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First Tridactylidae from the Eocene French amber (Insecta: Orthoptera)

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ABSTRACT

Guntheridactylus grimaulti n. gen., n. sp., first definitive Cenozoic Tridactylidae, is described from the earliest Eocene amber of Oise (France). It could be attributed to the Dentridactylinae because it has a subapical spine on hind tarsus, which is the main diagnostic feature of this subfamily. Nevertheless its tegmina venation is more developed than in the recent tridactylids.

KEY WORDS: Insecta. Orthoptera. Tridactylidae. Eocene. French amber.

INTRODUCTION

Tridactyloidea Brullé 1835 constitutes a small group that contains some of the most bizarre orthopteroids. They comprise the Tridactylidae Brullé 1835, Rhipipterygidae Chopard 1949 (both pygmy mole crickets), and Cylindrachetidae Giglio-Tos 1914 (sand gropers) [even if Gorochov et al. (2006) considered the Rhipipterygidae as a subfamily of the Tridactylidae]. The Tridactyloidea are currently considered as the sister group of all other Caelifera (Flook et al. 1999), or sister group of the Regiatidae Gorochov, 1996 (Lower Jurassic of England, known after a forewing), the set (Regiatidae + Tridactyloidea) being the sister group of the Caelifera (Gorochov 1996).

The Cylindrachetidae are still unknown in the fossil record. Gorochov (1992) erected the subfamily Mongoloxyinae for the Mesozoic taxa currently included in the Tridactylidae, viz. *Monodactylus* Sharov 1968, *Monodactyloides* Sharov 1968 (both based on fossils with body and hind legs structures), *Mongoloxya* Gorochov 1992, *Cretoxya* Gorochov et al. 2006 (based on a tegmina), and possibly *Cratodactylus* Martins-Neto 1990 (based on fossils with body and hind legs structures) (Sharov 1968; Martins-Neto 1990, Gorochov et al. 2006). Jell & Duncan (1986) described a 'tridactylid indet.' from the Early Cretaceous of Australia, on the basis of the presence of mesothoracic tarsus two-segmented, the presence of long ventral terminal spurs, and three or four expanded lamellae on dorsal side over distal half of metathoracic tibia. Nothing is indicated on its metathoracic tarsi. Serres (1829: 226) cited a '*Xya* Illiger' that 'paraît peu éloigné du' = 'seems a little bit far from' *Xya variegata*, from the Late Oligocene of Aix-en-Provence (France), Théobald (1937) listed it again, but this discovery has never been confirmed, and we never found any Tridactylidae among the 30,000 fossil insects we collected there. Zeuner (1941) listed the Tridactylidae as Cenozoic, without further indication. No tridactyloid is recorded in copal, Baltic or Dominican amber (Spahr 1992; Perez-Gelabert 2001).

Gorochov et al. (2006) characterized the Mongoloxyinae by 'the rather rich venation of the tegmina', which is clearly a plesiomorphy shared with the entire putative sister groups, and compared to the reduced tegmina venation of the modern Tridactyloidea. Thus the Mongoloxyinae could well be paraphyletic. The legs adapted for jumping of Tridactylidae, Rhipipterygidae, and Mongoloxyinae is also probably a symplesiomorphy, compared to the highly modified digging legs of the Cylindrachetidae (Günther 1992). Thus, there is no clear argument to include the Mongoloxyinae in the Tridactylidae, or even in the Tridactyloidea.

It remains that there is no representative of the modern lineage of Tridactylidae *sensu stricto* positively known from the fossil record. Thus, the Early Eocene tridactylid that we describe herein can be considered as the first definitive fossil representative of this family.

In the description below we follow the nomenclature of Ragge (1955) for wing venation and that of Günther (1979, 1994) for the body.

SYSTEMATIC PALAEONTOLOGY

Order: Orthoptera Olivier 1789

Family: Tridactylidae Brullé 1835

Subfamily: Dentridactylinae Günther 1979

GENUS: ***Guntheridactylus*** gen. nov.

Type species: ***Guntheridactylus grimaulti*** sp. nov.

Etymology. Combination of the family name of Kurk K. Günther, specialist of Tridactylidae, and *Tridactylus*, type genus of the family.

Diagnosis. Only nine antennal segments; presence of a short longitudinal vein between Sc and costal tegmina mar-

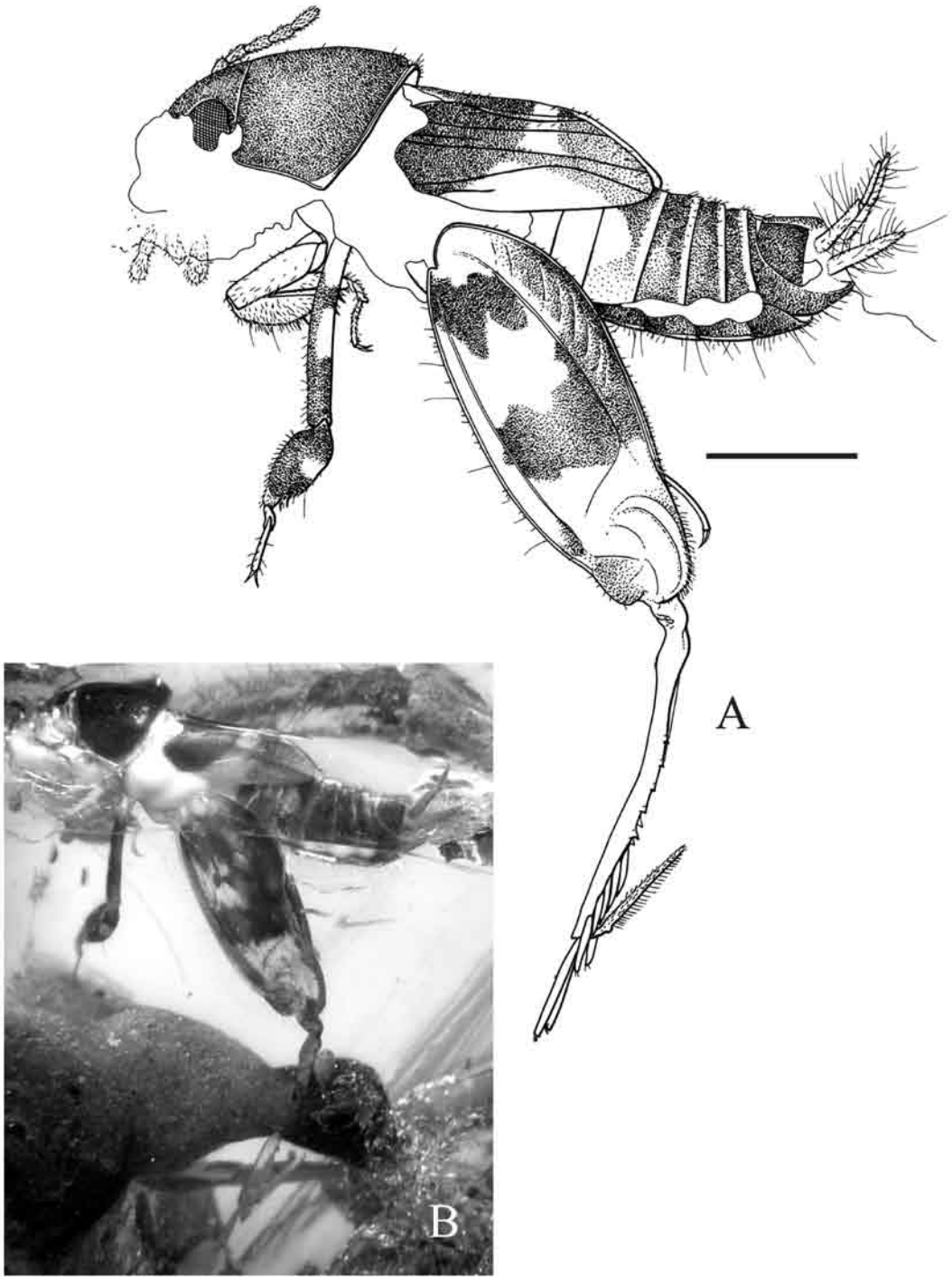


Plate 1. *Guntheridactylus grimaulti* n. gen., n. sp., holotype PA 15270 1/7. A, drawing of general habitus (scale bar represents 1 mm). B, photograph of general habitus.

gin and a straight longitudinal vein posterior of vein An1; a subapical spine ('Subapicalzahn') on the metatarsus; four pairs of expanded hind tibial setae ('Tibialblättchen'); six pairs of hind tibial spines ('Tibialzahn'); male paraprocts ('Paraproctfortsätze') not basally broadened.

Guntheridactylus grimaulti sp. nov.

(Plates 1-4)

Material. Holotype PA 15270 1/7 (male), paratype PA 15270 2/7 (fragmentary, sex unknown), fossilised in the same piece of amber with four ant workers of different species and a fly, deposited in the Laboratoire de Paléontologie, Muséum National d'Histoire Naturelle, Paris. The holotype is exceptionally well preserved, with its original coloration.

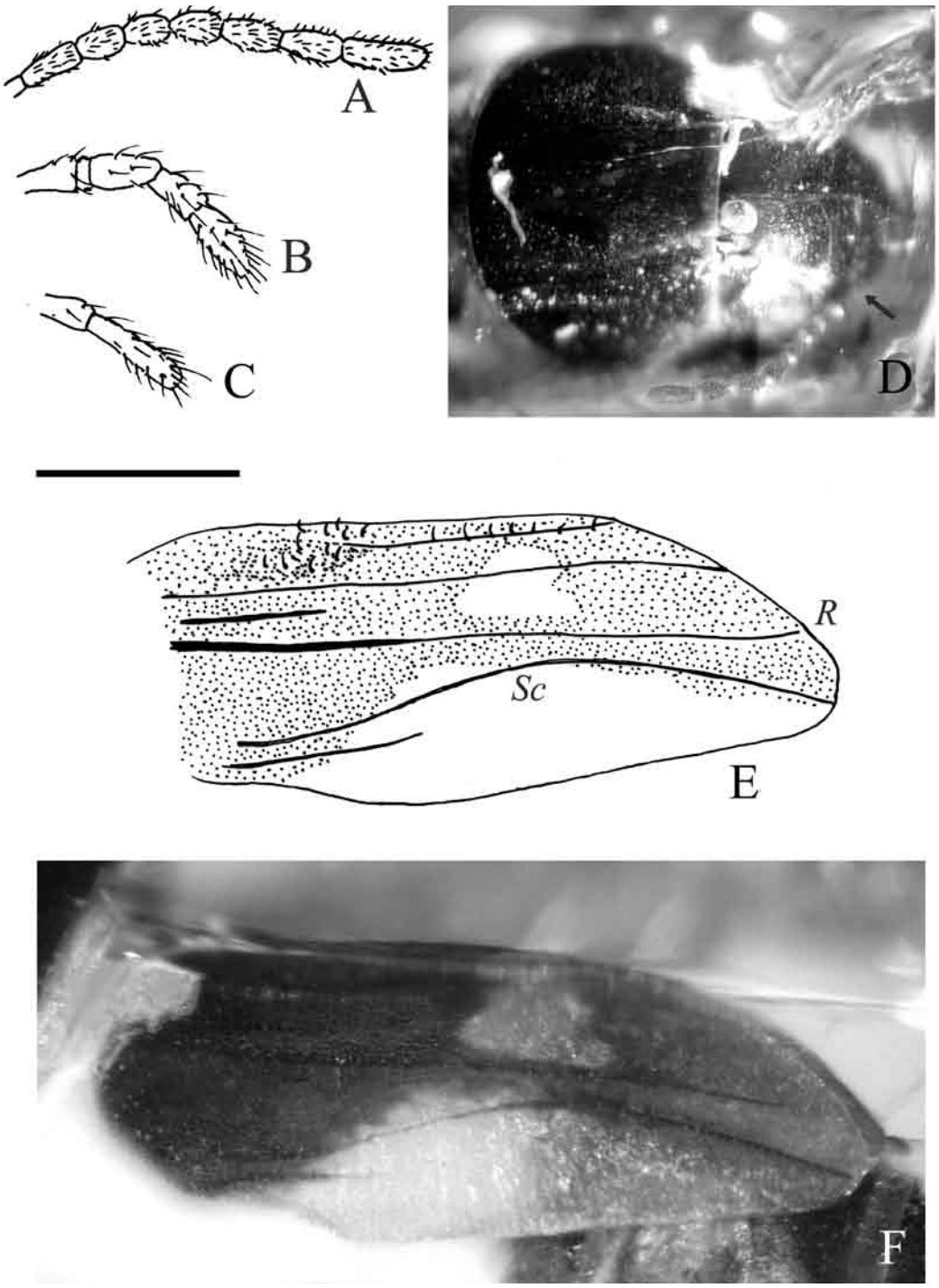


Plate 2. *Guntheridactylus grimaulti* gen. nov., sp. nov. holotype PA 15270 1/7. A, drawing of antenna (only 8 of the nine segments are clearly visible). B, drawing of maxillary palp. C, drawing of labial palp. D, photograph of head, dorsal view, arrow indicates first antennal segment. E, drawing of tegmina. F, photograph of tegmina. (all drawings have the same scale on this plate, scale bar represents 0.5 mm).

Etymology. Named after Yves Grimault who helped us to prepare and found the type material.

Type strata. Lowermost Eocene, *circa* - 53 Myr, Sparnacian, level MP7 of the mammal fauna of Dormaal (Nel *et al*., 1999).

Type locality. Farm Le Quesnoy, Chevrière, region of Creil, Oise department (north of France).

Diagnosis. As for the genus.

Description. The fossils have trace of coloration visible as dark zones on body, tegmina and legs (see plate 1, figures A and B; plate 2, figures E and F; plate 3, figures B, C and E); head brown, 0.8 mm long; nine antennal segments (plate 2, figure A and D) (unfortunately the basal segments cannot been illustrated or drawn correctly as they have a vertical position); eyes oval, 0.52 mm high, 0.44 mm wide;); three ocelli disposed in a curved line, the two laterals being close to the eyes; maxillary palp five-segmented with

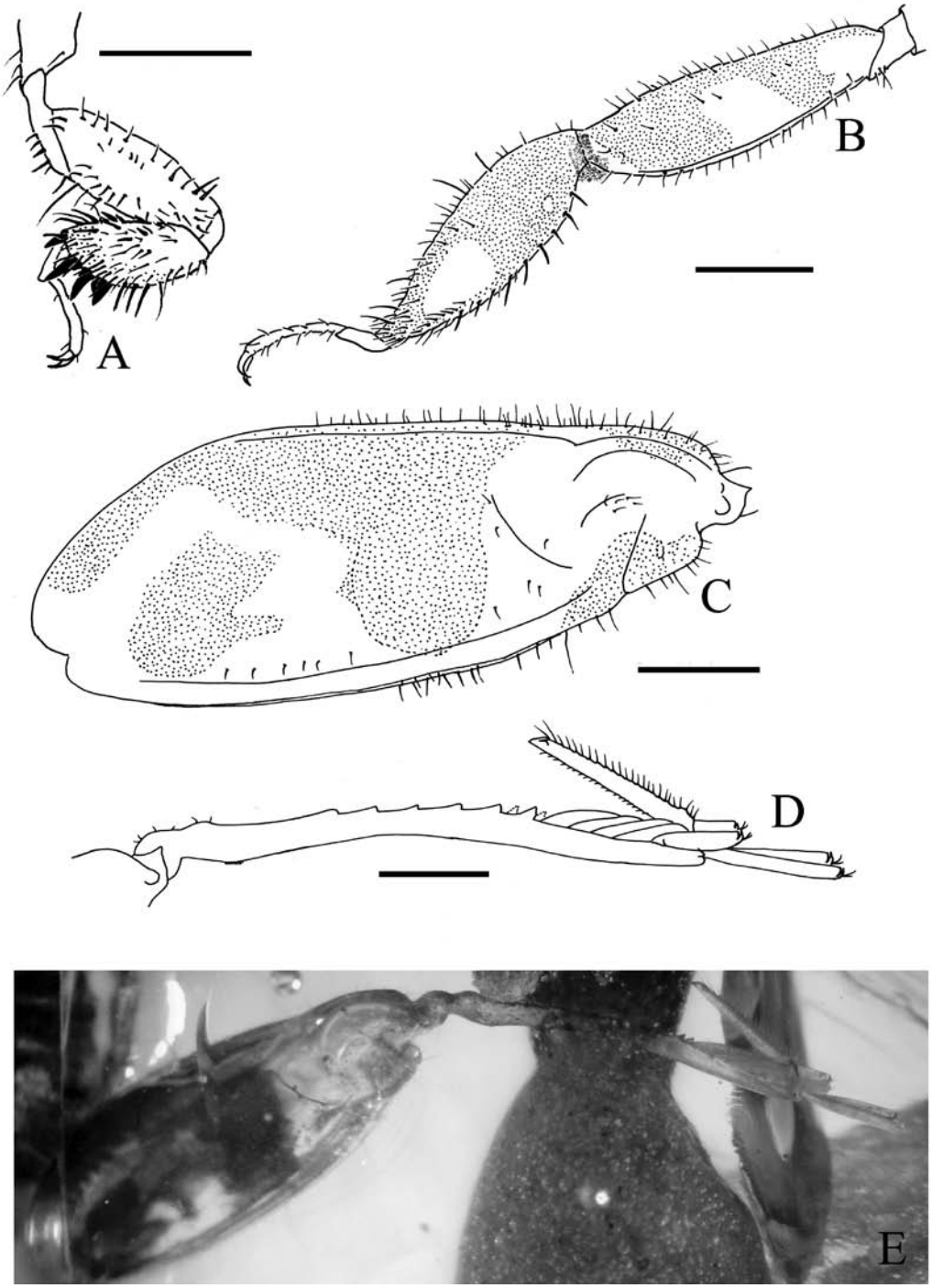
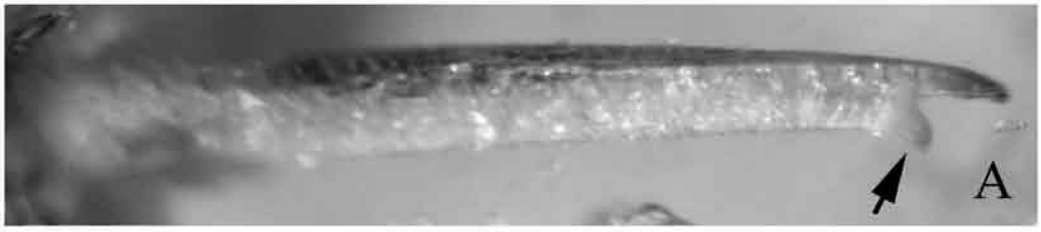


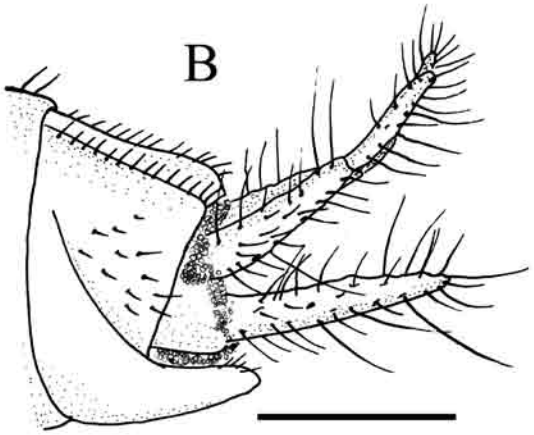
Plate 1. *Guntheridactylus grimaulti* n. gen., n. sp., holotype PA 15270 1/7. A, drawing of general habitus (scale bar represents 1 mm). B, photograph of general habitus.

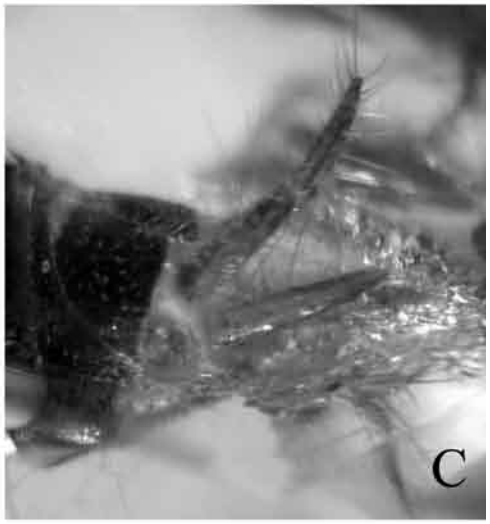
second segment very short (plate 2, figure B); labial palps two-segmented (plate 2, figure C).

Pronotum brown, 0.88 mm long; tegmina brown with a hyaline spot and an anterior hyaline area, 1.78 mm long, 0.70 mm wide (plate 2, figures E and F); a short longitudinal vein between Sc and costal tegmina margin; Sc undulate; R straight; An1 short; a straight longitudinal vein posterior of vein An1; a series of setae near posterior margin.

Fore leg not coloured (plate 3, figure A); femur broad with numerous strong setae; tibia slightly shorter than femur, broad, bearing several setae, four strong teeth, and three acute and long spines; tarsus two-segmented, with second segment more than twice longer than first; mid femur dark with two hyaline spots, 1.36 mm long, 0.4 mm wide (plate 3, figure B); mid tibia dark with two hyaline spots, 1.2 mm long, 0.38 mm wide; mid tarsus two-segmen-







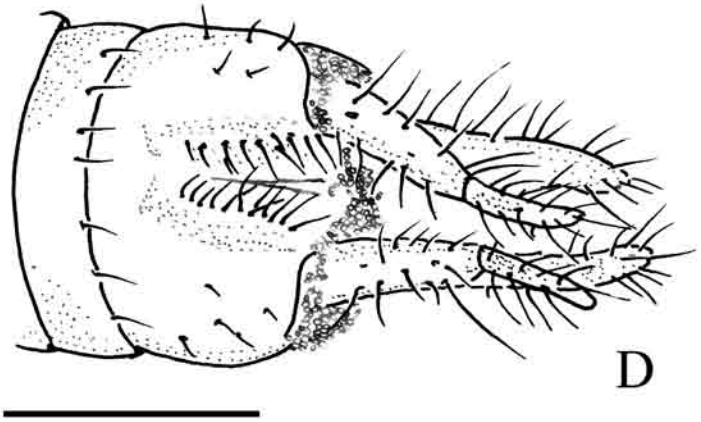


Plate 2. *Guntheridactylus grimaultí* gen. nov., sp. nov. holotype PA 15270 1/7. A, drawing of antenna (only 8 of the nine segments are clearly visible). B, drawing of maxillary palp. C, drawing of labial palp. D, photograph of head, dorsal view, arrow indicates first antennal segment. E, drawing of tegmina. F, photograph of tegmina. (all drawings have the same scale on this plate, scale bar represents 0.5 mm).

ted, with second segment more than twice longer than first; hind femur dark with hyaline zones, with margins setose, greatly broadened, 3.02 mm long, 1.14 mm wide (plate 3, figures C and D); hind tibia hyaline, 2.6 mm long, 0.14 mm wide (plate 3, figures D and E), a series of 16 very short and specialized brush-like setae, rounded at apex, in the proximo-ventral part of tibia, four pairs of expanded hind tibial setae; six pairs of hind tibial spines, the most basal one being very small; a pair of subapical spurs, 0.4 mm long; a pair of apical spurs, 0.64 mm long; subapical and apical spurs with a strong hook and a forked seta at their apex; metatarsus 0.85 mm long, with a subapical tooth and an inner and an outer row of setae (plate 4, figure A).

Abdomen dark, 2.4 mm long; male tergite 10 with a median furrow (plate 4, figure D), two longitudinal gibbosities bearing a row of long setae; only the setose cerci and paraprocts are visible, all other genital structures being hidden by small gas bubbles; cerci two-segmented, 0.8 mm long; paraprocts not basally broadened, 0.6 mm long (plate 4, figures B-D).

DISCUSSION

The holotype is an adult as it has male genital structures and functional sclerotized tegmina. The paratype is much more fragmentary and sex is thus indeterminable. *Guntheridactylus* gen. nov. shares with the Tridactyloidae the highly modified hind tibia and tarsi, and tegmina with a reduced venation. Affinities with the Mesozoic 'group' Mongoloxyinae are excluded. Jumping hind legs exclude affinities with the Cylindrachetidae. The recent Rhipipterygidae comprise two genera, *Rhipipteryx* Newman 1834 and *Mirhipipteryx* Günther 1969. Both lack hind tibial teeth and expanded hind tibial setae, unlike *Guntheridactylus* gen. nov. (Günther 1969). *Guntheridactylus* can be attributed to the Tridactylidae *sensu stricto*. Günther (1979) divided this family into the two subfamilies Tridactylinae and Dentridactylinae Günther 1979 on the basis of the presence of a subapical spine on the hind tarsus in the latter group, as in *Guntheridactylus*. The Dentridactylinae comprise the three genera *Dentridactylus* Günther 1974, *Paratridactylus* Ebner 1943, and *Bruntridactylus* Günther 1979. *Bruntridactylus* and *Guntheridactylus* can be separated from *Dentridactylus* and *Paratridactylus* because they have hind tibial setae (Ebner 1943; Günther 1979, 1991, 1994, 1995), which is probably a plesiomorphy. *Guntheridactylus* differs from *Bruntridactylus* by its male paraprocts not basally broadened. Furthermore, *Guntheridactylus* differs from all recent Tridactylidae by the presence of only nine antennal segments, a short longitudinal vein between Sc and costal tegmina margin, and a straight longitudinal vein posterior of vein An1 (*sensu* Günther 1994). This last character is probably a plesiomorphy, suggesting that *Guntheridactylus* could have a very basal position in the Tridactylidae, but more advanced than the Mesozoic Mongoloxyinae.

CONCLUSION

Guntheridactylus is the first definitive representative of the modern tridactylid lineage. It is strikingly similar to modern taxa, even if it retained few plesiomorphic characters. In particular, it has the coloration pattern and the highly specialised legs structures of the recent Tridactylidae (modified spurs, setae and spines, series of brush-like setae in proximo-ventral part of tibia). The accurate age of the modern tridactylid lineage is still unknown, as there is a gap in the fossil record between the distinctly more plesiomorphic Early Cretaceous Mongoloxyinae and this Early Eocene fossil. It remains to precise if modern tridactylids emerged before or after the K-T boundary.

Most of the Tridactylidae are normally related with humid habitats and seem to be gregarious (Rentz & Su 2003), which seems to have been the case for our fossil as two specimens of these exceptionally rare fossil insects (among about 20,000 inclusions in the Oise amber) have been found in the same amber piece. They are fossilised altogether with several ant workers of four different species. All these insects were probably living on the ground of the forest surrounding the rivers under the warm and humid palaeoclimate of the Early Eocene Paris Basin.

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