

**Biting midges (Diptera: Ceratopogonidae)
from the Lower Cretaceous amber from Alava, Spain**

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ABSTRACT. Two new species of fossil biting midges are described: *Protoculicoides skalskii* sp. n. based on one female and *Archiaustroconops alavensis* sp. n. based on five females. This small collection suggests that the Austroconopinae still predominated Ceratopogonidae diversity at 113 mya.

KEY WORDS: Diptera, Ceratopogonidae, Lower Cretaceous, amber, Alava, Spain, new species.

INTRODUCTION

The Lower Cretaceous amber in Alava, northern Spain, was recently discovered (ALONSO et. al. in press). It is believed to be of Middle Albian-Upper Aptian age, about 113 million years old. Its chemical composition suggests that it is of Araucarian origin (ALONSO et al. l.c.). To date approximately 1500 organic inclusions have been recorded. About 50% of them are Diptera. Among these inclusions, six specimens of biting midges have been found, although a great number of flies are still not studied and further ceratopogonids are likely present.

The fossil record of biting midges is well documented from the Lower Cretaceous to the Tertiary (EVENHUIS 1994, SZADZIEWSKI 1996, BORKENT 1996, 1997). This paper reports on further fossils of biting midges from the Lower Cretaceous period.

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MATERIAL AND METHODS

The pieces of amber were embedded in artificial resin Epotek 301 and then polished. The drawings were made with the aid of a camera lucida. The studied material is housed in the Museo de Ciencias Naturales de Alava, Siervas de Jesus 24, 01001 Vitoria-Gasteiz (Alava, Spain).

RESULTS

Protoculicoides skalskii sp. n.

(Figs. 1, 3)

Diagnosis

The species can be easily distinguished among fossil and extant biting midges by the presence bare wing membrane, a petiolate median vein, both radial cells long and a very long proboscis.

Description

Male. Unknown.

Female. Total length 1.32 mm. Eyes well separated above antennae (about 3 diameters of a facet). Flagellum with 13 flagellomeres; length 0.46 mm; flagellomeres 2-8 subglobular, 9-13 more elongated, antennal ratio 0.93. Proboscis very long, 2 times longer than eye height. Total length of head with proboscis half the length of thorax plus abdomen. Palpus very slender, 5-segmented. Third palpal segment cylindrical, 0.13 mm long, sensilla capitata not visible. Fourth and fifth palpal segments of almost same length. Scutellum rounded, with 4 marginal setae. Legs slender, unmodified. Tibial spur of fore leg distinct. Hind tibial spur and tibial comb not visible. Fourth tarsomeres almost cylindrical. Claws short, simple, equal, similar on all legs. Tarsal ratio of fore leg 1.7, of mid leg 2.1, of hind leg 2.0. Wing length 0.9 mm. Wing membrane without macrotrichia, microtrichia distinct. Media petiolate. Both radial cells well developed, second one somewhat longer than first (Fig. 1). Costa ending at tip of vein R3, costal ratio 0.73. Abdomen not modified, cerci short.

Etymology

The new species is named in honour of the late Andrzej Skalski in recognition of his valuable contributions to study of fossil insects.

Material examined

Holotype female, in amber from Alava, Spain, Lower Cretaceous, Museo de Ciencias Naturales de Alava, MCNA-8648.

Discussion

The genus *Protoculicoides* BOESEL belongs to a group of basal lineages of Ceratopogonidae from which during the Lower Cretaceous (or earlier) gave rise to the Austroconopinae and Leptoconopinae. During the Upper Cretaceous, these basal lineages gave rise to the Forcipomyiinae and Ceratopogoninae subfamilies

(SZADZIEWSKI 1996). The genus includes two fossil species: *P. depressus* BOESEL from Upper Cretaceous Canadian amber and *P. succineus* SZADZIEWSKI from Lower Cretaceous Lebanese amber. They are presently known only as females, as the purported male of *P. depressus* (BORKENT 1995) cannot be a member the genus (SZADZIEWSKI 1996).

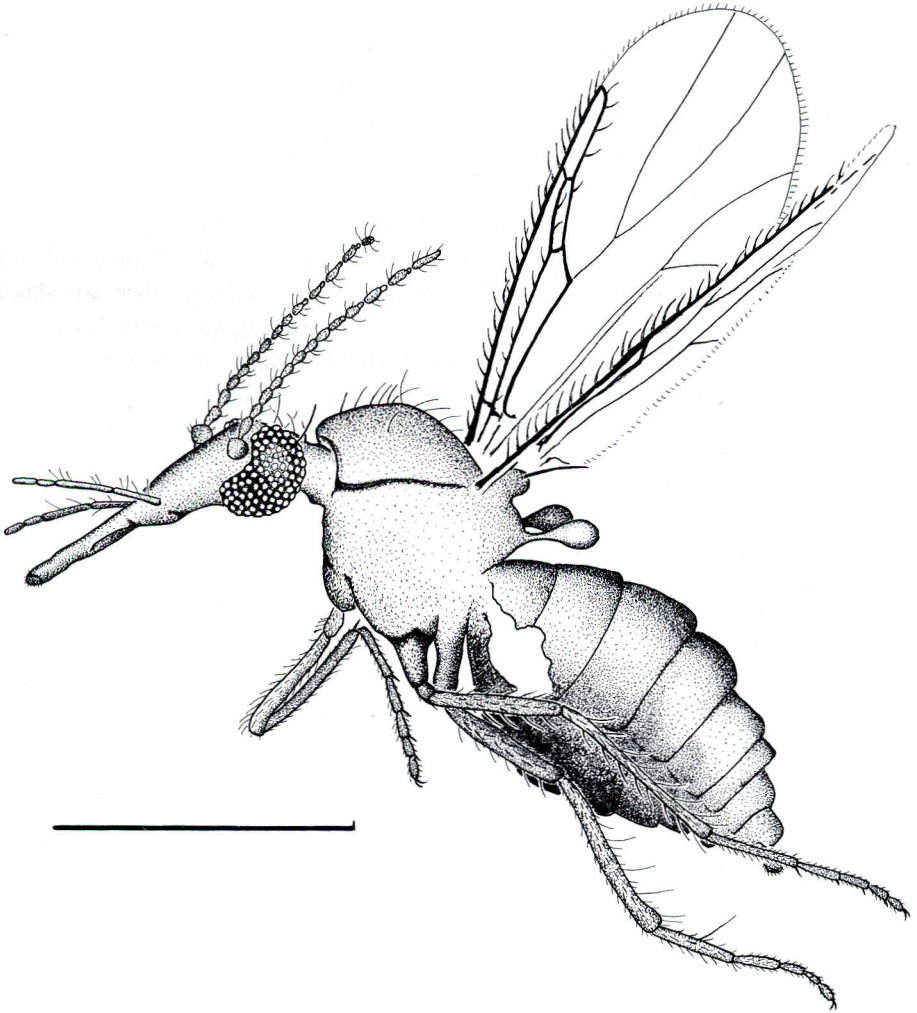


Fig. 1. Female of *Protoculicoides skalskii* sp. n., holotype. Scale bar = 0.5 mm.

The new species may be distinguished from previously described species by its distinctly longer proboscis, more widely separated eyes and lower costal ratio. Moreover, *P. depressus* is distinctly larger, with a wing length of 1.72 mm.

Recently BORKENT (1996) described the new genus and species *Alautunmyia elongata* from a female in Upper Cretaceous New Jersey amber and was distinguished by its long proboscis and widely separated eyes, similar to the new species described above. BORKENT (l.c.) compared his genus with the Upper Cretaceous *Culicoides filipalpis* REMM which also has a very long proboscis but did not make comparisons to *Protoculicoides* which like *A. elongata* have bare wings. Actually the female of *Alautunmyia elongata* has only smaller radial cells and more widely separated eyes and probably does not need a new genus. *Protoculicoides* with bare wings include morphologically unspecialized Cretaceous haematophages like extant *Culicoides* LATR. Within extant *Culicoides* eyes are fused to widely separated and the wing membrane is covered with macrotrichia. Just only a few, of over 1200 extant species have secondarily reduced macrotrichia. In the holotype of *P. depressus* eyes are greatly depressed; however their separation is clearly visible. They are weakly separated like in *P. succineus*. If a wide generic concept is accepted for *Culicoides* then we should similarly treat the genus *Protoculicoides*, to which may belong species with narrowly and widely separated eyes. Further specimens including males will probably help to understand the relationship between *Alautunmyia* and *Protoculicoides*.

Key to females of *Protoculicoides* and *Alautunmyia*

1. Eyes narrowly separated 2
- Eyes broadly separated 3
2. Wing length 1.72 mm. Distal 5 flagellomeres elongate
..... *P. depressus* BOESEL (Upper Cretaceous Canadian amber)
- Wing length 0.75 mm. Distal 4 flagellomeres elongate
..... *P. succineus* SZADZIEWSKI (Lower Cretaceous Lebanese amber)
3. Radial cells large. Proboscis very long
..... *P. skalskii* sp. n. (Lower Cretaceous Spanish amber)
- Radial cells small. Proboscis moderately long
..... *A. elongata* BORKENT (Upper Cretaceous New Jersey amber)

Archiaustroconops alavensis sp. n.

(Figs. 2, 4)

Diagnosis

The species can be distinguished by the presence of an evidently oblique transverse vein r-m and 5-segmented palpus.

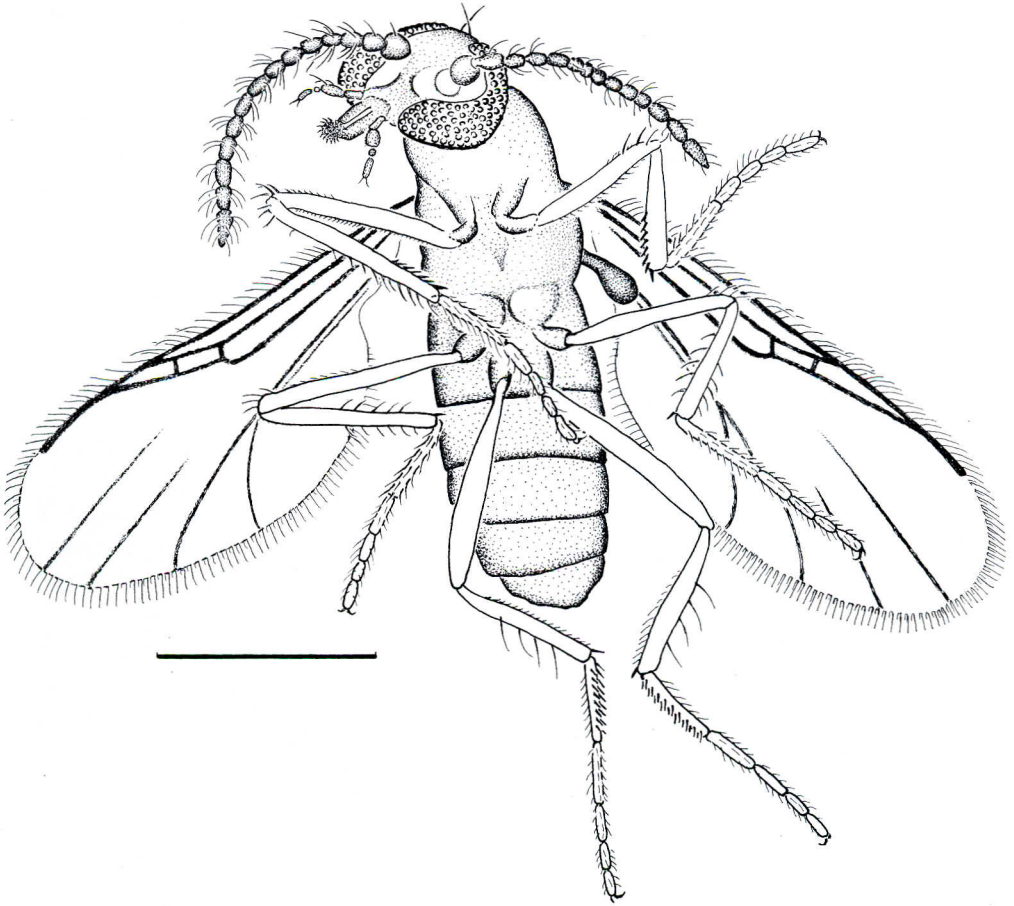


Fig. 2. Female of *Archiaustroconops alavensis* sp. n., holotype. Scale bar = 0.25 mm.

Description

Male unknown.

Female (holotype). Total length 0.7 mm. Eyes separated above antennae at distance of about 4 diameters of a facet. Length of flagellum 0.35 mm. Flagellomeres 2-13 gradually increasing in length, antennal ratio 0.9. Palpus 5-segmented. Third palpal segment cylindrical, stout, 30 μ m long; sensorium not visible. Fourth palpal segment very short; fifth slender, cylindrical, 22 μ m long. Scutellum with rounded apex, marginal setae not visible.

Legs slender, unmodified. All tibiae with apical spur-like spines. Tarsal ratio of fore leg 2.3, of middle leg 2.5, of hind leg 1.4. Wing length 0.65 mm. Wing membrane

without macrotrichia. Both radial cells well developed. Second radial cell 2.6 times longer than first one. Costa prolonged beyond apex of vein R_3 , costal ratio 0.9. Transverse vein r-m oblique. Petiole of median veins not preserved.

Material examined

Holotype female, amber from Alava, Lower Cretaceous, Spain. Museo de Ciencias Naturales de Alava MCNA-8836.1. Four other females which are likely members of this species are not designated as paratypes. They are preserved in amber pieces MCNA-8836.2, MCNA-8842, MCNA-8839, MCNA-8840.

Discussion

Archiaustroconops SZADZIEWSKI is a genus of Lower Cretaceous biting midges which belongs to the subfamily Austroconopinae (SZADZIEWSKI 1996). It was distinguished from the fossil and extant members of the genus *Austroconops* WIRTH et DYCE by the presence of an oblique cross vein r-m. In species of *Austroconops* r-m is more or less parallel to vein R_1 forming more or less straight line with R_3 and the base of median petiole is usually shifted to the wing base.

The new species differs from *A. ceratiformis* SZADZIEWSKI from Lebanese amber in having 5-segmented palpi which in the latter species are 4-segmented. The 5-segmented palpi within the subfamily are otherwise known only in *Austroconops gondwanicus* SZADZIEWSKI also from Lebanese amber (only male known).

CONCLUSION

Lower Cretaceous biting midges are known from Lebanese (SZADZIEWSKI 1996) and Austrian amber (BORKENT 1997). The barely preserved wing compression from the Lower Cretaceous deposits of Australia with long costa extending at least to wing apex determined by BORKENT (1997) as *Leptoconops* SKUSE should be placed among undeterminable fossils. It is probable not even a wing of a biting midge. It could also be a wing of a Sciaridae or Mycetophilidae. In figures (2G,H) shown by BORKENT (l.c.) radial cells are distinctly different in both counterparts. Radial cell is 1.5 times longer in his fig. H than in his fig. G. Such a determination introduces unnecessary confusion to the phylogenetic history of biting midges. Well characterized *Leptoconops* are first known from Upper Cretaceous deposits.

Lower Cretaceous Lebanese amber Ceratopogonidae are dominated by the subfamily Austroconopinae (SZADZIEWSKI 1996). A similar pattern is shown by the limited sample from Spanish amber described here: five of six biting midges determined here as *Archiaustroconops* are members of this subfamily. BORKENT (1997) recorded a species of *Minyohelea*, as a member of the Austroconopinae, from Lower Cretaceous Austrian amber. Both Austroconopinae and *Protoculicoides* are early lineages within the Ceratopogonidae and are present in both Lower and Upper Cretaceous deposits. *Minyohelea* and *Protoculicoides* are both known from Upper Cretaceous North American



Figs. 3-4. *Protoculicoides skalskii* sp. n. (3) and *Archiaustroconops alavensis* sp. n., MCNA 8836.2 (4).

deposits. The genus *Protoculicoides* along with a few genera representing early lineages within family were unspecialized haematophages from which the Forcipomyiinae and Ceratopogoninae evolved during the Upper Cretaceous.

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