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1 A new species of the long-legged fly genus *Microphorites* in Burmese amber (Dolichopodidae:
2 Microphorinae)

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10

11 **ABSTRACT**

12 We describe *Microphorites pouilloni* sp. nov., as first representative of this Cretaceous–
13 Paleogene genus of Dolichopodidae Microphorinae from the mid-Cretaceous Burmese amber.
14 The oldest records of this genus of small Diptera are from the early Cretaceous Lebanon and
15 Jordan, while the Burmese amber was probably produced on an island during the mid-
16 Cretaceous, which had separated from Gondwana during the Jurassic. This situation suggests a
17 possible late Jurassic origin for the genus *Microphorites*.

18

19 *Keywords:* Diptera

20 Empidoidea

21 sp. nov.

22 paleobiogeography.

23

24 **1. Introduction**

25 The subfamily Microphorinae is a small group of empidoid flies classified within the
26 Dolichopodidae (Sinclair and Cumming, 2006; Wahlberg and Johanson, 2018). It contains 47
27 extant described species in two genera and 16 extinct species in two extant and four fossil
28 genera (Brooks et al., 2019). They are recorded in the early Cretaceous Lebanese and Jordan
29 amber, the mid-Cretaceous of Spain and France, the late Cretaceous of France, and the
30 Paleogene amber of Czechia and France. Brooks et al. (2019) recently described two fossil
31 species they attributed to the extant genus *Schistostoma* Becker, 1902, from the mid-Cretaceous
32 Burmese amber. Tang et al. (2019) also described a monospecific genus *Pristinmicrophor* from
33 the same amber. *Microphorites* Hennig, 1971 is the most diverse extinct genus, with eight
34 described species from Lebanon, Jordan, France, Spain, and Moravia. Curiously no
35 *Microphorites* have been recorded from the very rich Burmese amber (Ross, 2019) until now.
36 Here we describe a new species of *Microphorites* from this amber, based on a well-preserved
37 male specimen. This new finding is of interest for the knowledge of the Cretaceous distribution
38 of this genus.

39

40 **2. Material and methods**

41 The type of *Microphorites pouilloni* sp. nov. is embedded in a small clear piece of amber
42 together with another small Diptera: Brachycera. They were separated and the type was
43 prepared using a diamond disk and examined using a Nikon binocular microscope SMZ 1500.
44 Photographs were taken with a Nikon camera D800, and the images were treated with Adobe
45 Photoshop Element 12. The piece of Burmese amber was found in deposits in the Hukawng
46 Valley (Kachin) of Myanmar (Yin et al., 2018: fig. 1A). The age of amber is confirmed by
47 radiometric analysis of zircons as earliest Cenomanian, *ca.* 99 Ma. (Shi et al., 2012). We follow
48 the classification of Brooks et al. (2019) for the Microphorinae, and Grichanov and Brooks
49 (2017) for the morphology and venation.

50

51 **3. Systematic paleontology**

52 Order: Diptera Linnaeus, 1758.

53 Family: Dolichopodidae Latreille, 1809.

54 Subfamily: Microphorinae Collin, 1960.

55 Genus: *Microphorites* Hennig, 1971.

56

57 Type species: *Microphorites extinctus* Hennig, 1971, p. 16, figs. 2, 3, 19–25.

58 Other species: *Microphorites extinctus* Hennig, 1971 (Lower Cretaceous, Lebanese amber); *M.*

59 *oculeus* Grimaldi and Cumming, 1999, *M. similis* Grimaldi and Cumming, 1999 (both Lebanese

60 amber); *M. deploegi* Nel et al., 2004 (Albian amber, Lower Cretaceous, France); *M. utrillensis*

61 Peñalver in Arillo, Peñalver and Delclós, 2008 (San Just amber, Lower Cretaceous, Spain);

62 *Microphorites pouilloni* sp. nov. (lowermost Cenomanian, Burmese amber, Myanmar); *M.*

63 *magaliae* Perrichot and Engel, 2014 (Vendean amber, Upper Cretaceous, France), *M.*

64 *moravicus* Tkoč et al., 2016 (Študlov amber, Cretaceous (Cenomanian) / lower Paleogene,

65 Moravia), *M. erikai* Bramuzzo and Nel, 2017 (lowermost Eocene Oise amber, France).

66

67 *Microphorites pouilloni* Ngô-Muller & Nel, sp. nov.

68 (Fig. 1)

69 *Holotype*. MNHN.F.A71310 (specimen 17A, collection Jean-Marc Pouillon), stored in the

70 collections of the Muséum National d'Histoire Naturelle, Paris, France.

71 *Locality and horizon*. Hukawng Valley, Kachin State, northern Myanmar; mid-Cretaceous

72 (lowermost Cenomanian).

73 *Etymology*. Named after Jean-Marc Pouillon, who donated the type specimen.

74 *Diagnosis.* Postpedicel rather short, triangular; presence of a group of very long bristles on male
75 terminalia; two pairs of scutellar bristles, apical pair more than twice length of lateral pair; no
76 colored pterostigma; basal part of M2 oblique, not perpendicular to M1; costal vein ending
77 between R4+5 and M1.

78 *Description.* A well-preserved specimen. Male. Body wholly dark brown, 1.7 mm long, wing
79 1.4 mm long, 0.5 mm wide. Head hemispheric, 0.4 mm long, distinctly wider than thorax in
80 dorsal view, ca 0.8 as long as thorax in dorsal view; eyes holoptic, close to each other on face,
81 ommatidia uniform, bare; margin of eye with a weak notch near antenna; vertex flat, with a pair
82 of ocellar bristles; ocellar tubercle weakly prominent; occiput round, slightly prominent;
83 antenna located near vertex, brown; scape small, almost bare; pedicel with two dorsal bristles,
84 small, globular; postpedicel nearly triangular, extended basally, rather short, 1.2 times as long
85 as wide; arista-like stylus apical, 3.8 times as long as postpedicel, basal segment very short,
86 simple, with microscopic hairs; palpus appressed to proboscis; palpus thin, finger-like, without
87 distinct apical bristle and some tiny hairs; proboscis large, discoid laterally, with some tiny
88 hairs.

89 Thorax narrow and strongly arched, 0.9 as long as high, setulae and bristles black; numerous
90 biserial acrostichal and dorsocentral setulae anteriorly, two long strong dorsocentral bristles in
91 posterior half, two notopleural bristles, one supra-alar bristle; pronotum small; mesonotum
92 distinctly raised at middle and posterior area; scutellum with one pair of long apical bristles
93 more than twice as long as a short pair of lateral bristles.

94 Legs wholly brown, fore coxa with three lateral bristles, mid and hind coxae each with two
95 lateral bristles, outer bristle not visible; hind femora with a series of bristles; all tibiae with two
96 rows of long lateral bristles.

97 Wings wide, 2.8 times longer than wide, hyaline, entirely covered with microtrichia, with long
98 setulae on posterior margin, veins dark brown. Costal vein with row of short spine-like bristles;

99 Rs base situated at 0.18 times wing length, short, with two branches; Sc ending at basal third of
100 Costa, no clearly darkened pterostigma; h very bold; R2+3 and R4+5 diverged at basal 1/4,
101 parallel apically; R2+3 straight apically; R4+5 slightly arched apically, unforked, ending near
102 wing tip; M with three branches M1, M2 and M4; short r-m crossvein present at basal 1/3 of
103 wing; cell bm triangular; crossvein dm-m complete.

104 Abdomen short and cylindrical, ca 1.8 times as long as thorax; tergites I to VII all with spine-
105 like dorsal bristles apically and near their middle; male genitalia: hypopygium large, rotated
106 and lateroflexed with three long apical setae.

107

108 **4. Discussion**

109 *Microphorites pouilloni* sp. nov. can be attributed to the Dolichopodidae subfamily
110 Microphorinae because of the following characters: antennal arista-like stylus two-articled,
111 male eyes holoptic, wing with costal vein circumambient, crossvein bm-m complete, wing cell
112 dm present (cell dm absent in the extinct genus *Avenaphora* Grimaldi and Cumming, 1999,
113 excluding affinities of *Microphorites pouilloni* sp. nov. with this last genus) and emitting three
114 branches.

115 Except for *Avenaphora*, the Microphorinae comprise the following genera, after Brooks et al.
116 (2019) and Tang et al. (2019): extant *Microphor* Macquart, 1827 and *Schistostoma*, and extinct
117 *Curvus* Kaddumi, 2005; *Meghyperiella* Meunier, 1908, *Pristinmicrophor* Tang et al., 2019, and
118 *Microphorites*. *Curvus* is a very poorly known genus with one species *C. khuludi* Kaddumi,
119 2005 from the early Cretaceous of Jordan. *Microphorites pouilloni* sp. nov. differs from *Curvus*
120 at least in the distinctly shorter cell dm (Kaddumi, 2005). *Meghyperiella* from the Baltic amber,
121 has also never been revised. According to Meunier (1908: 112) it has a stylus shorter than the
122 first flagellomere, unlike *Microphorites pouilloni* sp. nov. *Microphorites pouilloni* sp. nov. has
123 two pairs of scutellar bristles, unlike *Microphor* (Shamsev and Sinclair, 2006). *Microphorites*

124 *pouilloni* sp. nov. differs from *Microphor* and *Schistostoma* in the small, not right-angled, anal
125 lobe (Brooks et al., 2019). *Microphorites pouilloni* sp. nov. differs from *Pristinmicrophor* in
126 the postpedicel distinctly shorter, only 1.2 times as long as wide, instead of 3.0 times in the
127 later, a median vein with three branches, and no colored pterostigma instead of having a
128 triangular one. *Microphorites pouilloni* sp. nov. has the typical characters for *Microphorites*,
129 viz., antennae located near middle of anterior margins of eyes; arista two-articled; anal margin
130 of wing not making a strong curvature (putative synapomorphy); three radial veins; crossvein
131 r-m in basal fourth of wing; crossvein dm-m complete; cell dm present; three complete medial
132 branches (Bramuzzo and Nel, 2017).

133 *Microphorites pouilloni* sp. nov. differs from *M. moravicus* and *M. erikai* in the absence of a
134 clearly colored pterostigma (Tkoč et al., 2016; Bramuzzo and Nel, 2017). *Microphorites*
135 *pouilloni* sp. nov. differs from *M. magaliae* in the presence of a group of very long bristles on
136 male terminalia, and of two pairs of scutellar bristles, instead of only one pair in *M. magaliae*
137 and *M. deploegi* (Nel et al., 2004; Perrichot and Engel, 2014). *Microphorites utrillensis* and *M.*
138 *extinctus* have two strong subequal pairs of scutellar bristles, instead of one long apical pair
139 more than twice as long as the lateral pair as in *Microphorites pouilloni* sp. nov. and in *M.*
140 *similis* (Hennig, 1971; Grimaldi and Cumming, 1999; Arillo et al., 2008). *Microphorites*
141 *pouilloni* sp. nov. differs from *M. similis* in basal part of M2 oblique, not perpendicular to M1,
142 in the longer flagellomere I, in the costal vein ending between R4+5 and M1, not at apex of
143 R4+5 (Grimaldi and Cumming, 1999). *Microphorites pouilloni* sp. nov. shares with *M. oculus*
144 the long flagellomere I, but its costal vein ends between R4+5 and M1. The number and shape
145 of scutellar bristles is unknown in *M. oculus*.

146

147 **5. Conclusion**

148 The mid-Cretaceous Burmese amber was deposited on a land that is currently supposed to have
149 been an island in the Tethys Ocean at that time (Metcalf, 1996; Rasnitsyn and Öhm-Kühnle,
150 2018). It was possibly separated from the Gondwana paleocontinent during the Jurassic and
151 fused to Asia around 87 Ma. ago (Seton et al., 2012). The presence of *Microphorites*, a genus
152 known in the early Cretaceous of Lebanon that was a part of Gondwana at that time, suggests
153 that this genus is possibly late Jurassic.

154

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158

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225

226 **Fig. 1.** *Microphorites pouilloni* sp. nov., holotype MNHN.F.A71310. A, habitus, arrows
227 scutellar bristles; B, wing and abdomen, lateral view; C, terminalia, lateral view; D, head,
228 oblique view Scale bar = 1 mm (A); 0.5 mm (B); 0.1 mm (C); 0.2 mm (D).

229

230





R1

R2+3

R4+5

M1

M2

M4

r-m

dm-m





