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► **To cite this version:**

Jean-Marc Pouillon, André Nel. Revision of the Early Cretaceous mydid *Cretomydas santanensis* (Diptera: Mydidae). *Cretaceous Research*, 2020, 10.1016/j.cretres.2020.104604 . hal-03019294

**HAL Id: hal-03019294**

**<https://hal.sorbonne-universite.fr/hal-03019294v1>**

Submitted on 23 Nov 2020

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1 Revision of the Early Cretaceous mydid *Cretomydas santanensis* (Diptera: Mydidae)

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12 ABSTRACT

13 The Early Cretaceous mydid genus and species *Cretomydas santanensis* is revised on the basis  
14 of a new specimen, allowing to precise its relationships within the ‘advanced Mydidae’,  
15 probably close to the subfamily Diochlistinae. This extant group has a ‘Gondwanan’  
16 distribution, known from Southern South America and Australia, in accordance with its possible  
17 great antiquity in the Early Cretaceous. The presence of an ‘advanced Mydidae’ during the  
18 Cretaceous also suggests a greater antiquity for this family.

19

20 *Keywords:*

21 Insecta; Diptera; paleobiogeography; revision; dating.

22

## 23 **1. Introduction**

24 The Mydidae is a relatively small family of flies, with about 471 extant species in 63 genera.

25 Their fossil record is limited to date to two taxa, *Cretomydas santanensis* Willkommen &

26 Grimaldi, 2007 (Lower Cretaceous, Brazil) and *Mydas miocenicus* Cockerell, 1913 (Lower  
27 Oligocene, USA). The type specimen (UCM IP 8556, University of Colorado Museum of  
28 Paleontology) of *M. miocenicus* is an incomplete wing, currently in a poor state of preservation  
29 (see photograph in the internet site [https://www.idigpaleo.org/Detail/objects/9b5a8677-090f-  
30 11e3-af8d-50faf7e7a06b](https://www.idigpaleo.org/Detail/objects/9b5a8677-090f-11e3-af8d-50faf7e7a06b)), on which the main structures are hardly visible. Therefore  
31 *Cretomydas santanensis* is quite important for dating the Mydidae (Winterton & Ware, 2015).  
32 If it is based on a much more complete fossil than for *M. miocenicus*, with body and wings  
33 preserved, its original description lacks some information that could be important for its  
34 placement in the Mydidae. Here we describe a new specimen, allowing to complete our  
35 knowledge on this taxon.

36

## 37 **2. Material and methods**

38 The fossil was photographed with a CanonG12 Powershot. The holotype is deposited in the  
39 amber collection of the Musée d'Histoire Naturelle et d'Ethnographie de Colmar (MHNEC),  
40 France under collection number MHNE.2020.8.1. We follow the wing venation nomenclature  
41 of Dikow (2017: fig. 47.16-19).

42 urn:lsid:zoobank.org:pub:B1960AA4-947D-4AC6-A393-BA289E912461

43

## 44 **3. Systematic palaeontology**

45 Order: Diptera

46 Family Mydidae

47 Genus *Cretomydas* Willkommen & Grimaldi, 2007

48 Type species

49 *Cretomydas santanensis* Willkommen & Grimaldi, 2007

50 *Revised diagnosis*

51 Scape and first flagellomere short; hind tibia with a long longitudinal carina; hind basitarsomere  
52 slightly less than five times longer than its width; R4 ending at apex of R1(+R2+3); R5 ending  
53 on anterior wing margin; M1 and M2 well-separated, ending on anterior wing margin before  
54 wing apex; vein A1 strongly marked, ending on posterior wing margin (putative  
55 autapomorphy).

56

57 *Cretomydas santanensis* Willkommen & Grimaldi, 2007

58 (Fig. 1)

59 *New material*

60 Plesiotype MHNE.2020.7.1 (JMP.4147, Coll. Jean-Marc Pouillon); repository Musée  
61 d'Histoire Naturelle et d'Ethnographie de Colmar, France.

62 *Locality and horizon*

63 Crato Formation (Araripe Group), upper Aptian (122.5 – 112.6 Ma); Ceará, Brazil.

64 *Description*

65 A nearly complete fly, with wings, thorax, abdomen and a hind leg well-preserved; only head  
66 incomplete, partly hidden in rock; thorax 5.4 mm long, 4.5 mm wide; no insertion of bristles on  
67 scutellum; abdomen 9.1 mm long, 4.5 mm wide; hind tibia with a long longitudinal carina; wing  
68 clearly corrugate, 13.0 mm long, 4.3 mm wide; dc cell 4.1 mm long, 0.8 mm wide; cell between  
69 R1 and R2+3 7.7 mm long, 0.6 mm wide; R4 and R5 parallel, curved; R4 ending at apex of  
70 R1(+R2+3); R5 ending on anterior wing margin; M1 and M2 well-separated; M1 emerging  
71 from cell d while M2 emerging from cell m3, parallel and curved ending on anterior wing  
72 margin before wing apex; M3 nearly straight; R4 curved; a short veinlet between it and posterior  
73 wing margin near apex of cell m3, not aligned with M1+2; r-m near apex of cell d, with vein  
74 M1+2 making a strong curve before r-m; cell cua close, near wing margin; vein A1 concave,  
75 strongly marked and reaching posterior wing margin.

76

#### 77 4. Discussion

78 This fossil has the same wing venation and the same proportions in the main cells as the type  
79 of *Cretomydas santanensis*. It has just slightly shorter wings (13 mm long and 4.3 mm wide in  
80 our fossil while 14 mm long and 4.6 mm wide in holotype; dc cell 4.1 mm long, 0.8 mm wide  
81 for our fossil instead of 4.1 mm long, 0.8 mm wide in holotype; cell between R1 and R2+3 7.7  
82 mm long, 0.6 mm wide in our fossil while 9.0 mm long, 0.6 mm wide in holotype). Thus, we  
83 can consider that they correspond to the same species, although different extant species in the  
84 same genus of Mydidae can have very similar venations (see *Eumylas itapibura* and *Eumylas*  
85 *wilcoxi* in Almeida et al., 2014: fig. 4B–C). The venation of the plesiotype is better preserved  
86 than that of the holotype, especially in the cubito-anal area. It allows to precise the relationships  
87 of *Cretomydas*.

88 Willkommen & Grimaldi (2007: 381) attributed *Cretomydas* to the Mydidae on the basis  
89 of the following characters: ‘two-segmented antennal flagellum’; ‘veins R5, M1 and M2 join  
90 the wing margin before the wing tip’; ‘crossvein r-m is located at middle of the discal cell or  
91 close to the apex of discal cell’; ‘cell m3 closed’. Four families of flies have wing venation  
92 similar to that of *Cretomydas*, with veins appearing ‘tangled’, with branches of the medial vein  
93 curved forward and convergent with radial branches before apex, viz. the Nemestrinidae,  
94 Mydidae, Apioceridae, and the Mesozoic family Protapioceridae.

95 Willkommen & Grimaldi (2007) precised that the ‘first flagellomere long and slender,  
96 three times longer than wide; second flagellomere club-shaped’ for *Cretomydas*. The extant  
97 Mydidae have longer first and second flagellomeres, and the Apioceridae has a rather short  
98 second flagellomere, as in *Cretomydas*. Thus we need to discuss more precisely on the affinities  
99 of *Cretomydas*.

100 Affinities with the Nemestrinidae are excluded because these flies have a composite  
101 diagonal vein ‘diag vn’ straight from the discal cell to the outer wing margin, which is not the  
102 case in *Cretomydas*. The Apioceridae are also excluded because the discal cell and the cell m3  
103 are narrow in *Cretomydas*. The Protapioceridae have also a discal cell broader and shorter than  
104 in *Cretomydas* (Ren, 1998; Zhang et al., 2007; Zhang, 2015). Nevertheless, *Cretomydas* shares  
105 with these last two families the presence of two separated branches M1 and M2, while the  
106 majority of Mydidae have a vein M1+2. The character M1 and M2 separated is currently  
107 considered as a plesiomorphy in Apioceridae and Mydidae (Artigas & Papavero, 1990; Yeates  
108 & Irwin, 1996). Few extant Mydidae have their two veins M1 and M2 separated, viz. the three  
109 genera *Triclonus* Gerstaecker, 1868, *Diochlistus* Gerstaecker, 1868 (both Australia), and  
110 *Mitrodetus* Gerstaecker, 1868 (Argentina and Chile) which Artigas & Papavero (1990)  
111 considered as a subfamily Diochlistinae, plus *Rhaphiomidas* Osten Sacken, 1877. Notice that  
112 Hardy (1942: 201) considered *Triclonus* as a junior synonym of *Diochlistus* without clear  
113 argument, but he was not followed by Artigas & Papavero (1990) who separated the two genera.  
114 In the ‘Mydidae species catalog’ (<https://asiloidflies.si.edu/species-catalog-mydidae>), the two  
115 genera are also synonymized.

116 Yeates & Irwin (1996) made the unique phylogenetic analysis of the Mydidae on the  
117 basis of morphological character and proposed a series of synapomorphies of the Mydidae, the  
118 majority of which are not discernable in *Cretomydas*. But the new specimen of *Cretomydas* has  
119 no insertion of bristles on the scutellum, as in the extant Mydidae, unlike the Apioceridae,  
120 confirming its attribution to the Mydidae. Notice that Dikow et al. (2017) confirmed the sister  
121 group relationships between Apioceridae and Mydidae proposed by Yeates & Irwin (1996),  
122 supporting the polarizations of the characters proposed by these last authors.

123 Within the Mydidae, the wing venation of *Cretomydas* is very similar to those of the  
124 Diochlistinae and *Rhaphiomidas*, especially in the shape of the discal and m3 cells, and that of

125 crossveins at apex of discal cell and cell m3. The main differences with these genera are in the  
126 organization of the distal parts of veins R4, R5, M1, and M2.

127 Ovtshinnikova (2003) confirmed the transfer of the genus *Rhaphiomidas* from the  
128 Apioceridae into the Mydidae, as proposed by Yeates & Irwin (1996) who reinstated the  
129 subfamily Rhaphiomidinae for this genus. These last authors indicated that the vein R4 is  
130 ending into R1(+R2+3) at wing margin of before it in a clade that comprises the ‘advanced  
131 Mydidae’ (incl. *Diochlistus*) + Megascelinae, unlike *Rhaphiomidas*. In *Rhaphiomidas*, R4 is  
132 ending in the wing margin (Cazier, 1941; Van Dam, 2010).

133 Artigas & Papavero (1990) proposed a phylogenetic analysis of the Diochlistinae, based  
134 on an ‘a priori’ polarization of the characters, thus without real outgroup. They found  
135 *Mitrodetus* as sister group of (*Triclonus* + *Diochlistus*). The new specimen of *Cretomydas*  
136 shares the putative synapomorphy of a carinate hind tibia with the later subclade, character not  
137 indicated by Willkommen & Grimaldi (2007). Nevertheless, this character is also present in  
138 some other ‘advanced Mydidae’, viz. the two genera *Paramydas* Carrera & d’Andretta, 1948  
139 and *Apiophora* Philippi, 1865 (Artigas & Palma, 1979). Yeates & Irwin (1996) also considered  
140 this character state as an apomorphy of a clade (*Diochlistus* + (*Apiophora* & *Mydas* & *Ectypus*)).  
141 Thus *Cretomydas* would rather fall in the ‘advanced Mydidae’ than close to *Rhaphiomidas*, and  
142 (because of the venation) in the Diochlistinae. Notice that Yeates & Irwin (1996) did not include  
143 *Mitrodetus* in their analysis. Thus the monophyly of the Diochlistinae needs to be confirmed.

144 In *Mitrodetus*, M2 ends well above wing apex, while in *Cretomydas*, it ends slightly  
145 above it; and R4 is fused to R5 apically and R4+5 is ending into R1(+R2+3), while they are  
146 well-separated in *Cretomydas* (Artigas & Palma, 1979; Artigas & Papavero, 1990).  
147 Nevertheless, Paramonov (1950: 8) noticed that in *Triclonus*, the ‘apices of R4 and R5 can be  
148 either confluent or separated’. Thus this difference of *Triclonus* with *Mitrodetus* is quite weak.

149 Also Séguy (1928, 1930) indicated that these two genera have the character of distal fusion of  
150 R4 and R5.

151 In *Cretomydas*, R4 is ending into R1+(R2+3) and R5 is ending in the wing apex, while,  
152 in *Triclonus* and *Diochlistus*, R4 and R5 are ending independently into R1(+R2+3), after the  
153 key to Diochlistinae of Artigas and Papavero (1990). Séguy (1928: 133, fig. 11) also indicated  
154 that the two veins M1 and M2 end near wing apex in *Diochlistus* as in *Cretomydas*, while in  
155 *Triclonus*, M1 ends into R1(+R2+3).

156 Willkommen & Grimaldi (2007: 381) proposed the following diagnosis for *Cretomydas*:  
157 (1) ‘both scape and first flagellomere short’; (2) ‘wing venation resembling that of the Recent  
158 genus *Rhaphiomidas*’; (3) ‘end of vein M2 free’; (4) ‘crossvein r-m located close to apex of  
159 discal cell’; (5) ‘hind basitarsomere is slightly less than five times longer than it is wide’.  
160 Character (1) is unclear as the relative lengths of the antennomeres are not precised, after the  
161 photograph of the type specimen it seems that the scape and first flagellomere are relatively  
162 short too in *Rhaphiomidas*. Character (2) is clearly too vague because the venation of the  
163 Diochlistinae resembles that of *Rhaphiomidas*. Character (3) is present in *Rhaphiomidas* and  
164 all Diochlistinae, and cannot separate *Cretomydas* from these genera. Character (4) is present  
165 in many Mydidae. Concerning character (5), while in the *Rhaphiomidas* spp., the hind  
166 basitarsomeres are nearly 8-10 times as long as wide; the proportions width/length are nearly  
167 the same in *Diochlistus tenebrosus* and *Cretomydas* (see internet site  
168 <https://www.flickr.com/photos/insectcollection/4217468792/>). As a result, there is still no very  
169 clear autapomorphy to define *Cretomydas*.

170 One further difference between *Cretomydas* and the Diochlistinae & *Rhaphiomidas* is  
171 the presence of a very long and well-marked vein A1 ending on posterior wing margin in  
172 *Cretomydas*, while it is reduced and distally vanishing in *Rhaphiomidas*, *Mitrodetus* and  
173 *Diochlistus*, and absent in *Triclonus* (Artigas & Palma, 1979; Artigas & Papavero, 1990;



174 Rogers, 2007). In the Apioceridae, the vein A1 is also vanishing distally, suggesting that this  
175 character could be an autapomorphy of *Cretomydas*.

176

## 177 **5. Concluding remark**

178 *Cretomydas* would rather fall in the ‘advanced Mydidae’, suggesting that this family was  
179 already well-diversified during the Early Cretaceous. The extant *Mitrodetus* is from the  
180 Southern part of South America, while *Diochlistus* (and *Triclonus*) are Australian. This  
181 ‘Gondwanan’ distribution suggests a great antiquity for the Diochlistinae (see Artigas &  
182 Papavero, 1990: text-fig. 3), in accordance with the possible affinities of *Cretomydas* with this  
183 group of genera.

184

## 185 **Acknowledgements**

186 We express our gratitude to the Editorial Board of Cretaceous Research, and in particular Dr.  
187 Eduardo Koutsoukos. We thank two anonymous reviewers for their valuable comments on this  
188 manuscript.

189

## 190 **References**

191 Almeida, J.C., Lamas, C.J.E., Nihei, S.S., 2014. Apiophorinae of Brazil: taxonomic revision of  
192 the genus *Eumydas* Wilcox & Papavero, 1971 (Diptera: Mydidae). *Insect Systematics &*  
193 *Evolution* 45, 181–208.

194 Artigas, J.N., Palma, R.I., 1979. Los mididos de Chile y una especie Argentina (Diptera:  
195 Mydidae). *Gayana Zoologia* 41, 3–78.

196 Artigas, J.N., Papavero, N., 1990. Studies of Mydidae (Diptera). 5. Phylogenetic and  
197 biogeographic notes, key to the American genera and illustrations of spermathecae. *Gayana*  
198 *Zoologia* 54, 87–116.

199 Carrera, M., d'Andretta, M.A.V., 1948. Descrição de um novo gênero de Mydidae do Chile e  
200 redescrição do gênero *Megascelus* (Apioceratidae) (Diptera). Revista de Entomologia 19, 489–  
201 497.

202 Cazier, M.A., 1941. A generic review of the family Apioceratidae with a revision of the North  
203 American species (Diptera: Brachycera). American Midland Naturalist 25, 589–631.

204 Cockerell, T.D.A., 1913. The first fossil mydaid fly. The Entomologist 46, 207–208.

205 Dikow, T., 2017. Mydidae (mydas flies). pp. 1063–1095. In: Kirk-Spriggs, A.H., Sinclair, B.J.,  
206 (eds). Manual of Afrotropical Diptera, Volume 2. Nematocerous Diptera and lower Brachycera.  
207 Suricata, Pretoria, 5, i–xii + 427–1361.

208 Dikow, R.B., Frandsen, P.B., Turcatel, M., Dikow, T., 2017. Genomic and transcriptomic  
209 resources for assassin flies including the complete genome sequence of *Proctacanthus*  
210 *coquilletti* (Insecta: Diptera: Asilidae) and 16 representative transcriptomes. PeerJ 5 (e2951),  
211 1–20.

212 Gerstaecker, C.E.A., 1868. Systematische Übersicht der bis jetzt bekannt gewordenen  
213 Mydaiden (Mydasii Latr.). Stettiner Entomologische Zeitung 29, 65–103.

214 Hardy, G.H., 1942. Miscellaneous notes on Australian Diptera. 9. Superfamily Asiloidea.  
215 Proceedings of the Linnean Society of New South Wales 67, 197–204.

216 Osten Sacken, C.R., 1877. Western Diptera: descriptions of new genera and species of Diptera  
217 from the region West of the Mississippi and especially from California. Bulletin of the United  
218 States Geological and Geographical Survey of the Territories 3, 189–354.

219 Ovtshinnikova, O.G., 2003. The taxonomic position of the genus *Rhaphiomidas* Osten-Sacken,  
220 1877 (Diptera, Mydidae) in the superfamily Asiloidea, based on the structure of muscles of the  
221 male genitalia. Entomological Review 83, 696–701.

222 Philippi, R.A., 1865. Aufzählung der Chilenischen Dipteren. Verhandlungen der Zoologisch-  
223 Botanischen Gesellschaft in Wien 15, 595–782.

224 Ren, D., 1998. Late Jurassic Brachycera from Northeastern China (Insecta: Diptera). Acta  
225 Zootaxonomica Sinica 23, 65–82.

226 Rogers, R., 2007. Two new species of *Rhaphiomidas* (Diptera: Mydidae). Zootaxa 1664, 61–  
227 68.

228 Séguy, E., 1928. Etude sur quelques Mydidae nouveaux ou peu connus. Encyclopédie  
229 Entomologique, (B II), (Diptera) 4, 129–156.

230 Séguy, E., 1930. Contribution à l'étude de la faune du Mozambique. Voyage de M. P. Lesne  
231 1928-1929. Bulletin du Muséum National d'Histoire Naturelle de Paris (2) 2, 645-656.

232 Van Dam, M.H., 2010. A new species and key for *Rhaphiomidas* Osten Sacken (Diptera:  
233 Mydidae). Zootaxa 2622, 49–60.

234 Willkommen, J., Grimaldi, D.A., 2007. 11.20 Diptera: true flies, gnats, and crane flies. pp. 369–  
235 387. In: Martill, D., Bechly, G., Loveridge, R. (eds). The Crato fossil beds of Brazil: Window  
236 into an ancient world. Cambridge University Press, Cambridge, 624 pp.

237 Winterton, S.L., Ware, J.L., 2015. Phylogeny, divergence times and biogeography of window  
238 flies (Scenopinidae) and the therevoid clade (Diptera: Asiloidea). Systematic Entomology 40,  
239 491–519.

240 Yeates, D.K., Irwin, M.E., 1996. Apioceridae (Insecta: Diptera): cladistic reappraisal and  
241 biogeography. Zoological Journal of the Linnean Society 116, 247–301.

242 Zhang, J.-f., 2015. *Pseudapiocera shandongensis* gen. et sp. nov., a protapiocerid fly (Diptera:  
243 Brachycera: Protapioceridae) from the Early Cretaceous Jehol biota, China. Alcheringa: An  
244 Australasian Journal of Palaeontology 39, 459–464.

245 Zhang, K.-Y., Yang, D., Ren, D., 2007. Notes on the extinct family Protapioceridae, with  
246 description of a new species from China (Insecta: Diptera: Asiloidea). Zootaxa 1530, 27–32.

247

248 **Fig. 1.** *Cretomydas santanensis* Willkommen & Grimaldi, 2007, specimen MHNE.2020.7.1.

249 **A**, habitus. **B**, left wing. Scale bars: 10 mm.

250

251

252

