

CARBONIFEROUS INSECTS FROM THE STANTON FORMATION, KANSAS.

F. M. CARPENTER.

ABSTRACT. This is an account of three additional insects from the Rock Lake Shales, Stanton Formation, near Garnett, Kansas. One species, *Euchoroptera longipennis*, n. gen. & sp., is described, belonging to the Megasecopterous family, Prochoropteridae. This insect had many characteristics in common with the Protohymenoptera, such as an ovipositor, a rostrum, and the ability to fold the wings over the abdomen.

THE three specimens on which this paper is based were collected in an outcrop of the Stanton Formation near Garnett, Kansas. The thin shales of this exposure have already become famous for their remarkable flora, but so far they have yielded only one insect, *Parabrodia carbonaria* Carp.¹ I am indebted to Dr. Theodore White for calling my attention to these additional specimens and to Dr. Claude W. Hibbard for loaning them to me. All of the fossils, which are deposited in the Museum of the University of Kansas, were collected on the Bradford Chandler farm, Anderson County, Kansas.

An account of the geologic setting of these Garnett beds and of their stratigraphy and biota has been published by Moore, Elias, and Newell.² Although the flora is very suggestive of "Permian" age, these investigators have concluded that the "Permian" aspect is explainable in terms of climatic conditions, and that the beds are unquestionably of Middle Pennsylvanian age, belonging to the uppermost part of the Lansing group of the Missouri series. It is noteworthy that the insect fauna of the Garnett beds, although at present represented by only four specimens, is also peculiar. One of the insects is a roach (Blattaria) and the other three are Megasecoptera, an order which is otherwise represented in the Carboniferous of North America by only two specimens. Since at least ninety per cent of the insects of most Carboniferous deposits are roaches, this ratio is remarkable. Surprising also is the absence of Prothoptera, which are usually next to the roaches in abundance. The number of insects known from the Garnett beds is so small that we are in no position to come to any conclusions

¹ Univ. of Kansas Science Bull., 21 (9): 265-267, 1933.

² Journal of Geology, 44: 1-31, 1936.



FIG. 1. Photograph of *Euchoroptera longipennis*, n.sp. (holotype, X 1.7).
FIG. 2. Photograph of head, thorax and wings of same specimen (X 5).

regarding the significance of these facts. I do believe, however, that this deposit is the most promising insect-bearing formation of Carboniferous age which has been found in this continent; and that with extensive working it might surpass in entomological importance the famous Commeny shales of France.

One of the new specimens (No. 1252, C. W. Hibbard, coll.) is a complete cockroach tegmen, belonging to the family Archimylacridae. The wing is similar in shape and venation to that of *Phyloblatta fulva* (Sell.), from the LeRoy shales (Pennsylvanian) near Lawrence, Kansas.³ Although the fossil is better preserved than most Carboniferous roaches, I do not consider it advisable to describe the species as new. The taxonomy of fossil roaches has provided an unsolved problem for many years. The venation is so unstable that in spite of many attempts no one has succeeded in finding venation characteristics of genera and families which are beyond the limits of individual variation. The general procedure in the past, at least that used by Handlirsch, has been to describe as a new species almost every tegmen or fragment of a tegmen. This has resulted in the accumulation of a vast array of names, both generic and specific, which have no biological significance. Some paleontologists, either unaware of or indifferent to such variability, have continued to base species on isolated or fragmentary tegmina. In my opinion, however, it is time to discontinue this endless describing of fossil roaches and to give names only to those specimens which exhibit some remarkable characteristic, or which are from unusual localities or horizons.

The second specimen (No. 251A, B) from the Garnett beds is a very poorly preserved, but entire insect, with the wings spread laterally. The fore wings are 35 mm. long and 5 mm. wide. The hind wings are similarly shaped but are 5 mm. shorter. Unfortunately, because of weathering of the surface of the rock, no trace of the venation is discernible. The shape of the wings, however, is identical with that of the third specimen, described below, and so suggestive of that of the Megaseoptera as a whole that I feel convinced the insect belongs to the latter order.

The third fossil is a nearly complete insect, with the four

³ Univ. of Kansas Geol. Survey, 9: 512, 1908.

wings resting over the abdomen (Plate I, Figs. 1 and 2). This is a very well preserved specimen and its description follows:

Order MEGASECOPTERA

Family PROCHOROPTERIDAE

Euchoroptera, new genus.

Allied to Prochoroptera Handl. Head small, prothorax rounded, abdomen long and rather broad; wings much more slender than in Prochoroptera. Wing venation apparently similar to that of the latter genus.

Genotype: *Euchoroptera longipennis*, n. sp.

Euchoroptera longipennis, n. sp.

Text-figure 1 and Plate I, Fig. 1 and 2.

Fore wing: length, 20 mm.; width, 5 mm.; slender, about four times as long as broad; costal space somewhat broader proximally than distally; Sc terminating on R1 at about the level of the middle of the wing; a few costal veinlets are visible near the end of Sc and others doubtless occur proximally; R1 nearly parallel to Sc at mid-wing, but beyond the end of the latter, it diverges posteriorly, away from the costal margin, and gives rise to several long branches; a distinct pterostigma is

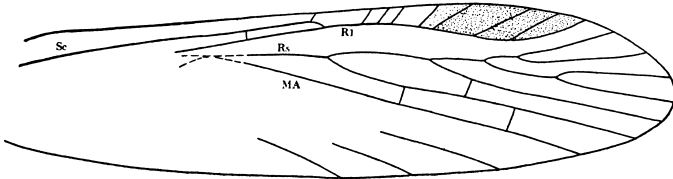


Fig. 1. Fore wing of *Euchoroptera longipennis*, n. sp., drawn from holotype. Sc, subcosta; R1, radius; Rs, radial sector; MA, anterior media.

present near the end of R1 in the region of these branches; Rs arising from R1 before the middle of the wing, but the region of its origin is not preserved; Rs forked dichotomously, the two lower branches simple; MA probably coalesced proximally with Rs, as in Prochoroptera, but the origin of MA is not preserved in the specimen; the cubitus and anal veins are unknown. Convexity and concavity of venation not indicated. Hind wing: similar to the fore wing in size and shape. Only about the same part of the venation of the hind wing is known as in the case of the fore wing; this part of the venation is apparently identical in both pairs of wings.

Body structure: the general form of the body and some of the details are preserved in the type specimen of this species. The most distinctive part of the body is the rounded pronotum, which is 2 mm. long and 3 mm. wide. That this structure is really the pronotum and not the head is shown by the basal attachment of the fore wings to that part of the thorax immediately behind it. The head itself is much narrower than the pronotum, but it is prolonged into a rostrum, 4 mm. long, resembling that of the Mecoptera in general form. The antennae and mouth-parts are not preserved. The meso- and metathorax are broad (4 mm. wide) and the two combined are 8 mm. long. No details of their structure are discernible. The abdomen is long (17 mm.) and fairly wide (4 mm.); its segmentation cannot be distinguished. Arising from near the end of the abdomen are several poorly-defined processes, and in addition one long (9 mm.) process, which, because of its thickness and slight curvature, I consider to be part of an ovipositor. One cercus is preserved for its entire length (50 mm.), which is about twice that of the whole body proper. Several of its segments are clearly preserved and show numerous short hairs. If all of the segments averaged about the same size as those preserved, the cercus would consist of about 60 segments.

Holotype: No. 1250A, 1250B, Dyke Museum of Natural History, University of Kansas (C. W. Hibbard, coll.). The preservation is unusually good for a Carboniferous insect. As shown in the photograph (Plate I, Figs. 1 and 2) the fore wings rest over the abdomen. The drawing of the venation included here has been made with the aid of enlarged photographs of the right and left wings of both counterparts, the veins of the fore and of the hind wings being carefully worked out in differently colored inks. Fragments of plants occur on the rock in the vicinity of the insect and a few leaves of the conifer, *Walchia*, can be seen protruding from beneath the thorax.

The fossil was collected in the Rock Lake Shales, SW $\frac{1}{4}$ of SE $\frac{1}{4}$ of Section 32, T. 19S, R. 19E, Bradford Chandler farm, Anderson County, Kansas.

This insect is one of the most interesting and puzzling fossils I have ever encountered. I am convinced that its closest affinities are with the Prochoropteridae, previously represented by the single fossil, *Prochoroptera calopteryx* Handlirsch, from the Carboniferous of Mazon Creek, Illinois. Only a part

of the venation of Prochoroptera is known, this including the proximal two-thirds of the fore and hind wings. Since not more than the distal two-thirds of the wings are known in Euchoroptera, the middle third is the only part preserved in both fossils. This area is so nearly identical in the two species, however, that I have little doubt of the similarity of the rest of the venation.

The body structure of Prochoroptera, though not so well known as in Euchoroptera, also suggests a close relationship. As indicated in Handlirsch's figure,⁴ Prochoroptera had a small head, though the anterior part from which the beak would arise (if it were present) is broken away. The pronotum is rounded as in Euchoroptera, and the eighth abdominal segment gives rise to a pair of elongate plates, which are almost certainly part of the ovipositor.⁵

The family Prochoropteridae was placed by Handlirsch in the order Megaseoptera, though he regarded it as an aberrant group which might eventually require a separate order. In most respects the structure of Euchoroptera confirms Handlirsch's conclusion on the ordinal position of the family, but in a few particulars it emphasizes the aberrancy of the family. Some of the peculiarities of Euchoroptera are especially interesting in that they suggest affinity with the Protohymenoptera, a suborder (or order) now generally recognized as related to the Megaseoptera. The following discussion summarizes the features of Euchoroptera which bear on the relationship of the genus and the family Prochoropteridae.

1. Wings. The most significant aspect of the wings of *longipennis* is the fact that, as preserved, they rest backward over the abdomen. The symmetry of their arrangement eliminates any probability that this position is an abnormal one into which they have been forced during preservation of the insect. The type specimen of *Prochoroptera calopteryx* has the wings in a similar position of rest. The significance of this occurrence in both representatives of the family becomes apparent when we consider that the Carboniferous Megaseoptera have been regarded as paleopterous insects, *i.e.*, not capable of folding the wings back over the abdomen at rest. In

⁴This Journal, 31, pp. 376-377, 1911.

⁵These structures are shown in Handlirsch's figure (*op. cit.*, p. 376), but were described by him as "a slit-like sexual organ, limited laterally by longitudinal ridges."

this connection the Protohymenoptera (Permian) are of interest. So far as known, except for one family, the Protohymenoptera were palaeopterous; the exceptional family (Asthenohymenidae) is represented by a sufficiently large series of specimens to show that the members of that group did rest with their wings back over the abdomen. Although the Prochoropteridae do not, at first glance, seem to be at all closely related to the Asthenohymenids, it is probable that the ability to fold the wings back over the abdomen was not independently developed in the two families. This position of the wings at rest in both the Asthenohymenidae and Prochoropteridae again raises the question, originally proposed by Tillyard, of the validity of the groups Palaeoptera and Neoptera as phyletic groups of the Pterygota. I believe it is now clear, especially from the position of the wings in the type of Eucharoptera, that the Prochoropteridae and Asthenohymenidae folded their wings at rest essentially like the Neoptera, and not like the zygoterous Odonata. However, it does not seem to me that that circumstance alone is sufficient to eliminate the concept of the Neoptera and Palaeoptera for the rest of the Pterygota (*i.e.*, exclusive of the Megasecoptera). In my opinion the folding of the wings over the abdomen in these Megasecoptera (Asthenohymenidae and Prochoropteridae) was developed independently from that in the true Neoptera. A somewhat similar situation is found in the case of insect metamorphosis. Holometabolism is now generally regarded as of monophyletic origin, but complex metamorphosis resembling holometabolism closely occurs in certain Homoptera (Aleyrodidae).

Another interesting feature of the wings of *longipennis* is the presence of a distinct pterostigma. This is significant, for although there is not even an indication of a pterostigma having been present in the Carboniferous Megasecoptera, a strongly formed (though narrow) one is present in the Protohymenoptera (Permian). This is another suggestion of relationship between Eucharoptera and the Protohymenoptera.

2. Body Structure. The prolongation of the head of *longipennis* is most interesting. So far as known other Carboniferous Megasecoptera had no such structure, but the most recently found specimens of the Protohymenoptera show beyond question that a similar rostrum was present there.⁶ It may be

⁶ Carpenter: Proc. Amer. Acad. Arts Sciences, 73, p. 32, 1939.

that all the Megaseoptera had the same type of head structure. There is no evidence furnished by the specimens of Eucheroptera to indicate whether the mouth-parts were mandibulate (as in the Mecoptera) or haustellate, but the Protohymenoptera have no suggestion of haustellate parts.

The presence of the ovipositor in Eucheroptera is especially noteworthy. I have already shown that an ovipositor occurred in the Protohymenoptera⁷ and pointed out that although no Carboniferous Megasecopteran is known to possess an ovipositor, we are not justified in assuming it was lacking. The specimen of Eucheroptera bears out my suggestion that a complete external ovipositor probably existed in the Carboniferous Megasecoptera. That the structure mentioned in Eucheroptera is an ovipositor can scarcely be doubted. It must be borne in mind, of course, that the specimen has been flattened somewhat and that the ovipositor (or at least part of it) is preserved in lateral view.

Cerci like those in Eucheroptera occur in both the Megasecoptera and Protohymenoptera. Apart from these Megasecoptera, the Protephemeroidea and probably some Palaeodictyoptera, such elongate cerci are unknown in Carboniferous insects.

From the foregoing account it is apparent that Eucheroptera has much in common with the Protohymenoptera, which in my opinion are the closest known relatives of the Prochoropteridae as a whole. Whether the latter family fits within the actual limits of the Protohymenoptera cannot be determined until more of the venation is known.

⁷ This Journal, 5, 22, p. 128, 1931; and Proc. Amer. Acad. Arts Sciences, 73, pp. 32-37, 1939.