

**MEGATYPUS PARVUS SPEC. NOV., A NEW GIANT
DRAGONFLY FROM THE LOWER PERMIAN OF KANSAS
(PROTODONATA: MEGANEURIDAE)**

M.S. ENGEL¹

Department of Entomology, Comstock Hall, Cornell University,
Ithaca, New York 14853, United States

Received November 8, 1997 / Revised and Accepted February 5, 1998

The new sp. is described and figured (holotype in MCZ, Harvard Univ., Cambridge, MS). It is differentiated from other *Megatypus* spp. by the termination of ScP before the wing apex, the smaller wing length, and the relative positions of ScP, RA and RP. A key is presented for the meganeurid genera of North America and for the known spp. of the genus *Megatypus*.

INTRODUCTION

Discussions of the Paleozoic insect fauna instantly bring to mind the giant dragonflies of the order Protodonata. The order is only known from the Lower Permian and Upper Carboniferous (approx. 255-325 million years ago), having gone extinct in the Permian along with five other insect orders (CARPENTER, 1992). Some authors have placed the family Triadotypidae in the Protodonata (e.g., BRAUCKMANN & ZESSIN, 1989) thereby extending the group into the Lower Triassic; however, this family is best classified in the Triadotypomorpha, sister to the Triadophlebiomorpha, and not as a protodonate (BECHLY, 1996). Fossils of Protodonata can be distinguished from the true dragonflies (Odonata) by the absence of a nodus, absence of a pterostigma, absence of a well-developed arculus, presence of free M and Cu veins at the wing base, and absence of a costal triangle (KUKALOVÁ-PECK, 1991; CARPENTER, 1992). The largest of these ancient insects was *Meganeuropsis permiana* (CARPENTER, 1939), a representative of the family Meganeuridae, with an estimated wing span of 710 mm (about 28 inches)! The Meganeuridae is represented by three genera in North America, these being

¹ Present address: 1503 Rosewood Terrace Drive, Ballwin, MO 63021, United States

Tupus SELLARDS (1906), *Megatypus* TILLYARD (1925), and *Meganeuropsis* CARPENTER (1939).

Herein I present the description of a fourth species of the genus *Megatypus* from the Wellington shales of Kansas and provide a key to the species of the genus. The various species of *Megatypus* have been described and figured by TILLYARD (1925) and CARPENTER (1933, 1943). In addition, a key to the genera of Meganeuridae occurring in North American fossil localities is presented as an aid to the identification of these giants. Terminology for wing venation generally follows that of RIEK & KUKALOVÁ-PECK (1984) and BECHLY (1995, 1996).

KEY TO THE GENERA OF MEGANEURIDAE OF NORTH AMERICA

- 1 Precostal area long, extending at least to midwing, widened in basal half of wing; wings large (longer than 250 mm) (subfamily Meganeurinae) *Meganeuropsis* Carpenter
- 1' Precostal area short, at most reaching one-fourth of wing length; wings usually much less than 250 mm (subfamily Tupinae) 2
- 2 CuP-crossing distinct at wing base *Megatypus* Tillyard
- 2' CuP-crossing indistinct *Tupus* Sellards

KEY TO THE SPECIES OF *MEGATYPUS*

- 1 ScP- reaching to wing apex (approx. length 165 mm) *schucherti* Tillyard
- 1' ScP- terminating before wing apex 2
- 2 Wings very large (approx. length 250 mm) *ingentissimus* Tillyard
- 2' Wings relatively short (less than 150 mm in total length) 3
- 3 RA+ not merging into C near wing apex; area separating RA+ and RP- at separation of RP1/RP2 greater than that separating ScP- and RA+; IR1 originating strongly distad RP1/RP2 separation (approx. length 115 mm) *vetustus* Carpenter
- 3' RA+ merging into C near wing apex; area between RA+ and RP- at separation of RP1/RP2 nearly equal to that separating ScP- and RA+; IR1 originating just after RP1/RP2 separation (approx. length 140 mm) *parvus* sp. nov.

MEGATYPUS PARVUS SPEC. NOV.

Figure 1

Material. — **Holotype:** Wilbur Collection; Lower Permian, Wellington Shales, Elmo, Kansas. The holotype is deposited in the Museum of Comparative Zoölogy (MCZ), Harvard University.

Etymology. — The specific epithet is derived from the Latin word *parvus*, meaning "little".

DIAGNOSIS. — This species differs from the other "small" *Megatypus* species, *M. vetustus*, by its larger size, the more proximal origin of IR1, the merging of RA+ and C near the wing apex, and the crowding of RA+ and RP- at the origin of RP1/RP2. The close position of RP- and RA+ at the origin of RP1/RP2 is similar with that seen in *M. ingentissimus*. The area between these veins is equal to the area separating ScP- and RA+ in both *M. ingentissimus* and *M. parvus*. Overall, the

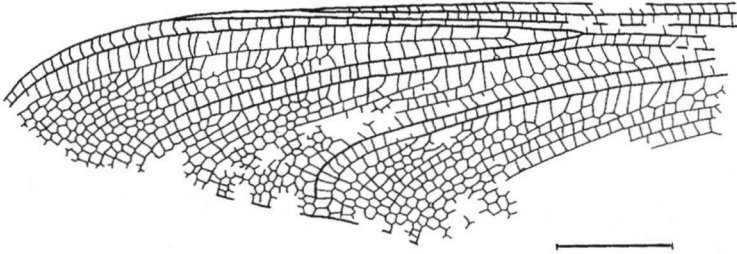


Fig. 1. Wing venation of *Megatypus parvus* sp. nov.; scale bar = 10 mm.

venation of *M. parvus* is most similar to that of *M. schucherti* (as depicted by CARPENTER, 1943), but differs in the termination of ScP- and its overall size. Like *M. schucherti*, RA+ merges into C near the wing apex. *M. parvus* is part of a group of *Megatypus* species in which ScP- terminates well before the wing apex, while *M. schucherti* is the only *Megatypus* species in which this vein reaches the wing apex.

DESCRIPTION. — Preserved length of wing 62 mm; maximum width 19.5 mm (estimated total length approximately 140 mm). Wing long and slender. Costal area narrow, about as wide as separation between ScP- and RA+. ScP- terminating well before wing apex. RA+ merging with C near wing apex such that they cannot be distinguished. Area separating ScP- and RA+ at separation of RP1/RP2 nearly equal to area between RA+ and RP-; area between latter two veins only slightly narrower than area between RP- and IR2 at same point; area between IR2 and RP3+4 at same point about twice as wide as area separating RP- and IR2. RP1- and RP2- diverging widely, neither giving rise to any branches. IR1 originating shortly after RP1/RP2 separation, forming a series of pectinate branches just before half of its total length. IR2 with a series of pectinate branches beginning shortly after RP1-/RP2- divergence, widely separating from RP3+4 just before RP1/RP2 separation, separation by wing margin greater than area separating RP1- and RP2-. RP3+4 and MA+ running close to one another and becoming strongly curved towards wing margin. Crossveins numerous and cells small. Other venational details are presented in Figure 1.

ACKNOWLEDGEMENTS

I am thankful to G. CHAVARRÍA (currently of the Smithsonian Institution), S. COVER, and P. PERKINS of the Museum of Comparative Zoölogy for help during my visits to their institution. I am grateful to J. KUKALOVÁ-PECK for comments on odonotoid wing venation and for discussions of insect paleontology. I am particularly indebted to G. BECHLY for kindly reading earlier versions of the manuscript and providing many constructive criticisms, all of which greatly improved the work. Support for this study was provided by a National Science Foundation (USA) Predoctoral Fellowship.

REFERENCES

- BECHLY, G., 1995. Morphologische Untersuchungen am Flügelgeäder der rezenten Libellen und deren Stammgruppenvertreter (Insecta, Pterygota, Odonata) unter besonderer Berücksichtigung der phylogenetischen Systematik und des Grundplanes der Odonata. *Petalura* (Spec. Vol.) 1 (1995): 1-341.
- BECHLY, G., 1996. Morphologische Untersuchungen am Flügelgeäder der rezenten Libellen und deren Stammgruppenvertreter (Insecta, Pterygota, Odonata) unter besonderer Berücksichtigung der phylogenetischen Systematik und des Grundplanes der Odonata. *Petalura* (Spec. Vol.) 2 (1996): 1-402.
- BRAUCKMANN, C. & W. ZESSIN, 1989. Neue Meganeuridae aus dem Namurium von Hagen-Vorhalle (BRD) und die Phylogenie der Meganisoptera. *Dt. Ent. Z.* 36: 177-215.
- CARPENTER, F.M., 1933. The lower Permian insects of Kansas. 6. Delopteridae, Protelytroptera, Plecoptera and a new collection of Protodonata, Odonata, Megasecoptera, Homoptera and Psocoptera. *Proc. Am. Acad. Arts Sci.* 68: 411-503.
- CARPENTER, F.M., 1939. The lower Permian insects of Kansas. 8. Additional Megasecoptera, Protodonata, Odonata, Homoptera, Psocoptera, Protelytroptera, Plecoptera and Protoperlaria. *Proc. Am. Acad. Arts Sci.* 72: 29-70.
- CARPENTER, F.M., 1943. The lower Permian insects of Kansas. 9. The orders Neuroptera, Raphidioidea, Caloneuroidea and Protorthoptera (Probnisidae), with additional Protodonata and Megasecoptera. *Proc. Am. Acad. Arts Sci.* 75: 55-84.
- CARPENTER, F.M., 1992. Superclass Hexapoda. In: R.L. Kaesler, [Ed.], Treatise on invertebrate paleontology, part R, Arthropoda 4, vols 3-4. Geol. Soc. Am. & Univ. Kansas, Boulder.
- KUKALOVÁ-PECK, J., Fossil history and the evolution of hexapod structures. In: I.D. Naumann, [Ed.], The insects of Australia, [2nd edn], Vol.1, pp. 141-179. Melbourne Univ. Press, Carlton.
- RIEK, E.F. & J. KUKALOVÁ-PECK, 1984. A new interpretation of dragonfly wing venation based upon early Upper Carboniferous fossils from Argentina (Insecta: Odonatoidea). *Can. J. Zool.* 62: 1150-1166.
- SELLARDS, E.H., 1906. Types of permian insects. *Am. J. Sci.* (IV) 22: 249-258.
- TILLYARD, R.J., 1925. Kansas Permian insects. 5. The orders Protodonata and Odonata. *Am. J. Sci.* (V) 10: 41-73.