov., for the fossil forms. Two new genera are erected: *Amarixys* gen. nov. for *Curculioides gracilis* (Petrunkevitch, 1945) and *A. stellaris* sp. nov., and *Terpsicroton* gen. nov. for *Poliochera alticeps* Pocock, 1911. Three new species are erected in the genus *Curculioides*: *C. mcluckiei* sp. nov., *C. pococki* sp. nov., and *C. gigas* sp. nov., and one in the genus *Poliochera*: *P. gibbsi*, sp. nov.

KEY WORDS: Arachnida, arthropod, Carboniferous, Chelicerata, morphology, Namurian, palaeobiogeography, Pennsylvanian, phylogeny, systematics, taxonomy, Westphalian.



In recent years, much new information on living ricinuleids has become available, necessitating a review of the functional morphology and phylogeny of the fossils. Furthermore, the holotype of *Curculioides ansticii* Buckland, 1837, the first described ricinuleid, has been rediscovered (Torrens 1981, 1982), and new fossil material has come to light, so that the total number of fossil ricinuleids now known is 25 specimens.

The systematic work of Petrunkevitch (1913, 1945, 1949, 1955) has proved to be erroneous in many respects, so that new descriptions and taxonomic revision are necessary. For example, he asserted that the fossil ricinuleids lacked eyes, presumably based on the fact that living ricinuleids lack eyes (although they have an area of thin cuticle on the lateral edge of the carapace which is thought to be light-sensitive), yet a pair of eyes is present on each side of the carapace in nearly every fossil studied. These organs are visible in Petrunkevitch's photographs (e.g. 1913, pl. VII, fig. 38), but he made no mention of them in the text. Nearly all of the criteria used by Petrunkevitch to separate the species of fossil ricinuleids is based on characters which are subject to taphonomic distortion: the width of the carapace for example (see below). Petrunkevitch commonly confused ridges and furrows between descriptions of the same specimen (a good example of this was described for the trigonotarbid *Aphantomartus* in Selden & Romano 1983), because of the effects of internal and external moulds.

Therefore, new descriptions are given here. Discussion of the differences between the new descriptions and the older excludes minor corrections to measurements: the width of the carapace for example. In the present work, the characters used are different from those on which Petrunkevitch based his taxonomy, and whereas the current taxonomic system of fossil ricinuleids presented here is far from satisfactory, it is hoped the new taxobases will be more useful in the future. Resulting from the fossil study, a phylogenetic analysis of all ricinuleids is presented, including a cladogram (Fig. 2) illustrating the hypothesis of relationships among fossil species and modern genera based on the new work.

1. Age and provenance of the fossils

All known fossil ricinuleids are Carboniferous in age; the oldest is *Curculioides adompha* Brauckmann, 1987, from rocks of upper Namurian B age of the Ruhr area, Germany. All other fossil ricinuleids are Westphalian in age. One doubtful specimen, called '*Poliochera vel Curculioides pustulatus*' by Laurentiaux-Vieira and Laurentiaux (1963), comes from near Beijing, China; all other Westphalian ricinuleids are from the U.S.A. and England. *C. ansticii* is from Coalbrookdale, Shropshire, and Sedgley, Worcestershire, single *Curculioides* specimens are known from Ilkeston, Derbyshire, and Ryton-on-Tyne, Tyne and Wear, and the other four British specimens are from Coseley, West Midlands; all are Westphalian B in age. All American fossil ricinuleids are from Mazon Creek, Illinois (Westphalian D, Pfefferkorn 1979), except one, which is from near Morris, Oklahoma.

2. Sedimentary environment and preservation

The sedimentary environment in which the fossil ricinuleids occur, in both the European and American situations, is one of a delta. The fossils occur in concretions within shales, and in all localities well studied (e.g. Mazon Creek, Richardson & Johnson 1971) these shales include upright trees or other evidence of rapid deposition in an otherwise low energy situation, such as a flood basin fed by crevasse splays or storm surges.

All specimens studied are preserved in ironstone nodules composed of clays and siderite, weathered to a greater or lesser extent to haematite and limonite (see Woodland & Stenstrom 1979; Woodland 1985). The majority are preserved as external moulds, but in some cases internal moulds of part of the specimen are present. Kaolinite, and in some cases, calcite and pyrite, forms a natural cast of the cuticle of most specimens, and this material has been scraped out in order to reveal the morphological details preserved on the mould surfaces. Where both internal and

