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Corentin Jouault, André Nel, Vincent Perrichot. New evanioid wasps (Hymenoptera: Praeaulacidae, Aulacidae) from Cenomanian Burmese amber. *Cretaceous Research*, 2020, 110, pp.104407. 10.1016/j.cretres.2020.104407 . insu-02462021

HAL Id: insu-02462021

<https://insu.hal.science/insu-02462021>

Submitted on 31 Jan 2020

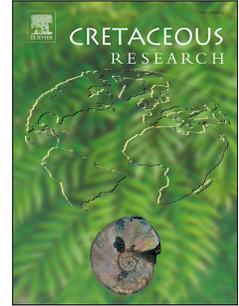
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Journal Pre-proof

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PII: S0195-6671(19)30456-2

DOI: <https://doi.org/10.1016/j.cretres.2020.104407>

Reference: YCRES 104407

To appear in: *Cretaceous Research*

Received Date: 25 October 2019

Revised Date: 20 December 2019

Accepted Date: 26 January 2020

Please cite this article as: Jouault, C., Nel, A., Perrichot, V., New evanioid wasps (Hymenoptera: Praeaulacidae, Aulacidae) from Cenomanian Burmese amber, *Cretaceous Research*, <https://doi.org/10.1016/j.cretres.2020.104407>.

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1 New evanioid wasps (Hymenoptera: Praeaulacidae, Aulacidae) from
2 Cenomanian Burmese amber

3

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10

11 **ABSTRACT**

12 The Cenomanian amber from Kachin State of Myanmar contains a diversified fauna of fossil
13 evanioid wasps. Two new genera are described and figured, as *Rasnitsevania ferox* gen. et sp.
14 nov. in the family Praeaulacidae, and *Electrofoenia jehani* gen. et sp. nov. in Aulacidae.
15 Characteristic features of *Rasnitsevania* gen. nov. include a large mesosoma, a two-segmented
16 metasomal petiole with first segment long, trapezoidal, and the fore wing venation with a long
17 cell 1-mcu and a cell 2rm shorter than 3rm. *Electrofoenia* is characterized by the pronotum
18 transversely striate and the fore wing with vein 1Rs less than twice as long as 2Rs, 2Rs+M
19 short, 2M longer than 3M, and 1cu-a basal to fork of 1M and 1cu. The Praeaulacidae and
20 Aulacidae display an extensive fossil record suggesting that the Mesozoic Evanioidea were
21 much more diverse than today. An updated list of the fossil record of the Praeaulacidae is
22 provided.

23

24 **Keywords.** Hymenoptera, Evanioidea, Praeaulacidae, Aulacidae, Cenomanian, fossil record

25 **1. Introduction**

26

27 The Evanioidea comprises the extant families Evaniidae, Aulacidae, Gasteruptiidae, and
28 the Mesozoic families †Praeaulacidae (including Nevaniinae, see below), †Anomopterellidae,
29 †Andreneliidae, †Baissidae, and †Othniodellithidae (following the classification of Li et al.,
30 2018). Evanioid wasps are easily recognizable by their articulation of the metasoma located
31 high on the propodeum and well above the metacoxae (Goulet and Huber, 1993). Their
32 relatively rich fossil record suggests that their diversity was higher during the Mesozoic than
33 in the extant ecosystems in which they are rivaled by the hyperdiverse Ichneumonoidea,
34 Chalcidoidea or Platygastroidea. The extant Evanioidea comprises approximately 1,200
35 described species contra more than 24,000 species for the hyperdiverse Ichneumonoidea
36 (Huber, 2009; Yu et al., 2011; Engel and Krombein, 2012; Zhao et al., 2012; Aguiar et al.,
37 2013; Jennings et al., 2018). Extant taxa are predators or ectoparasites of roaches, aculeate
38 wasps, or bees, and endoparasites of xylophagous insects (Huben, 1995; Jennings and Austin,
39 2004; Turrisi and Vilhelmsen, 2010).

40 Molecular and morphological studies strongly support the monophyly of the Evanioidea
41 (Dowton and Austin, 1994; Dowton et al., 1997; Vilhelmsen et al., 2010; Heraty et al., 2011;
42 Sharkey et al., 2012; Klopstein et al., 2013; Payne et al., 2013; Li et al., 2018). And the
43 monophyly of its constituent families are also well supported, e.g., Aulacidae (Jennings and
44 Austin, 2000; Smith, 2001; Turrisi, 2006, 2007, 2014; Turrisi et al., 2009; Turrisi and Madl,
45 2013), Gasteruptiidae (Jennings and Austin, 2002; Macedo, 2009, 2011; Zhao et al., 2012;
46 van Achterberg and Talebi, 2014), Evaniidae (Deans and Huben, 2003; Deans, 2005; Deans et
47 al., 2006; Kawada and Azevedo, 2007; Mullins et al., 2012).

48 Considered as the ‘ancestral’ group of Evanioidea, the Praeaulacidae is an extinct family
49 composed of three subfamilies (Table 1) and characterized by a more complete wing
50 venation, except for some species of the subfamily Cretocleistogastrinae (Rasnitsyn, 1988; Li

51 et al., 2013). The Nevaniinae have been considered a family (Nevaniidae) by Engel et al.
52 (2016), Engel (2017), and Turrisi and Ellenberger (2019), however without any clear
53 justification. Its two constituent genera *Nevania* and *Eonevania* were retrieved nested within
54 the Praeaulacidae in the phylogenetic analysis of the Evanioidea by Li et al. (2018), hence the
55 present treatment of this lineage as a subfamily rather than a family. The Aulacidae comprise
56 extant and fossil species, distributed in two subfamilies Hyptiogastritinae (Engel, 2006, 2017)
57 and Aulacinae (Shuckard, 1841).

58 Fossil Evanioidea are rather common and known from rock imprints and amber inclusions.
59 The latter are especially frequent during the Cretaceous with occurrences in amber from the
60 Barremian of Lebanon (Deans et al., 2004; Basibuyuk et al., 2002), Albian of Spain (Peñalver
61 et al., 2010; Pérez-de la Fuente et al., 2012), Cenomanian of Myanmar (Cockerell, 1917a,
62 1917b; Basibuyuk et al., 2000a; Engel, 2006, 2017; Jennings et al., 2004, 2013; Li et al.,
63 2013, 2015, 2018; Engel and Wang, 2016; Engel et al., 2016; Shih et al., 2019; Turrisi and
64 Ellenberger, 2019) and Russia (Rasnitsyn, 1975), Turonian of the USA (Basibuyuk et al.,
65 2000b; Engel, 2006, 2013), and Santonian of Russia (Rasnitsyn, 1975).

66 Here we focus on the highly fossiliferous Burmese amber from Kachin, northern
67 Myanmar, also called “burmite”. It has been exploited by Chinese jewelry industries since at
68 least two millenia. It is only about a century ago that this amber was studied scientifically for
69 the first time (Cockerell, 1916a, 1916b, 1917a, 1917b, 1920a, 1920b; Burn, 1918). This resin
70 is renowned for its well-preserved and plethoric inclusions of plants, arthropods and other
71 invertebrate and vertebrate organisms. The main source for this material is the site of the
72 “Noije Bum hill”. Recently a strong craze around the study of this amber, linked to an
73 increasing availability of material, has allowed for the description of many new taxa including
74 evanoid wasps (Ross, 2019). We found two new genera and species, that we describe herein
75 in Praeaulacidae and Aulacidae, respectively.

76

77 **2. Material and methods**

78

79 The two amber pieces containing the specimens studied herein derive from the deposits of
80 Noiye Bum in the Hukawng Valley (26° 29' N, 96° 35' E), Kachin State, northern Myanmar
81 (see detailed map in Grimaldi and Ross, 2017: fig. 2). Radiometric data established an Early
82 Cenomanian age (98.79 ± 0.62 Ma) for Kachin amber, based on zircons from volcanic clasts
83 found within the amber-bearing sediments (Shi et al., 2012). Some ammonites found in the
84 amber-bearing bed and within amber corroborates a Late Albian / Early Cenomanian age
85 (Cruickshank and Ko, 2003; Yu et al., 2019).

86 The new praeaulacid specimen is embedded in a piece of dark orange amber with a
87 moss in syninclusion. It is a nearly complete individual but with the gaster torn apart and
88 moved perpendicularly to the body axis, with apical metasomal segment missing. The
89 Aulacidae is nearly complete, missing only the apical flagellomere on both antennae, and is
90 distinctly compressed laterally. It is embedded in a piece of clear yellow amber. Both type
91 specimens are housed in the amber collection of the Geological Department and Museum of
92 the University of Rennes, France (IGR). The specimens were examined with a Leica MZ
93 APO stereomicroscope. Photographs were made using a Zeiss Axio Zoom.V16
94 stereomicroscope and Axiocam 512 digital camera with Zen software allowing for
95 measurements and digital photography. All images are digitally stacked photomicrographic
96 composites of several individual focal planes, which were obtained using HeliconFocus. The
97 figures were composed with Adobe Illustrator and Photoshop softwares. The wing venation
98 terminology follows Li et al. (2015) for the Praeaulacidae and Engel (2017) for the Aulacidae.

99

100 **3. Systematic paleontology**

- 101
- 102 Order Hymenoptera Linnaeus, 1758
- 103 Suborder Apocrita Gerstaecker, 1867
- 104 Superfamily Evanioidea Latreille, 1802
- 105 Family †Praeaulacidae Rasnitsyn, 1972
- 106 Subfamily †Nevaniinae Zhang & Rasnitsyn, 2007
- 107
- 108 Genus *Rasnitsevania* Jouault, Nel & Perrichot, gen. nov.
- 109 urn:lsid:zoobank.org:act:AFE2DEC6-07DA-4C87-A919-DC1F9CE2B9C5
- 110
- 111 Type species: *Rasnitsevania ferox* Jouault, Nel & Perrichot, sp. nov.
- 112
- 113 *Etymology.* The new genus-group name combines a patronym for Prof. Alexandr Rasnitsyn,
- 114 eminent Russian hymenopterist, and the suffix ‘evania’ which is commonly used for evanioid
- 115 genera. Gender feminine.
- 116 *Diagnosis.* Medium-sized (body about 7 mm in length). Antenna 31-segmented. Mesosoma
- 117 longer than high. Mesocoxa much closer to metacoxa than to procoxa. Fore wing with 10
- 118 closed cells; pterostigma narrow basally, gradually widening distally until meeting with 2r-rs
- 119 at 1/3 of pterostigmal length; 1-Rs shorter than 1-M, both veins nearly aligned and slightly
- 120 longer than M+Cu when combined, 1-Rs meeting R just before pterostigma; Rs nearly
- 121 straight beyond 2r-rs; 2r-rs longer than maximal width of cell 2rm; 2m-cu slightly distad of
- 122 2r-m; cu-a interstitial or slightly postfurcal; cell 2cua distinctly longer than wide; 2rm smaller
- 123 than 3rm; 2cua much smaller than 2mcu. Hind wing venation complete with C tubular; cells
- 124 R, Cu and R longer than wide; vein Rs not reaching wing margin. Metasomal petiole bi-

125 segmented; first petiolar segment about half as long as second petiolar segment; remaining
126 metasoma as long or slightly longer than first and second segments combined.

127

128 *Rasnitsevania ferox* Jouault, Nel & Perrichot, sp. nov.

129 urn:lsid:zoobank.org:act:C3719820-1657-4562-8553-0F6F3CF4A47B

130 (Figs. 1–3)

131

132 *Material.* Holotype, sex unknown, accession number IGR.BU-005, preserved in a rectangular
133 piece of amber measuring 13 × 11 × 6 mm.

134 *Locality and horizon.* Noiye Bum Hill, Hukawng Valley, Kachin State, Myanmar; lower
135 Cenomanian, Upper Cretaceous.

136 *Etymology.* The specific epithet derives from the Latin *ferox*, meaning "fierce", in reference to
137 its general fierce aspect.

138 *Diagnosis.* As for the genus.

139 *Description.* Head large (Figs. 1, 2A, 2B and 3A), about as wide as long; posterior margin
140 developed. Eyes wide, elongate ovoid; three ocelli visible on the third part of the head
141 between eyes. Antenna inserted far above mandibles (at level of mid-length of eyes), almost
142 as long as head and mesosoma combined, with 31 antennomeres. In frontal view, scape nearly
143 as broad as long (in width and maximal length), trapezoidal (thinner at the base and larger at
144 the top); pedicel narrower than scape distally, and about as long as wide; first flagellomere
145 cylindrical, as wide as pedicel, and as long as scape; following flagellomeres progressively
146 decreasing in length, longer than broad or at most as long as broad. Mandibles stout, with four
147 sharp teeth; apical tooth longest. Palp formula at least 5-4.

148 Mesosoma stout (Figs. 1, 2A and 2C). Pronotum comparatively short, anterior margin
149 developed. Mesonotum with notauli distinct. Mesopleuron slightly convex. Propodeum

150 rounded dorsally and laterally. Fore leg thin and short. Mid-leg shorter than fore leg.
151 Metacoxa longer than mesocoxa; metatrochanter nearly as long as metacoxa; metafemur
152 elongate, slightly swollen medially; metatibia thin, about as long as metafemur; combined
153 length of metatarsomeres about 2/3 length of metatibia. Tibial spur formula ?1/2/2; one of the
154 hind tibial spurs longer than the other.

155 Fore wing (Figs. 2C and 3B) well-preserved but partly folded; veins C, R, M+Cu and A
156 present, with M+Cu fork closer to wing base than to pterostigma; Rs and M reaching wing
157 margin; 1rm elongate, as long as combined lengths of 1cua and 2cua; 1-M 1.5 times as long
158 as 1RS; 1Rs and 1-M nearly straight and aligned; 2cua broader than 1cua but nearly twice as
159 short; M+Cu and 1Cu aligned; 2mcu slightly longer than wide; 2-Cu curved; 2r-rs oblique,
160 meeting pterostigma in its basal third, and three times as long as pterostigmal width; 2cua 0.8
161 times shorter than 2mcu; 3r long and 1.6-1.7 times as long as 1+2r; 2rm and 1mcu in contact;
162 2rm 2.7 times shorter than 1+2r and 4.5 times shorter than 3r; 2rm 0.7 times shorter than 3rm;
163 3r-m slightly longer than 2r-m; cu-a slightly postfurcal and nearly straight. Hind wing (Fig.
164 3B) well-preserved but hidden under fore wing, with clear and discernible venation. Veins C,
165 R, M+Cu and A present, Rs not reaching wing margin; r-m 0.6 times as short as first abscissa
166 of Rs; first abscissa of M sub-equal to r-m; Cu and cu-a veins meeting into a ghost vein; cells
167 R, Rs and A opened.

168 Metasoma. First and second metasomal segments trapezoid in dorsal view, their maximal
169 width subequal (Fig. 2C); first segment nearly twice as long as broad; second segment about
170 twice as long as first segment; remaining preserved segments (3 to 6) only slightly longer than
171 first and second segments combined; tergite 3 slightly longer than tergite 2, following tergites
172 progressively decreasing in length; tergite 7 torn apart, incomplete; metasomal apex missing.

173 Measurements (in mm): head width 1.8-2.0; head length 1.6 (without mandibles); antennal
174 length (as preserved) 6.5-7; mesosomal length from pronotal margin to petiolar insertion 2.7;

175 fore wing length 4.6, width (as preserved) 1.6; length of first and second metasomal segments
176 0.6 and 1.2, combined length of remaining segments (3 to 6) 2.0.

177

178 *Remarks.* *Rasnitsevania* gen. nov. is assigned to the Praeaulacidae based on the hind wing
179 venation with Rs, r-m and cu-a present (only R, M+Cu and A are present in other Evanioidea,
180 except in the Othniodellithidae) and the numerous antennomeres (31 versus at most 26
181 antennomeres in other Evanioidea). It is excluded from Othniodellithidae for the absence of
182 cephalic horn and the distinct fore wing venation (Engel et al., 2016; Engel, 2017).

183 Within the Praeaulacidae, *Rasnitsevania* gen. nov. has the characteristics of Nevaniinae as
184 defined by Zhang and Rasnitsyn (2007), viz. a two-segmented petiole and the vein M+Cu
185 shorter than 1-Rs & 1-M combined. *Rasnitsevania* gen. nov. can be easily distinguished from
186 the two other nevaniine genera by the first petiolar segment that is twice as short as the
187 second segment (both segments are subequal in *Nevania* and *Eonevania*). *Rasnitsevania* gen.
188 nov. also differs from *Nevania* by its petiole trapezoidal rather than tube-like; its fore wing
189 cell 2rm more than twice as short as 3rm (vs. 2rm as long as or longer than 3rm); its vein 2r-m
190 about twice as short as 3r-m (vs. slightly shorter); its vein 2r-rs sub-equal to 1-Rs (vs. 2r-rs
191 shorter than 1-Rs); its vein 2-Rs shorter than Rs+M (vs. sub-equal); its cell 1m-cu separated
192 from 2rm by a conspicuous vein 2-M (absent in *Nevania*); and its hind wing with vein 1-Cu
193 present (vs. absent).

194 *Rasnitsevania* gen. nov. additionally differs from *Eonevania* by its fore wing with cell 2rm
195 more than twice as short as 3rm (vs. 2rm slightly shorter than 3rm), the vein 3r-m oblique and
196 straight (vs. vertical and curved medially), the vein 2r-rs branching out before the mid-length
197 of pterostigma (vs. at mid-length of pterostigma); and the vein 2A absent (vs. present and
198 complete).

199

200 Key to the genera of Nevaniinae:

201 1. First petiolar segment sub-equal or slightly shorter than second petiolar segment; fore
202 wing cell 2rm slightly shorter, sub-equal or longer than 3rm 2

203 – First petiolar segment twice as short as second petiolar segment; fore wing cell 2rm twice
204 as short as 3rm *Rasnitsevania* gen. nov.

205 2. Petiolar segment tubular; fore wing cell 2rm as long as or longer than 3rm

206 *Nevania* Zhang & Rasnitsyn, 2007

207 – Petiolar segment trapezoidal; fore wing cell 2rm slightly shorter than 3rm

208 *Eonevania* Rasnitsyn & Zhang, 2010

209

210 Family Aulacidae Shuckard, 1841

211 Subfamily Aulacinae Shuckard, 1841

212 Tribe Electrofoenini Cockerell, 1917

213

214 Genus *Electrofoenia* Jouault, Nel & Perrichot, gen. nov.

215 urn:lsid:zoobank.org:act:6B8A8F04-FA68-43DC-8EC7-60CCB9E0FB9A

216

217 Type species: *Electrofoenia jehani* Jouault, Nel & Perrichot, sp. nov.

218

219 *Etymology.* The new genus-group name is a combination of the Greek word *elektron*
220 (meaning, ‘amber’) and the suffix ‘foenia’, which is commonly used for the aulacid genera.

221 Gender feminine.

222 *Diagnosis.* The new genus differs from other electrofoenine genera in the pronotum
223 transversely striate; the fore wing with vein 1Rs less than twice as long as 2Rs; 1M and 1m-cu
224 nearly half as long as 1Rs; and 2Rs+M short, not surpassing base of pterostigma.

225

226 *Electrofoenia jehani* Jouault, Nel & Perrichot, sp. nov.

227 urn:lsid:zoobank.org:act:566B2187-B68B-4D1C-B5D5-75B9B0C8FF0C

228 (Fig. 4)

229

230 *Material.* Holotype male, accession number IGR.BU-006; preserved in a rounded piece of
231 amber measuring 10.5×2 mm.

232 *Locality and horizon.* Noiye Bum Hill, Hukawng Valley, Kachin State, Myanmar; lower
233 Cenomanian, Upper Cretaceous.

234 *Etymology.* The specific epithet is a patronym honoring Fabrice Jehan, a former biology
235 teacher of one of us (JC).

236 *Diagnosis.* As for the genus.

237 *Description.* Head apparently longer than wide (but evidently distorted in full-face view);
238 occipital carina complete; malar space narrow, shorter than basal mandibular width;
239 compound eye large, prominent, slightly ovoid, without circum-ocular carina, inner margins
240 parallel; ocelli forming a small triangle (but distorted by preservation) positioned on top of
241 vertex above dorsal margin of compound eyes. Antennal toruli broadly separated, situated
242 near base of clypeus and at lower tangent of compound eyes; scape robust, longer than
243 pedicel, longer than or sub-equal to first flagellomere; flagellum filiform, with 10 preserved
244 flagellomeres all longer than wide except flagellomere 10 which is slightly longer than first
245 one. Clypeus short; mandibles projecting, bidentate, apical tooth longest; outer margin of
246 mandibles arched inward in apical half.

247 Mesosoma longer than high; pronotum distinctly striate transversely (Fig. 4A), without
248 defined, raised posterior dorsal surface bordering mesoscutum, with posterior border broadly
249 concave, lateral surfaces large; mesoscutum with prominent carina along anterior border;

250 mesopleuron short. Legs long, with slender podites; tibial spur formula 1-2-2;
251 protrochantellus distinct but fused to associated femora; metatrochantellus present but
252 somewhat indistinct; metabasitarsus elongate and longer than combined lengths of remaining
253 tarsomeres; pretarsal claws small, simple; arolium minute.

254 Fore wing (Fig. 4B) with costal space slightly narrower than pterostigma; pterostigma
255 longer than wide, broadest after midlength, tapering gradually to apex; r-rs originating slightly
256 distad of pterostigmal midlength; veins 1M and 1m-cu relatively long, about half as long as
257 1Rs; 1Rs+M nearly twice as long as 2Rs+M; 2Rs arched apically; rs-m phantom-like; cell
258 1Rs longer than 1R1; 1m-cu subequal to 1M; 2m-cu meeting 1Rs slightly apical to mid length
259 (vein 2M longer than 3M); cell 1Cu basad M+Cu fork, thus short 2M+Cu present prior to
260 bifurcation of veins 1M and 1Cu. Hind wing with C+R the only visible vein.

261 Metasoma elongate in profile, cylindrical, longer than mesosoma; first metasomal segment
262 (petiole) cone shaped, short; following segments not easily distinguishable from each other by
263 preservation. Parameres directed ventrally, keel-shaped, about as high as apical metasomal
264 segment. Aedeagus partly exposed, with acute tip.

265 Measurements (in mm). Total length as preserved (excluding antennae) 3.4; head length
266 (excl. mandibles) 0.8; compound eye 0.4 long, 0.2 wide; mesosomal length 1.0, maximum
267 height 0.5-0.6; dorsal length of propodeum (between metanotum and petiolar insertion) 0.3;
268 metasomal length 2.1; metafemur length 1.1, metatibial length 0.9; metabasitarsus length 0.5,
269 lengths of remaining tarsomeres (from base to apex), 0.15 / 0.1 / 0.05 / 0.05; fore wing length
270 3.0.

271
272 *Remarks.* *Electrofoenia* gen. nov. is assigned to the Aulacidae based on the elbowed
273 antennae with 10 flagellomeres (antennae filiform in Baissidae, with more than 20
274 flagellomeres in Praeaulacidae, 18-19 flagellomeres in Othniodellithidae, and at least 16

275 flagellomeres in Anomopterillidae). It also differs from Othniodellithidae by the absence of
 276 cephalic horn and the shorter scape; and from Baissidae by its propleuron extending forward
 277 to form a pronounced ‘neck’ (neck absent in Baissidae). Within Aulacidae, the new genus
 278 differs from the Hyptiogastritinae by a more complete fore wing venation with the veins rs-m
 279 and 2m-cu present. The complete occipital carina, mandibles elongate and projected forward,
 280 wing venation, and pretarsal claws minute and simple are typical of the Aulacinae:
 281 Electrofoenini (Engel, 2017). Within this tribe, *Electrofoenia* gen. nov. differs from
 282 *Exilaulacus* (tentatively placed in Electrofoenini by Turrisi and Ellenberger, 2019) and
 283 *Electrofoenus* in the pronotum striate, the more tubular gaster, and the fore wing with 2M+Cu
 284 present, 1M about half as long as 1Rs, 2Rs+M distinctly shorter, and 2Rs more than twice as
 285 long as 1Rs (thus second submarginal cell distinctly larger; refer to Cockerell, 1917c; Li et al.,
 286 2018). It is more similar to *Electrofoenops* in the presence of vein 2M+Cu and 2m-cu meeting
 287 second submarginal cell after midlength. But *Electrofoenia jehani* differs from
 288 *Electrofoenops* in the fore wing vein 2Rs more than twice as long as 1Rs (vs. sub-equal);
 289 2Rs+M short (vs. long); pronotum transversely striate; and mandibles bidentate (vs. pronotum
 290 apparently smooth and mandibles tridentate; see Engel, 2017).

291

292 Key to the genera of Electrofoenini (modified from Engel, 2017):

- 293 1. Fore wing with lcu-a basad M-Cu split, thus short 2M+Cu present; 2m-cu meeting
 294 second submarginal cell after midlength 2
 295 – Fore wing with lcu-a confluent with M-Cu, thus 2M+Cu absent 3
 296 2. Fore wing vein 1Rs as long as 2Rs; vein 2Rs+M long; mandible tridentate; pronotum
 297 smooth *Electrofoenops* Engel

298 – Fore wing vein 1Rs twice as short as 2Rs; vein 2Rs+M short; mandible bidentate;
 299 pronotum transversely striate *Electrofoenia* gen.
 300 nov.

301 3. 2m-cu meeting second submarginal cell before midlength; mandible stout, projecting
 302 *Electrofoenus* Cockerell

303 – 2m-cu meeting second submarginal cell after midlength; mandible relatively short
 304 *Exilaulacus* Li, Shih & Ren

305

306 4. Discussion

307

308 The new genera and species described herein extend the fossil record of Praeaulacidae and
 309 Aulacidae, which now comprise 65 species in 20 genera (all extinct, see Table 1) and 22 fossil
 310 species in 12 genera, respectively (see Turrisi and Ellenberger, 2019: Appendix A). The
 311 Praeaulacidae were known only from Jurassic and Cretaceous compression fossils until
 312 recently, but remarkably the latest findings in Burmese amber have revealed the first and only
 313 Cretaceous record of the Nevaniinae and Praeaulacinae. Aulacidae are more widespread and
 314 known by extant, Cenozoic and Mesozoic species. In the Aulacinae, only the tribe
 315 Electrofoenini is known from Burmese amber, now with three genera and five species.

316 The mid-Cretaceous Burmese amber shows a rich and unique diversity of Evanioidea, with
 317 mostly genera that have not been found in any other fossil deposit. The absence of shared
 318 genera with other Cretaceous amber deposits is particularly intriguing, and contrasts with
 319 Cenozoic records. For example, *Pristaulacus* shows a wide distribution during the Eocene
 320 with fossils from Baltic amber and the USA (Brues, 1910, 1923, 1933; Cockerell, 1916a;
 321 Jennings and Krogmann, 2009); and *Aulacus* species have been recorded in amber from
 322 France and Baltic area during the Eocene (Brues, 1933; Nel et al., 2004). Unlike these genera,

323 the Burmese amber aulacids seem to have a local distribution, either due to the lack of
324 information in the fossil record or an endemism related to the island situation of the Burma
325 Terrane during the mid-Cretaceous (Rasnitsyn and Öhm-Kühnle, 2018; Westerweel et al.,
326 2019). Similarly, the praeaulacid genera from Burmese amber are unique, hitherto known
327 only from this deposit.

328 The Cretaceous record of evanioids is comparatively similar to that of the Ichneumonoidea
329 (100 species each according to www.fossilworks.org). The latter are much more diverse today,
330 suggesting a shift in the evanioids and ichneumonoids between the mid-Cretaceous and the
331 Cenozoic.

332

333 **5. Conclusions**

334

335 The numerous studies on Burmese amber during the last twenty years have dramatically
336 increased our knowledge on the mid-Cretaceous entomofauna. The Evanioidea do not escape
337 this general tendency, with a significant amount of specimens of this superfamily (Zhang et
338 al., 2018; Ross, 2019; Turrisi and Ellenberger, 2019). The two newly described genera
339 emphasize the tremendous evanioid diversity that occurred during the Cretaceous. It is likely
340 that this will be complemented by further discoveries in well known or recently found amber
341 deposits of Cretaceous or even Cenozoic age (e.g., Ethiopia, Congo, China, India), providing
342 essential paleobiogeographical elements for the evolutionary history of the group.

343

344 **Acknowledgements**

345

346 We are grateful to Prof. Bo Wang for access to the imaging facilities at the Nanjing
347 Institute of Geology and Palaeontology (NIGPAS, China); and to the editor (Dr. Eduardo

348 Koutsoukos) and the reviewers (Prof. Alexandr Rasnitsyn and Dr. Giuseppe Turrisi) for
349 insightful comments on the manuscript.

350

351 **References**

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612 **Table 1.** Diversity and distribution of the family Praeaulacidae.

613

614 **Figures captions**

615

616 **Fig. 1.** *Rasnitsevania ferox* gen. et sp. nov., holotype IGR.BU-005. A, Habitus in ventral
617 view. B, Habitus in dorsal view. Scale bars: 1 mm.

618 **Fig. 2.** *Rasnitsevania ferox* gen. et sp. nov., holotype IGR.BU-005. A, Details of petiole and
619 wings in dorsal view. B, Head in full face view. Scale bars: 0.5 mm.

620 **Fig. 3.** Line drawings of *Rasnitsevania ferox* gen. et sp. nov., holotype IGR.BU-005. A, Head
621 in full face view. B, Fore and hind wings with nomenclature of cells (in bold) and veins. Scale
622 bars: 1 mm.

623 **Fig. 4.** *Electrofoenia jehani* gen. et sp. nov., male, holotype IGR.BU-006. A, Habitus in left
624 lateral view. B, Line drawing of fore wing with nomenclature of cells (in bold) and veins.
625 Scale bars: 0.5 mm (A), 1 mm (B).

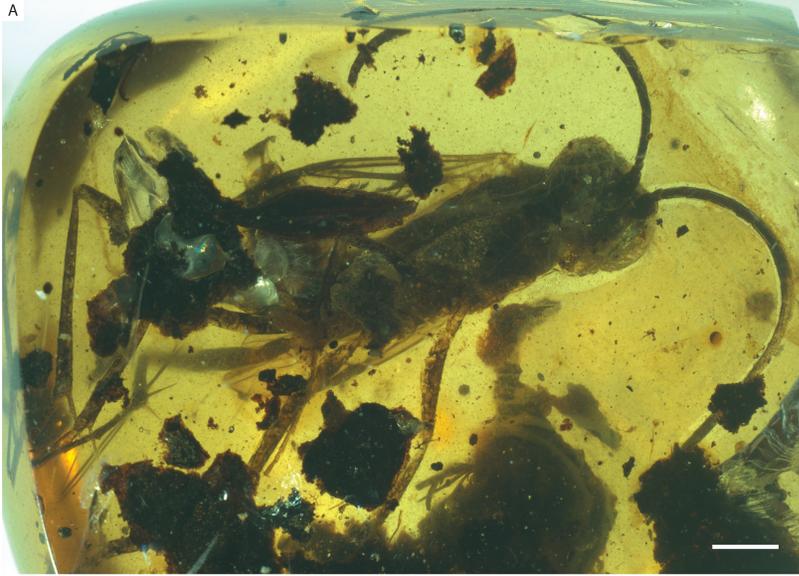
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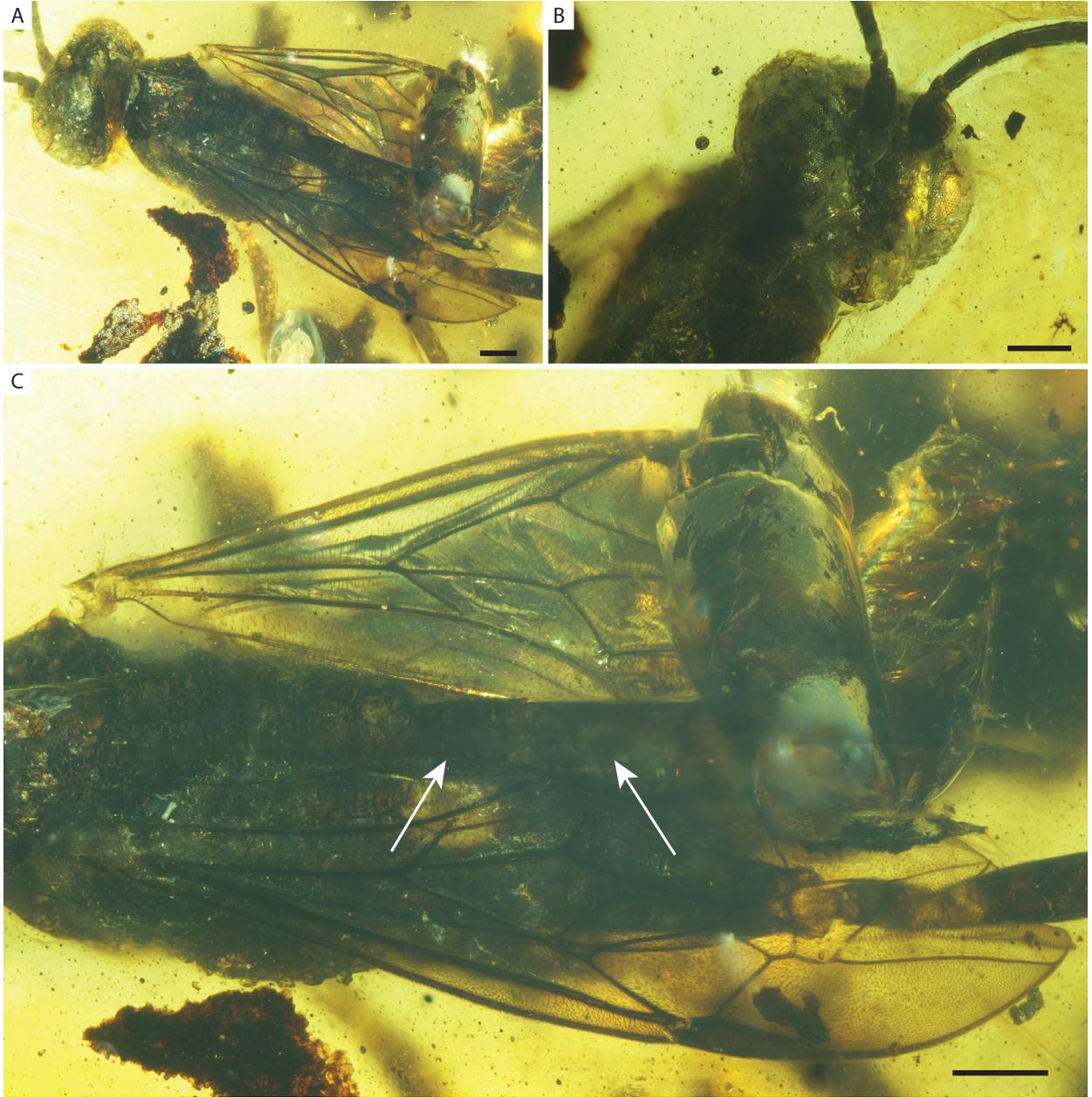
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| Subfamilies / Genera | Species | Distribution | Age | References |
|---|---------|--------------|-----------------|--|
| Praeaulacinae | | | | |
| <i>Archaulacus</i> Li, Shih & Ren | 1 | China | Middle Jurassic | Li et al., 2014a |
| <i>Aulacogastrinus</i> Rasnitsyn | 1 | Kazakhstan | Late Jurassic | Rasnitsyn, 1972, 1983 |
| | 3 | China | Middle Jurassic | Zhang and Rasnitsyn, 2008 |
| <i>Eosaulacus</i> Zhang & Rasnitsyn | 1 | China | Middle Jurassic | Zhang and Rasnitsyn, 2008 |
| <i>Evanigaster</i> Rasnitsyn | 1 | Kazakhstan | Late Jurassic | Rasnitsyn, 1972 |
| <i>Evaniops</i> Rasnitsyn | 1 | Kazakhstan | Late Jurassic | Rasnitsyn, 1972 |
| <i>Gulgonga</i> Oberprieler, Rasnitsyn & Brothers | 1 | Australia | Late Jurassic | Oberprieler et al., 2012 |
| <i>Habraulacus</i> Li, Rasnitsyn, Shih & Ren | 1 | Myanmar | Late Cretaceous | Li et al., 2015 |
| <i>Praeaulacinus</i> Rasnitsyn | 3 | Kazakhstan | Late Jurassic | Rasnitsyn, 1972, 1973 |
| <i>Praeaulacites</i> Rasnitsyn | 5 | Kazakhstan | Late Jurassic | Rasnitsyn, 1972 |
| <i>Praeaulacon</i> Rasnitsyn | 4 | Kazakhstan | Late Jurassic | Rasnitsyn, 1972 |
| <i>Praeaulacops</i> Rasnitsyn | 1 | Kazakhstan | Late Jurassic | Rasnitsyn, 1972 |
| <i>Praeaulacus</i> Rasnitsyn | 6 | Kazakhstan | Late Jurassic | Rasnitsyn, 1972 |
| | 2 | Mongolia | Late Jurassic | Rasnitsyn, 2008 |
| | 9 | China | Middle Jurassic | Zhang and Rasnitsyn, 2008; Li et al., 2014a, 2018; Li and Shih, 2015 |
| Nevaniinae | | | | |
| <i>Eonevania</i> Rasnitsyn & Zhang | 1 | China | Middle Jurassic | Rasnitsyn and Zhang, 2010 |
| <i>Nevania</i> Zhang & Rasnitsyn | 8 | China | Middle Jurassic | Zhang and Rasnitsyn, 2007; Li et al., 2014b |
| | 1 | Kazakhstan | Late Jurassic | Zhang and Rasnitsyn, 2008 |
| <i>Rasnitsevania</i> Jouault, Nel & Perrichot | 1 | Myanmar | Late Cretaceous | This study |
| Cretoleistogastrinae | | | | |
| <i>Cretoleistogaster</i> Rasnitsyn | 3 | Russia | Late Cretaceous | Rasnitsyn, 1975 |
| <i>Miniwestratia</i> Rasnitsyn | 1 | Mongolia | Late Cretaceous | Rasnitsyn, 1990a |
| <i>Nanowestratia</i> Rasnitsyn | 1 | Russia | Late Cretaceous | Rasnitsyn, 1990a |
| <i>Sinowestratia</i> Zhang & Zheng | 1 | China | Late Cretaceous | Zhang & Zheng, 2000 |
| <i>Westratia</i> Rasnitsyn | 3 | Russia | Late Cretaceous | Rasnitsyn, 1990a, 1990b |
| | 4 | Mongolia | Late Cretaceous | Rasnitsyn, 1990a |
| | 1 | Australia | Late Cretaceous | Jell & Duncan, 1986 |

Table 1. Diversity and distribution of the family Praeaulacidae.

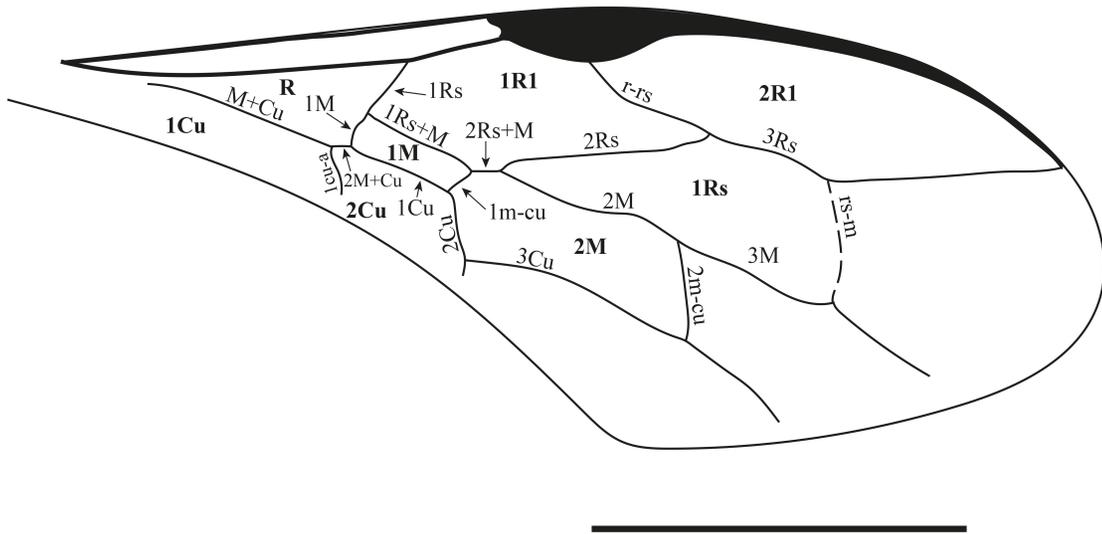




A



B



Author statement

Corentin Jouault, Vincent Perrichot: Conceptualization; **Corentin Jouault, André Nel, Vincent Perrichot:** Data curation, Writing-Original draft preparation. **Corentin Jouault, Vincent Perrichot:** Investigation. **Corentin Jouault, André Nel, Vincent Perrichot:** Writing- Reviewing and Editing.

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Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

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