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ABSTRACT

The limoniid fly *Trentepohlia* (*Mongoma*) *pouilloni* n. sp. Ngô-Muller, Garrouste & Nel, is the first fossil insect to be described from Sumatra. On the basis of its wing morphology and venation, it is very similar to the extant Sumatran species *Trentepohlia* (*Mongoma*) *pennipes* (Osten Sacken, 1888), supporting a Miocene rather than older age for the amber. By comparison with the few available data on the biology of the extant species of the subgenus *Mongoma*, it probably lived in a warm and humid forest where it was trapped in dipterocarpacean resin. The wide Cenozoic distribution of the subgenus *Mongoma* in Europe and South-East Asia is in accordance to its extant circumtropical distribution.

KEYWORDS

Insecta; Diptera; Tipuloidea; n. sp.; Sumatra amber

Introduction

The limoniid flies are very frequent in the fossil record (see Fossilworks internet site at http://fossilworks.org/). The family is supposed to be dated from Late Triassic (Blagoderov et al. 2007). They are frequently found as compression fossils or inclusions in amber. Their larvae are either aquatic or terrestrial living in fungi, decayed vegetation, plant roots, etc. Among them, the extant genus *Trentepohlia* Bigot, 1854 is one of the largest genera with more than 300 species distributed on all continents except Antarctica. It is currently subdivided into seven extant subgenera plus an Eocene one (Podenas 2003; Evenhuis 2014; Oosterbroek 2019). It is quite old as a species: *Trentepohlia* (*Paramongoma*) *dzeura* was described from Burmese amber (100 Myrs old) (Podenas & Poinar 2009). Fossils of subgenera *Trentepohlia* Bigot, 1854, *Paramongoma* Brunetti, 1911, *Mongoma* Westwood, 1881, and *Onutia* Podenas, 2003 are known.

Here we describe the first fossil species of the subgenus *Mongoma* in amber, found in the Sumatra Miocene. Two species, *T.* (*M.*) *cruciferella* Cockerell, 1917 and *T.* (*M.*) *pallescens* Cockerell, 1921, attributed to this subgenus were previously described from the lacustrine Eocene – Oligocene of the Isle of Wight (UK) (Cockerell 1921).

Gayet (1991) cited the presence of fossil insects in a Cenozoic lacustrine outcrop near Padang in Sumatra but no fossil was ever studied or even collected. Thus the present fossil is the first fossil insect to be described from Sumatra. It is a part of a small collection of amber pieces with inclusions bought from a local trader (Starnborn Creations). Many Coleoptera: Platypodidae are also present in our material from the same amber. Interestingly Bąk et al. (2016) cited the presence of *Ambrosiella*-like fungi from the amber from Jambi mine, adding

that such fungi are frequently associated to scolytid or platypodid beetles that attack the tree trunks.

Material and methods

The present specimen is preserved in a piece of relatively clear, yellow amber, without syninclusions, which was ground and polished prior to examination and photography.

Brackman et al. (1984) first studied fossil resins from the Miocene of Sumatra. These fossil resins are of Glessite type and were probably produced by trees of the family Dipterocarpaceae, likely close to *Shorea*. Narudeesombat et al. (2014) and Naglik et al. (2018) confirmed this family origin. Messer (1990) indicated that resin exudate by the dipterocarpacean *Shorea javanica* is locally exploited. Leelawatanasukand et al. (2013) also cited the existence of Sumatra amber. Sumatra amber is a byproduct of coal mining. Eocene to Pliocene coal mines with amber were recorded (Belkin & Tewalt 2007; Bąk et al., 2016). Narudeesombat et al. (2014) were the first to figure an undetermined insect from the Oligocene-Miocene amber of the Central Sumatra Basin.

Our material comes from the South Sumatra Basin, probably from Sinamar, Dharmasraya Regency, West Sumatra (De Smet & Barber, 2005). Numerous amber inclusions are deformed because of amber was probably heated by volcanic activity that occurred in the area during the Miocene (Kosmowska-Ceranowicz et al. 2017).

The fossil was studied and measured using incident and transmitted light with stereomicroscopes (Olympus SZX9 and Nikon SMZ 1500). Images were digitally compiled using Helicon Focus software, and arranged using Adobe Photoshop software. The taxonomic actions established in the present work are registered in ZooBank, and with the publication urn:lsid:zoobank.org:act:B216AE76-FC1F-44CD-A892-2EF3FF6DE041

We followed the catalogue of the Tipuloidea of Oosterbroek (2019) to obtain the World list of extant *Mongoma* spp. We followed wing venation nomenclature of Cumming & Wood (2017) and classification of the Limoniidae of Starý (1992), also followed by Petersen (2006).

Systematic palaeontology

Order Diptera Linnaeus, 1758

Family Limoniidae Rondani, 1856

Genus *Trentepohlia* Bigot, 1854

Subgenus *Mongoma* Westwood, 1881

Type species. *Mongoma fragillima* Westwood, 1881.

Trentepohlia (*Mongoma*) *pouilloni* Ngô-Muller, Garrouste & Nel, n. sp. (Figures 1-2)

Etymology. Named after Mr. J.-M. Pouillon, who helped us a lot in our studies on fossil insects.

Material. Holotype JMP 2365, stored in collection Jean-Marc Pouillon.

Diagnosis. Wing characters only. Wing hyaline, 8 mm long; Rs twice as long as r-m; R2 distinctly shorter than R3; part of Rs distal of base of R2 present, but distinctly shorter than R2; base of M3 distinctly distal of that of M2; cell dm more than three times as long as wide; m-cu more basal than basal side of dm; CuA and CuP fused distally, forming a short but distinct vein CuA+CuP; cell cua broader than cell bm.

Description. Body dark, well preserved, except for the missing apex of abdomen; thorax hardly visible because of infuscate amber, head 0.75 mm wide, antennae 2.5 mm long; wing characters: halter long, 1.2 mm, 0.2 mm wide; preserved part of abdomen 3.6 mm wide. Preserved part of wing 7.2 mm long, wing probably ca. 8.0 mm long, 1.6 mm wide; hyaline except for a brown elliptic pterostigma, 0.8 mm long, 0.2 mm wide; sc-r present far from Sc apex, Sc ending on costa 0.4 mm basal of apex of R1+2; distance between the point where R2 ends on R1 and apex of R1+2 0.5 mm; Rs separating from R1 2.5 mm from wing base; distance between base of Rs and r-m 1.3 mm; r-m 0.68 mm long, aligned with basal part of Rs; length of part of Rs between r-m and base of R2 1.7 mm; R2 oblique, 0.4 mm long; R3+4 very short but distinct, 0.1 mm long; R3 longer than R2, 0.9 mm long; R4 longer than R3, ca. 1.9 mm long; length of basal stem of M 3.3 mm; length of basal side of cell dm 0.2 mm; anterior side of cell dm 0.7 mm long, posterior side of cell dm 0.9 mm long, the two points of separations of M1 and M2 and of M3 and M4 are at the same level; dm 3.5 times as long as wide, 1.0 mm long and 0.3 mm wide; basal part of M3 short and curved; distal parts of M1, M2, M3 and M4 straight; m-cu slightly basad to basal side of cell dm; CuA strongly curved distal of m-cu and ending into CuP; CuA+CuP 0.2 mm long; cell cua between CuA and CuP broad, broader than cell bm and as broad as cell br; A1 making a strong sigmoidal curve, ending on posterior wing margin 2.4 mm basal of apex of CuA+CuP; A2 a small arched vein.

Discussion

The wing venation of this fly is typical of the limoniid genus *Trentepohlia* Bigot, 1854, subgenus *Mongoma* Westwood, 1881 on the basis of the following characters, modified after Petersen (2006): Sc long, sc-r far from Sc apex, Sc ending after split of Rs; part of R1 distal of point of fusion of R2 with R1, subequal to R2, R2 typically directed toward wing base and ending into R1; two branches of Rs (R3, R4) attaining wing margin, R3 and R4 strongly

divergent; r-m crossvein at antero-basal angle of cell dm and aligned with basal part of Rs; four medial veins (M1, M2, M3, M4) attaining wing margin; M4 aligned with basal part of M; cell dm present; CuA intersecting CuP near posterior wing margin, thus cell cua is closed; one anal vein A1 attaining wing margin.

Mongoma is the most species-rich worldwide subgenus of *Trentepohlia*, with 145 described species (Oosterbroek 2019). It is very well represented in the Oriental region, but also present in Afrotropical, Australasian / Oceanian, East Palaearctic, and Neotropical regions. There is currently no phylogenetic analysis of *Trentepohlia* and no extensive revision of *Mongoma*. If Oosterbroek (2019) placed this genus in the Limoniinae, Petersen (2008) considered it as being of 'unplaced position' in the Limoniidae. Thus we should compare our fossil with extant species of *Mongoma,* which is currently clearly not feasible because many species have never been revised since their original descriptions. In fact the entire subgenus urgently needs a revision. Lack of information on the terminalia of our fossil and of some extant species also renders the comparison very delicate. Nevertheless we have compared a set of 10 wing characters (see Supplementary table 1) between our fossil and the extant *Mongoma* spp. from the Oriental region (see Supplementary tables 2-3). The value of these characters is even questionable, since the venation within a single species of Limoniidae may greatly vary (see Alexander & Leonard 1912). In table 2, some characters could not be coded for certain taxa, being absent in the original description. In fact, we could completely fill in the lines of the taxa for which a figure of the venation was given in the literature. Thus 21 taxa are incompletely filled, while 42 are completely informed for the defined set of characters.

Among them, *Trentepohlia* (*Mongoma*) *pouilloni* n. sp. shares nine character states with only one taxon *T*. (*M.*) *pennipes*, the unique difference being 'cell cua broader than cell bm' (Podenas et al. 2015). This continuous character could be due to taphonomic deformation of the fossil, a situation rather frequent for the structures of the insects included in the Sumatra

amber. Nevertheless, three other extant *Mongoma* spp. from the Oriental region also share the same state of character present in *T*. (*M.*) *pouilloni* n. sp. (see table 2). The other extant taxa differ from *T*. (*M.*) *pouilloni* n. sp. in at least three character states. *T*. (*M.*) *pennipes* is supposed to be present in a very wide area, including Mozambique (Africa), Seychelles (Indian Ocean), China, Korea, Philippines, India, Malaysia, Papua New Guinea Indonesia (including Sumatra) (Oosterbroek 2019). Thus *T*. (*M.*) *pouilloni* n. sp. is possibly closely related to *T*. (*M.*) *pennipes* present in the same island.

Cockerell (1917) described and partly figured a wing (compression fossil) that he attributed to the subgenus *Mongoma*, *T*. (*M.*) *cruciferella* Cockerell, 1917 from the Latest Eocene of the Isle of Wight (Gurnet Bay). Its wing is 5.0 mm long, and differs from that of *T*. (*M.*) *pouilloni* n. sp. in the absence of a stem of R3+4. Cockerell (1921) described another species *T*. (*M.*) *pallescens* Cockerell, 1921 from the same outcrop. It differs from *T*. (*M.*) *pouilloni* n. sp. in wings 4.0 mm long, m-cu aligned with basal side of dm, and a shorter R3.

Conclusion

T. (*M.*) *pouilloni* n. sp. seems to be very closely related to the extant species *T*. (*M.*) *pennipes*, suggesting a Miocene age than an Eocene one for the amber. This hypothesis needs to be tested through future study of the other embedded insects. The biology of the *Mongoma* spp. remains nearly unknown, however adult specimens of *T*. (*M.*) *inexpectata* Mederos-López & Gelhaus, 2014 were observed in shelter cavities between tree roots in Cuba forests (Mederos-López & Gelhaus 2014). This particular behavior may result in a higher probability of being trapped in resin. These flies probably lived in warm and humid forests, in accordance with the dipterocarpacean origin of the amber. The presence of the subgenus *Mongoma* in the Latest Eocene of UK and the Miocene of Sumatra suggests that it was widespread during Cenozoic period and is in accordance to its extant circumtropical distribution.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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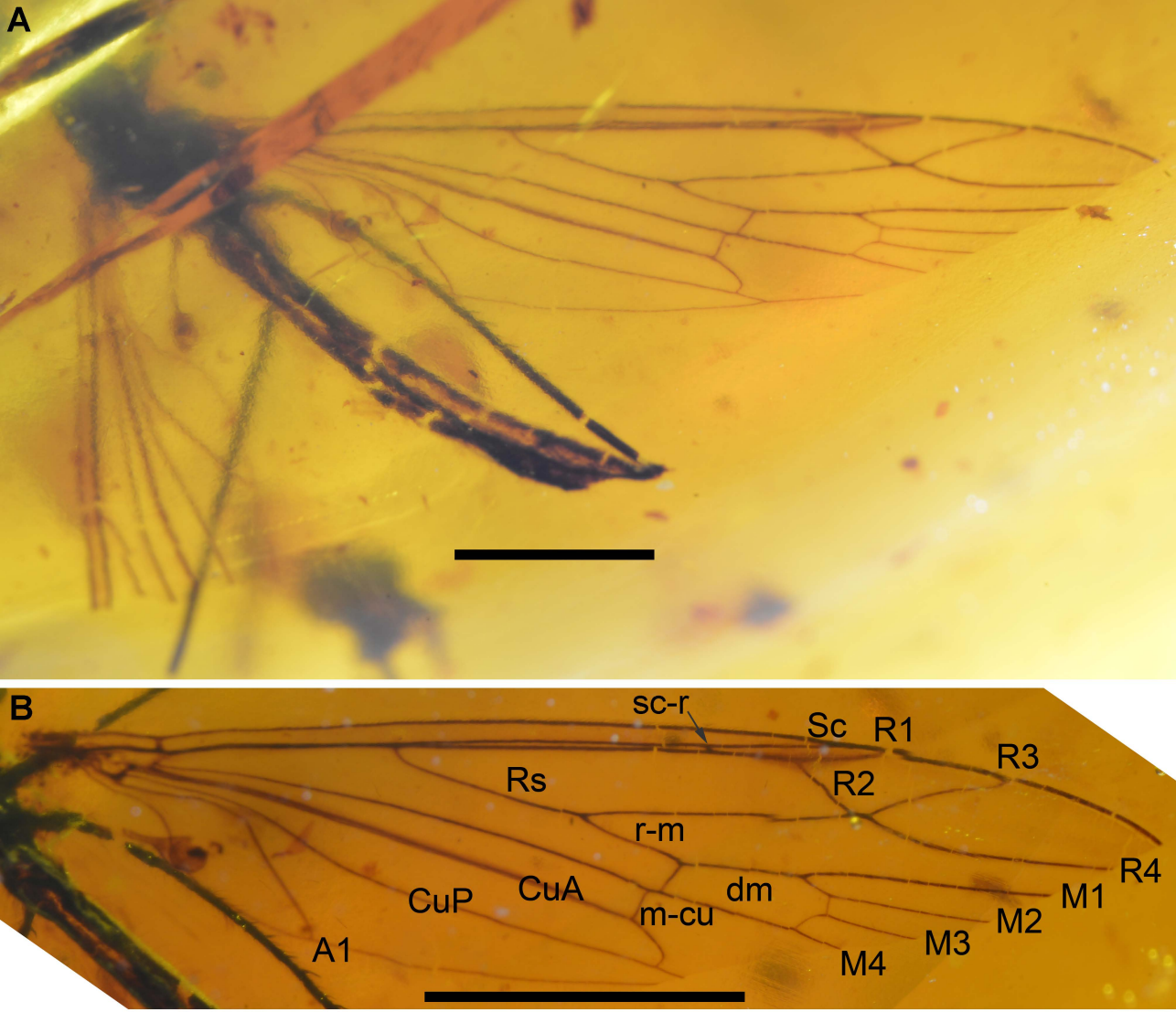
Figure 1. *Trentepohlia* (*Mongoma*) *pouilloni* n. sp. Ngô-Muller, Garrouste & Nel, holotype JPM 2365. A, general habitus (scale bar: 1 mm); B, fore wing (scale bar: 2 mm).

Figure 2. *Trentepohlia* (*Mongoma*) *pouilloni* n. sp. Ngô-Muller, Garrouste & Nel, holotype JPM 2365. Head (scale bar: 1 mm).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