

A New Genus of Fossil Digger Wasps (Insecta: Hymenoptera, Crabronidae) from the Upper Eocene of Florissant, USA

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Abstract—A new digger wasp, *Florimena impressa* gen. et sp. nov. (Hymenoptera: Crabronidae, Pemphredoninae), from the Upper Eocene shales of Florissant (Colorado, United States) is described. It is distinguished from all known members of the subtribe Spilomenina by the convex frons and in regularly rounded propodeum without a distinct bend between the upper and posterior sides.

Keywords: Crabronidae, digger wasps, new taxa, Upper Eocene, Florissant, Colorado

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INTRODUCTION

To date, the Upper Eocene beds of Florissant (Colorado, United States) have yielded ten digger wasp species assigned to two families. The family Sphecidae is represented by *Hoplisidia kohliana* Cockerell, 1906, *Chalybion mortuum* Cockerell, 1907 (Sceliphrinae, Sceliphriini), and *Ammophila antiquella* Cockerell, 1906 (Ammophilinae, Ammophilini) and the family Crabronidae, by *Pison cockerellae* Rohwer, 1908 (Crabroninae, Trypoxylini), *Psammaecius sepultus* (Cockerell, 1906) (Bembicinae, Bembicini), *Mellinus handlirschi* Rohwer, 1908 (Mellininae, Mellinini), *Tracheliodes mortuellus* Cockerell, 1906, *Ectemnius longoevus* (Cockerell, 1910) (Crabroninae, Crabronini), and *Passaloecus scudderii* Cockerell, 1906, and *P. fasciatus* Rohwer, 1909 (Pemphredoninae, Pemphredonini).

Extant members of the first five tribes either dig their nests in soil, reinforcing the internal walls of cells by humidified ground (Ammophilini, Bembicini, Mellinini), or use moistened clay for building molded nests or partitions between cells and closing plug in linear nests placed in various pre-existing cavities (Sceliphriini, Trypoxylini). In this connection, it is expected to record members of these tribes in deposits of water bodies.

However, this does not concern other genera listed above, since extant species of *Ectemnius* Dahlbom, 1845 and *Tracheliodes* Dahlbom, 1845 have nests built by females in wood (and, in the second genus, in ground) without moistened clay; *Passaloecus* Shuckard, 1837 occupies pre-existing cavities in wood or dry stems of bushes with a soft core. Obviously, for this reason xylobiont digger wasps are much more rarely recorded in fossil deposits. It is noteworthy that females of *Passaloecus* use resinous secretions of plants for cov-

ering the interior walls of cells and producing the partitions between them; this probably causes the prevalence of this genus and related taxa in fossil resins.

Living members of *Passaloecus* and the species of this genus described here from the beds of Florissant have two discoidal cells in the forewings. At the same time, fossil resins of different ages have yielded seven Pemphredoninae species, the forewings of which contain a single discoidal cell: *Eopinoecus samogiticus* Budrys, 1993 and *E. truncifrons* Budrys, 1993 from the Upper Eocene Baltic amber, and *Palarpactophilus saxonicus* Ohl et Bennett, 2009 from the Middle Eocene Saxon amber (Pemphredonini, Pemphredonina: Ohl and Bennett, 2009; Antropov, 2011), *Cretospilomena familiaris* Antropov, 2000 from the Albian–Cenomanian Burmese amber, *Psolimena electra* Antropov, 2000 from the Upper Cretaceous (Turonian) of New Jersey amber, *Lisponema singularis* Evans, 1969 from the Upper Cretaceous (Campanian) of the Canadian amber, and also *Menopsila dupeae* Bennett, Perrichot et Engel, 2014 from the Upper Cretaceous (Cenomanian–Santonian) Vendean amber (Spilomenini, Spilomenina). As for the records from deposits, to date, they have yielded only one Pemphredoninae species with reduced second discoidal cell, *Plisomena gigantea* Antropov, 2014 (Spilomenini, Spilomenina) from the Upper Eocene of Isle of Wight, which is distinguished by the not enlarged pterostigma and also by the relatively large body size compared to members of this tribe.

All other fossil Spilomenini listed above, as most of related extant taxa, are distinguished not only by the reduced venation, but also by relatively small size; in my opinion, this, along with the mostly xylobiont lifestyle, is one of the reasons for the low probability of recording them in fossil deposits. Therefore, the first

record from the Upper Eocene beds of Florissant of a member of this tribe referred to the new genus *Florimena* gen. nov. is of particular interest.

The pedunculate abdomen with a sting, single-segmented trochanters, short pronotum with a straight posterior margin and pronotal lobes separated from the tegulae, and also cylindrical first tarsomere of the hind legs suggest that the specimen studied belongs to apoid wasps of the family Crabronidae, while the scutum with well-pronounced adlateral and parapsidal lines, the forewings with enlarged pterostigma, the closed and not shortened marginal cell, with its acute apex lying on the anterior wing margin, and also the short abdominal pedicel with nonseparated proximal and distal parts of tergite 1 indicate that it belongs to the subtribe Spilomenina of the tribe Spilomenini of the subfamily Pemphredoninae (Antropov, 2011).

The material was examined using Leica MZ 9.5 and Carl Zeiss Stemi SV 6 stereomicroscopes with a drawing unit. The photographs were taken using Canon EOS D6 and Leica DFC420 digital cameras mounted on a Leica 165C stereomicroscope and treated with image processing software (Adobe Photoshop CS). Linear illustrations were produced using drawing unit and the CorelDRAW 7 software. Measurements were taken using an ocular micrometer.

SYSTEMATIC PALEONTOLOGY

Superfamily Apoidea Latreille, 1802

Family Crabronidae Latreille, 1802

Subfamily Pemphredoninae Dahlbom, 1835

Tribe Spilomenini Menke, 1989

Subtribe Spilomenina Menke, 1989

Genus *Florimena* Antropov, gen. nov.

Etymology. From the toponym *Florissant* and generic name *Spilomena*; feminine gender.

Type species. *F. impressa* sp. nov.

Diagnosis. Head wide, much wider than long; upper part of frons significantly widely convex, with distinct medial line; ocellar triangle obtuse; pronotal collar regularly convex, without transverse ridge; admedial lines almost reaching posterior margin of scutum; adlateral lines almost complete; acute apex of marginal cell lying on anterior wing margin; pterostigma distinctly enlarged, more than twice longer than width of second submarginal cell; vein 3-RS approximately equal to vein 2-RS; forewings with two submarginal and one discoidal cells; second submarginal cell not narrowed, wider than long; recurrent vein 1m-cu connected to first submarginal cell near its apex; anterior external angle of discoidal cell (between veins 1-RS+M and 1m-cu) approximately equal to 60°; vein RS of hind wing straight, twice longer than vein 1r-m; vein cu-a of hind wing interstitial, slightly longer than vein 1r-m; cell cua of hind wing longer anteriorly than posteriorly (vein M+Cu longer than vein 1A); femora and tibiae not modified; tibiae with-

out distinct spines; propodeum regularly rounded, without distinct bend between upper and posterior sides, without lateral corners or teeth, with triangular dorsal area and clear medial furrows; first abdominal segment without separate sternal pedicel; apical abdominal tergite oval conical, without pygidial plate.

Species composition. Type species.

Comparison and remarks. *Florimena* gen. nov. differs from all known genera of Spilomenina (sensu Antropov, 2011) in the distinctly convex upper part of the frons and regularly rounded propodeum without a distinct bend between the upper and posterior sides.

Florimena gen. nov. differs from all known extinct genera of Spilomenina, except for *Psolimena*, in the regularly convex pronotal collar without a transverse ridge.

Psolimena (Antropov, 2000a) differs from *Florimena* in the forewing having a shortly truncate apex of the marginal cell separated from the anterior wing margin; in the 3-RS vein shorter than 2-RS, almost straight anterior external corner of the discoidal cell; in the hind wing with an externally curved RS; the postfurcal cu-a not longer than 1r-m; the cua cell equal in length anteriorly and posteriorly (M+Cu is equal to 1A); and also in the smaller body size.

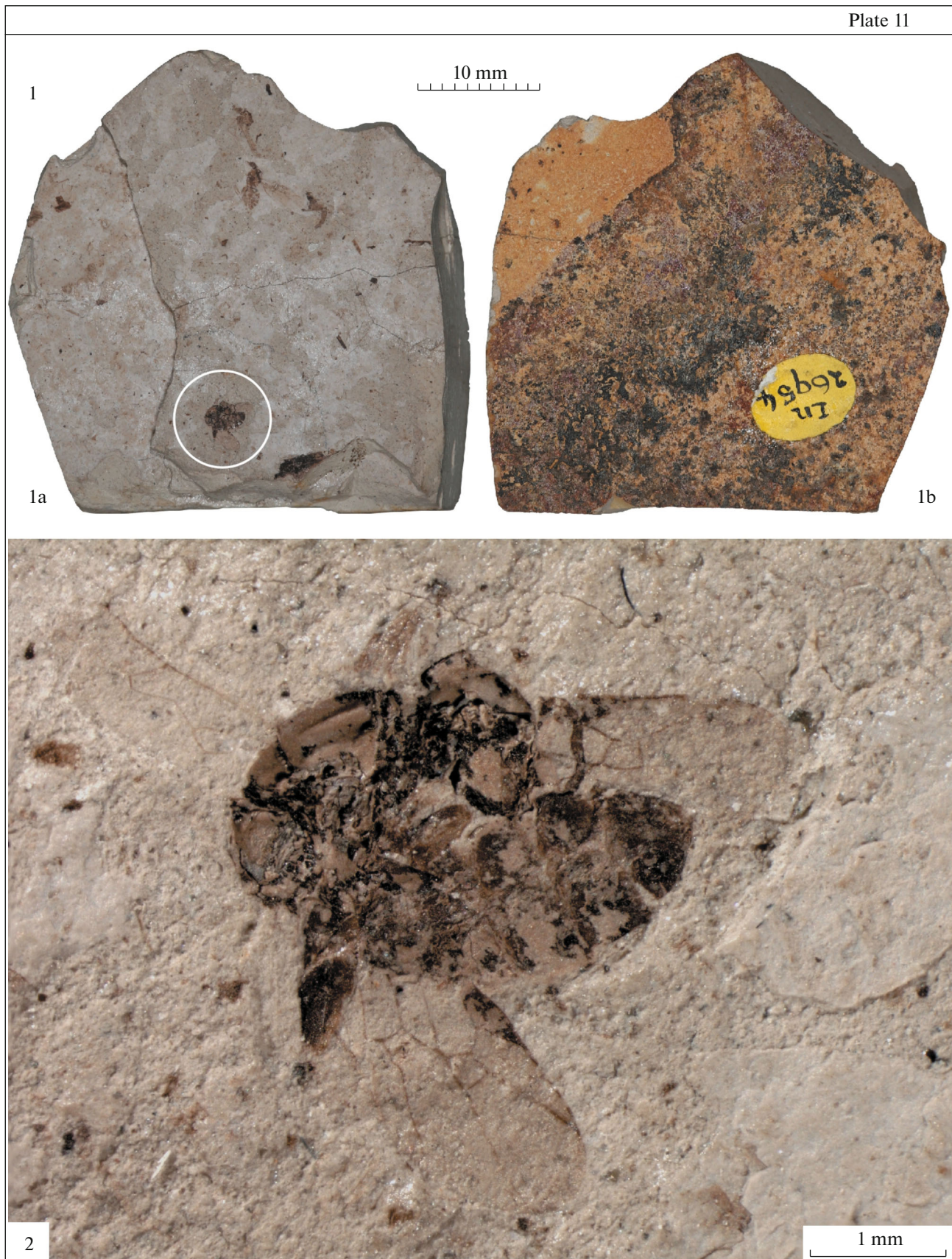
Lisponema (Evans, 1969) differs from *Florimena* in the short pronotal collar with a transverse ridge; the forewing with a shortly truncate apex of the marginal cell separated from the anterior wing margin, the 3-RS shorter than 2-RS, almost straight anterior external corner of the discoidal cell; the hind wing with the internally concave RS, thrice longer than 1r-m; the cu-a twice longer than 1r-m; the cua cell shorter anteriorly than posteriorly (M+Cu is shorter than 1A); the presence of short lateral teeth on the propodeum; and also in the smaller body size.

Cretospilomena (Antropov, 2000b) differs from *Florimena* in the pronotal collar with a transverse ridge, the acute anterior external angle of the discoidal cell more than 60°; in the hind wing with the RS not longer than 1r-m; the cua cell equally long anteriorly and posteriorly (M+Cu and 1A are equal); and in the body size half that *Florimena*.

Menopsila (Bennett et al., 2014) differs from *Florimena* in the presence of a short interantennal spine; the pronotal collar with a transverse ridge; the forewing with 3-RS shorter than 2-RS; the acute anterior external angle of the discoidal cell, distinctly greater than 60°; and in the smaller body size.

Plisomena (Antropov et al., 2014) differs from *Florimena* in the forewing with a prestigma longer than the reduced (probably secondarily) pterostigma, the first and second submarginal cells almost equal in size; and presumably in the distinctly larger body size. In addition, in *Plisomena*, the recurrent vein 1m-cu is connected to the second submarginal cell, which only occurs in several extant South American species of the

Plate 11



sample [opposite part of the sample contains an imprint of a winged male ant (Formicidae) and two partial imprints nematoceran dipterans; counterpart is absent]; United States: "Florissant, Colorado. Purch. G.F. Sternberg. Oct. 1926. Brit. Mus. Geol. Dept. Miocene"; Late Eocene.

Description (Fig. 1). The head is 1.5 times wider than its maximum length; the upper part of the frons is distinctly convex, with a narrow longitudinal groove. The distance between the posterior ocelli is 3.4 times greater than the distance between the posterior ocellus and eye and 2.6 times greater than the distance between the posterior and anterior ocelli. The scape is more than thrice longer than its maximum thickness; the middle flagellomeres are slightly longer, preapical ones are not longer, and apical flagellomeres are at most twice longer than thick. The scutum is regularly convex; the transverse suture between the scutum and scutellum has regular longitudinal ridges; the scutellum is flat-convex; the postscutellum is flat. The upper part of the frons has weak vertical striae; the scutum, scutellum, and propodeum are smooth, without a rough sculpture.

Measurements in mm and ratios: body length, about 5.4; forewing: length, 3.2; ptStg, 0.74: 0.2 (length : width); veins (minimum distance between the ends): 1-R, 0.72; 2r-rs, 0.19; 3-RS, 0.2; 4+5-RS, 0.81; 1m-cu, 0.33; 2-RS+M, 0.13; 2-M, 0.27; 2r-m, 0.2; 2-RS, 0.19; hind wing: length, 2.8; veins (minimum distance between the ends): RS, 0.32; 1r-m, 0.13; M, 0.54; cu-a, 0.17; legs (length : thickness): ti1, 0.54 : 0.18; f2, 0.88 : 0.27; ti3, 1.25 : 0.22; f3, 1.18 : 0.29.

Remarks. Although reliable information on the biology of this species is not available, the absence of digging adaptations (rakes on the anterior legs, a psammophore in the lower part of the head, flat pygidial plate) suggests that it nested in hollow stems or wood, most likely abandoned burrows of xylophagous insects.

Material. Holotype.

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REFERENCES

- Antropov, A.V., To the knowledge of the fauna of the genus *Spilomena* (Hymenoptera, Sphecidae) of South America, *Zool. Zh.*, 1991, vol. 70, no. 11, pp. 57–62.
- Antropov, A.V., Five new neotropical species of the genus *Spilomena* (Hymenoptera: Sphecidae: Pemphredoninae), with additional comments on the previously described species, *Russ. Entomol. J.*, 1992, vol. 1, no. 1, pp. 67–73.
- Antropov, A.V., Further supplements to the knowledge of the neotropical fauna of digger wasps of the genus *Spilomena* (Hymenoptera: Sphecidae: Pemphredoninae), *Russ. Entomol. J.*, 1993, vol. 1, no. 2, pp. 41–57.
- Antropov, A.V., A new digger wasp (Hymenoptera, Sphecidae, Pemphredoninae) from New Jersey amber, in *Studies on Fossils in Amber, with Particular Reference to the Cretaceous of New Jersey*, Grimaldi, D., Ed., Leiden: Back, 2000a, pp. 339–343.
- Antropov, A.V., Digger wasps (Hymenoptera, Sphecidae) in Burmese amber, *Bull. Natur. Hist. Mus. Ser. Geol.*, 2000b, vol. 56, no. 1, pp. 59–77.
- Antropov, A.V., A new tribe of fossil digger wasps (Hymenoptera: Crabronidae) from the Upper Cretaceous New Jersey amber and its place in the subfamily Pemphredoninae, *Russ. Entomol. J.*, 2011, vol. 20, no. 3, pp. 229–240.
- Antropov, A.V., Belokobylskij, S.A., Compton, S.G., et al., The wasps, bees and ants (Insecta: Vespida = Hymenoptera) from the Insect Limestone (Late Eocene) of the Isle of Wight, UK, *Earth Environ. Sci. Trans. Roy. Soc. Edinburgh*, 2014, vol. 104, pp. 335–446.
- Bennett, F.D., Perrichot, V., and Engel, M.S., A new genus and species of pemphredonine wasps in Late Cretaceous Vendean amber (Hymenoptera: Crabronidae), *Paleontol. Contrib.*, 2014, no. 101, pp. 41–45.
- Evans, H.E., Three new Cretaceous aculeate wasps (Hymenoptera), *Psyche*, 1969, vol. 76, no. 3, pp. 251–261.
- Ohl, M. and Bennett, D.J., A new genus and species of apoid wasps from Saxonian amber (Hymenoptera: Apoidea: Crabronidae), *Denisia, N. Ser.* 26, 2009, vol. 86, pp. 145–150.

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