



HAL
open science

A new micropterigid moth from the mid-Cretaceous Burmese amber (Insecta: Lepidoptera)

Valerie Ngô-Muller, Romain Garrouste, Jean-Marc Pouillon, André Nel

► To cite this version:

Valerie Ngô-Muller, Romain Garrouste, Jean-Marc Pouillon, André Nel. A new micropterigid moth from the mid-Cretaceous Burmese amber (Insecta: Lepidoptera). *Cretaceous Research*, 2020, 109 (104375), pp.104375. 10.1016/j.cretres.2020.104375 . mnhn-03992880

HAL Id: mnhn-03992880

<https://mnhn.hal.science/mnhn-03992880v1>

Submitted on 22 Jul 2024

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

1 A new micropterigid moth from the ‘mid’–Cretaceous Burmese amber (Insecta: Lepidoptera)

2

3 Valerie Ngô-Muller^{a,b}, Romain Garrouste^b, Jean-Marc Pouillon^c, André Nel^b

4

5 ^a*UFR Sciences du Vivant, Université Paris Diderot, Université de Paris, Paris, France*

6 ^b*Institut de Systématique, Évolution, Biodiversité, ISYEB – UMR 7205 – CNRS, MNHN,*

7 *UPMC, EPHE, Muséum national d’Histoire naturelle, Sorbonne Universités, Paris, France*

8 ^c*Nivolas Vermelle, France*

9

10 Abstract. *Sabatinca pouilloni* Ngô-Muller and Nel sp. nov., the fourth Micropterigidae moth
11 from the ‘mid’-Cretaceous Burmese amber, is described and illustrated. Its hind wing R is
12 complete, a symplesiomorphic character state only present in the extant New Zealand
13 ‘*Sabatinca calliarcha* clade’. The new fossil species does not belong to the same group than
14 the three previously micropterigid species from the same amber, suggesting that the genus
15 *Sabatinca* diversified earlier than 100 Ma, well before the recently proposed date of 80 Ma.

16

17 Keywords

18 Zeugloptera; *Sabatinca*; sp. nov.; dating

19

20 Introduction

21 Moths are rather rare in the fossil record, especially for the Mesozoic. Furthermore, they are
22 frequently difficult to separate from the two other amphiesmenopteran orders Trichoptera
23 Kirby, 1813 and Tarachoptera Mey, Wichard, Müller & Wang, 2017 on the sole basis of their
24 wing venation, especially for the Liassic taxa (Ansorge, 2002, 2003; Sohn et al., 2012).
25 Nevertheless, they can be of a great interest for the phylogenetic analysis and past history of

26 the order, especially for the most ‘basal’ non-Glossata groups that lack proboscis. If we do not
27 consider some fossils of uncertain affinities, four families of this kind are recorded for the
28 Mesozoic, viz. the Eolepidopterigidae Rasnitsyn, 1983, the Mesokristenseniidae Huang, Nel &
29 Minet, 2010, the Ascololepidopterigidae Zhang, Shih, Labandeira & Ren, 2013, and the
30 Micropterigidae Herrich-Schäffer, 1855. Only the Micropterigidae are known by Mesozoic
31 fossils in amber, while the three other families are based on compression fossils that give
32 relatively less information (Sohn et al., 2015).

33 The entomofauna of the ‘mid’-Cretaceous Burmese (Myanmar) amber is one of the richest
34 known for the Mesozoic, but it currently comprises only six recorded Lepidoptera, viz. a
35 Douglasiidae, a Gelechiidae, a Gracillariidae, and three Micropterigidae (Zhang et al., 2017;
36 Poinar, 2019; Ross, 2019), plus a larger still undescribed Macroheterocera (Huang, pers.
37 comm.). Here we describe a new Micropterigidae, different from those already described.

38

39 Material and methods

40 The type of *Sabatinca pouilloni* gen. et sp. nov. (Muséum National d’Histoire Naturelle, Paris,
41 France) is embedded in a small clear piece of amber. It was prepared using a diamond disk and
42 examined using Nikon binocular microscopes SMZ 1500 and SMZ25. Photographs were taken
43 with a Nikon camera D800, and the images were treated with Adobe Photoshop Element 12
44 and CS6. The piece of Burmese amber was found in deposits in the Hukawng Valley (Kachin)
45 of Myanmar (Yin et al., 2018: fig. 1A). The age of amber is confirmed by radiometric analysis
46 of zircons as earliest Cenomanian, ca. 99 Ma. (Shi et al., 2012).

47 We follow the most recent classification of the Lepidoptera proposed by Regier et al. (2015:
48 table 1), with the correspondence to that of Van Nieukerken et al. (2011).

49 The paper is registered in the Zoobank at [urn:lsid:zoobank.org:pub:795B28B1-99F9-4AC0-](https://zoobank.org/pub:795B28B1-99F9-4AC0-986B-33CC05B7063A)
50 986B-33CC05B7063A

51
52 Systematic palaeontology
53 Order Lepidoptera Linnaeus, 1758
54 Suborder Zeugloptera Chapman, 1917
55 Superfamily Micropterigoidea Herrich-Schäffer, 1855
56 Family Micropterigidae Herrich-Schäffer, 1855
57 Genus *Sabatinca* Walker, 1863
58
59 *Sabatinca pouilloni* Ngô-Muller and Nel sp. nov.
60 Figures 1-5
61 The species is registered in the Zoobank at [urn:lsid:zoobank.org:act:CDE8ED0A-B9FF-4C43-](https://zoobank.org/urn:lsid:zoobank.org:act:CDE8ED0A-B9FF-4C43-A1E8-D18D3B33A669)
62 [A1E8-D18D3B33A669](https://zoobank.org/urn:lsid:zoobank.org:act:CDE8ED0A-B9FF-4C43-A1E8-D18D3B33A669)
63 Material. Holotype MNHN.F.A71311 (female, specimen 25, collection Jean-Marc Pouillon),
64 stored in the collections of the Muséum National d'Histoire Naturelle, Paris, France.
65 Etymology. In honour of Dr Jean-Marc Pouillon, who donated the type specimen to the MNHN,
66 Paris.
67 Diagnosis. Forewing Sc and R forked, with sc-r ending basal of fork of R; Rs anteriorly
68 pectinate; no crossvein ir; Rs4 pre-apical; Hind wing Sc and R simple, well separated and
69 complete; sc-r present.
70 Locality and horizon. Hukawng Village, Kachin State, Northern Myanmar; 'mid'-Cretaceous.
71 Description. Body length 2.7 mm. Forewing length 2.5 mm; hind wing length 2.4 mm.
72 Head with tufts of very long piliform scales on frons and vertex. Antennae short, nearly
73 forewing length; scape greatly swollen with a distinct indentation on its mesial surface; pedicel
74 swollen, markedly wider than basal flagellomeres (large arrow on Fig. 4A); flagellum filiform
75 to submoniliform, with flagellomeres barrel-shaped, basal flagellomeres relatively long,

76 subsequent flagellomeres markedly shorter; ascoid sensillae present in the first 10 basal
77 flagellomeres (arrow on Fig. 4A), but with basal arrangement indiscernible, absent in the seven
78 more distal flagellomeres, which are shorter than the basal ones. Two ocelli. Maxillary palpus
79 with four visible segments (Fig 1C), folded between first and second visible segments; second
80 visible segment longest (arrow on Fig. 1C), last segment shortest, clawlike and tapering to
81 terminal end). Labial palpus quite shorter, three-segmented. Mandibles present, sclerotized, but
82 detailed structure indiscernible. Labrum not visible.

83 Spur formula 0-0-4 (Figs. 4 and 5A). Epiphysis arising from the inner wall of foretibia.
84 Metafemur swollen, metatibia with spines. Tarsus with five tarsomeres.

85 Scales covering both fore- and hindwings, but their shape hardly visible. Fore- and hindwings
86 of nearly the same lengths with pointed apices (Fig. 2). Margins of fore- and hindwings with
87 very long hair-like setae, almost reaching 0.3 mm (Fig. 2B). Forewing index (ratio of wing
88 width/wing length) 0.32; no pterostigma; humeral vein absent; Sc forked; sc-r absent; R deeply
89 bifurcating; Rs four-branched; branching points of R and Rs1 to Rs3 linearly aligned; crossvein
90 ir absent; Rs4 terminating slightly ante-apically; M forking to M1+2 and M3, M1+2 further
91 forking to veins M1 and M2; no intermedian (im) cross-vein; CuA bifurcating; CuP simple and
92 straight; anal veins not visible (Fig. 2A and B; drawing on Fig. 3A). Hind wing shorter than
93 forewing, wing index 0.95; four frenular bristles (wing coupling apparatus) on anterior margin.
94 Sc and R simple, separated with a sc-r crossvein; Rs four-branched; M three-branched; CuA
95 bifurcating; CuP and anal vein simple (Fig. 2C; drawing on Fig. 3B).

96 Abdomen 1.8 mm long, 0.48 mm wide; female genitalia partly visible.

97

98 Discussion.

99 *Sabatinca pouilloni* sp. nov. belongs to the Lepidoptera because of the following
100 synapomorphies, after Huang et al. (2010): presence of overlapping scales on the body and the

101 four wings, a fore tibia epiphysis; absence of apical spur on foretibia; free section of M1 meeting
102 crossvein r-m and markedly angulate at this junction. The absence of proboscis excludes
103 affinities with the Glossata Fabricius, 1775. More precisely, the Lophocoronidae Common,
104 1973 (Lophocoronina Common, 1990) have a very short proboscis but the five-segmented
105 maxillary palps of *Sabatinca pouilloni* sp. nov. exclude affinities with this group (Common,
106 1973). The Eriocraniidae Rebel, 1901 (Dacnonypha Hinton, 1946) and the Neopseustidae
107 Hering, 1925 (Neopseustina Davis & Nielsen, 1980) and other Hepialoidea Stephens, 1829
108 have easily visible and long proboscis (Davis, 1978, Davis and Nielsen, 1980). The Heteroneura
109 Tillyard, 1918 wing venation are quite different from that of *Sabatinca pouilloni* sp. nov. Six
110 groups remain possible, viz. the Jurassic-Cretaceous suborder Eolepidopterigina Rasnitsyn,
111 1983 (Eolepidopterigidae Rasnitsyn, 1983), the Jurassic Mesokristenseniidae and
112 Ascololepidopterigidae, the Zeugloptera Chapman, 1917 or Micropterigiodea Herrich-
113 Schäffer, 1855 (Micropterigidae Herrich-Schäffer, 1855), the Aglossata Speidel, 1977 or
114 Agathiphagoidea Kristensen, 1967 (Agathiphagidae Kristensen, 1967), and the
115 Heterobathmiina Kristensen & Nielsen, 1979 or Heterobathmioidea Kristensen & Nielsen,
116 1979 (Heterobathmiidae Kristensen & Nielsen, 1979).

117 *Sabatinca pouilloni* sp. nov. shares with the Eolepidopterigidae the three-branched M, but
118 strongly differs from this family in the pattern of the branches of Rs, viz. pectinate vs. double-
119 forked; midtibia with only one pair of spurs instead of two (Rasnitsyn, 1983, 1984; Zhang et
120 al., 2013, 2015). *Sabatinca pouilloni* sp. nov. greatly differs from the Ascololepidopterigidae
121 in the presence of four metatibial spurs and M three-branched (Zhang et al., 2013). *Sabatinca*
122 *pouilloni* sp. nov. has no medial spurs on mid-tibia (spur formula 0-0-4), unlike the
123 Agathiphagidae (spur formula 1-4-4). *Sabatinca pouilloni* sp. nov. has no apical mid-tibial
124 spurs as for the Micropterigidae and Heterobathmiidae, while the Mesokristenseniidae have
125 only one. The absence of foretibial spurs is a putative synapomorphy of *Sabatinca pouilloni* sp.

126 nov. with the Micropterigidae, Heterobathmiidae, and the Glossata. The forewing M with three
127 branches of *Sabatinca pouilloni* sp. nov. is a derived character supposed to have evolved
128 independently in Micropterigidae and Glossata. The hind wing Sc simple of *Sabatinca pouilloni*
129 sp. nov. is a putative apomorphy shared by all Lepidoptera except the Agathiphagidae.
130 *Sabatinca pouilloni* sp. nov. has a sc-r crossvein in hind wing, a putative plesiomorphy present
131 in Trichoptera, the Agathiphagidae, and many Micropterigidae. Like most lepidopterans,
132 *Sabatinca pouilloni* sp. nov. has an unforked hind wing R vein. *Sabatinca pouilloni* sp. nov.
133 has no hind wing areole (crossvein ir absent), while a closed areole occurs in
134 Mesokristenseniidae, certain Zeugloptera, the Aglossata, some Heterobathmiina, and a few
135 Glossata; however this character is homoplastic. Huang et al. (2010: 882) regarded ‘the loss of
136 the hind wing areole as an autapomorphy of the Myoglossata, independently evolved in the
137 Acanthoctesia’. *Sabatinca pouilloni* sp. nov. has no forewing areole between Rs3 and Rs4+5,
138 unlike the Agathiphagidae, many Micropterigidae, the Heterobathmiidae, and the
139 Mesokristenseniidae. *Sabatinca pouilloni* sp. nov. has the dorsal surface of mid tibia with a two
140 spines and the lateral surface with three spines, a situation different from that of the
141 Mesokristenseniidae that have the dorsal surface with a row of three or four pairs of spines.
142 *Sabatinca pouilloni* sp. nov. differs from the unique genus *Heterobathmia* of the family
143 Heterobathmiidae in the forked Sc and R and the absence of the ir crossvein (Kristensen and
144 Nielsen, 1979; 1998).
145 Within the Micropterigidae, *Sabatinca pouilloni* sp. nov. does not fall in the Northern
146 Hemisphere genera because its R is deeply furcate (Hashimoto, 2006; Imada and Kato, 2018),
147 viz. in *Micropterix* Hübner, 1825, *Paramartyria* Issiki, 1931, *Palaeomicroides* Issiki, 1931,
148 *Melinopterix* Imada and Kato, 2018, *Issikiomartyria* Hashimoto, 2006, *Epimartyria*
149 Walsingham, 1898, *Vietomartyria* Hashimoto and Mey, 2000, *Kurokopteryx* Hashimoto, 2006,
150 and *Neomicropteryx* Issiki, 1931.

151 The hind wing with R1 vein distinct in basal half and the antennal scape greatly swollen
152 with a distinct indentation on its mesial surface support an attribution to the ‘sabatincoid’ group
153 of genera (Gibbs, 2010; Gibbs and Kristensen, 2011). The forewing R forked supports an
154 attribution to the ‘*Sabatinca* sensu stricto’ lineage. The three-segmented labial palp makes it
155 fall in the genus *Sabatinca* Walker, 1863, while *Palaeomicra* Meyrick, 1886 has a two-
156 segmented labial palp (Gibbs, 2010). Affinities with the Neotropical genus *Hypomartyria*
157 Kristensen & Nielsen, 1982 are excluded because of the absence of a crossvein ir in fore- and
158 hind wings; the four-branched Rs excludes affinities with the Neotropical genus *Squamicornia*
159 Kristensen & Nielsen, 1982 (Kristensen & Nielsen, 1982: figs 3 & 32).

160 Sohn et al. (2012) listed six fossil genera in the Micropterigidae, viz. *Auliepterix* Kozlov,
161 1989, *Baltimartyria* Skalski, 1995, *Electrocrania* Kusnezov, 1941, *Moleropterix* Engel and
162 Kinzelbach, 2008, *Palaeosabatinca* Kozlov, 1989, and *Parasabatinca* Whalley, 1978.

163 The Mesozoic genera *Palaeosabatinca* and *Auliepterix* and the Baltic amber genus
164 *Electrocrania* differ from *Sabatinca pouilloni* sp. nov. in the simple forewing R (Kusnezov,
165 1941; Kozlov, 1988, 1989; Kurz, 2015). The Baltic amber genus *Baltimartyria* differs from
166 *Sabatinca pouilloni* sp. nov. in the presence of a crossvein ir in fore- and hind wing (Skalski,
167 1995; Mey, 2011). The earliest Eocene genus *Moleropterix* is based on an incomplete wing
168 from the Moler Formation in Denmark. It differs from *Sabatinca pouilloni* sp. nov. in the Rs
169 branches with a double fork instead of being pectinate (Engel and Kinzelbach, 2008). The
170 Cretaceous *Parasabatinca* differs from *Sabatinca pouilloni* sp. nov. in the simple R and Rs not
171 anteriorly pectinate (Whalley, 1978).

172 Many characters that are diagnostic of *Sabatinca* are not visible on *Sabatinca pouilloni*
173 sp. nov., especially abdominal structures (Gibbs and Lees, 2014: 245). Zhang et al. (2017) listed
174 the characters ‘Rs4 terminating post-apically’ and ‘hind wing with R partly or completely
175 coalescent with Sc’ as typical of *Sabatinca*. The first character is not shared by *Sabatinca*

176 *pouilloni* sp. nov., but we consider that it is not sufficient to separate it from this genus. The
177 second character is not discriminating because the extant New Zealand species of the ‘*S.*
178 *calliarcha* clade’ (e.g. *Sabatinca calliarcha* Meyrick, 1912, *S. heighwayi* Philpott, 1927, *S.*
179 *lucilia* Clarke, 1920, *S. weheka* Gibbs, 2014, and *S. pluvialis* Gibbs, 2014), have hind wing vein
180 R basally well-defined and well separated from Sc, as in *Sabatinca pouilloni* sp. nov. (Philpott,
181 1927; Gibbs, 2014; Gibbs and Lees, 2014: 244, fig. 2), but this character is likely a
182 symplesiomorphy. *Sabatinca pouilloni* sp. nov. differs from *Sabatinca calliarcha* in the
183 absence of the crossvein ir (Gibbs, 2014).

184 Zhang et al. (2017) revised and/or described three micropterigid species from the
185 Burmese amber and attributed them to *Sabatinca*. *Sabatinca perverta* Cockerell, 1919 shares
186 with *Sabatinca pouilloni* sp. nov. the anteriorly pectinate Rs without crossvein ir but differs
187 from it in the fused hind wing Sc and R. *Sabatinca cretacea* Zhang Wang, Shih & Ren, 2017
188 differs from *Sabatinca pouilloni* sp. nov. in the presence of a crossvein ir in forewing and the
189 fused hind wing Sc and R. *Sabatinca limula* Zhang Wang, Shih & Ren, 2017 differs from
190 *Sabatinca pouilloni* sp. nov. in the presence of a crossvein ir in forewing and the crossvein sc-
191 r ending at the fork of R. Lastly they all differ from *S. pouilloni* in rounded wing apices.

192

193 Remark. The Liassic Archaeolepidae Whalley, 1985 are based on forewings with very
194 incomplete venation, very hard to compare to the other Mesozoic moths. *Archaeolepis* Whalley,
195 1985 differs from *Sabatinca pouilloni* sp. nov. in a shorter fork of R (Whalley, 1985). Ansoerge
196 (2002, 2003) described or revised a series of Liassic Amphiesmenoptera based on wings. They
197 all differ from *Sabatinca pouilloni* sp. nov. in the pattern of Rs with a double fork, instead of
198 being pectinate.

199

200 Conclusion

201 *Sabatinca pouilloni* sp. nov. shares with the New Zealand ‘*calliarcha* species group’ the
202 character state ‘hind wing vein R basally well-defined and well separated from Sc’ but it is
203 putatively plesiomorphic, and not sufficient to attribute it to this clade (Gibbs and Lees, 2014:
204 fig. 6). *Sabatinca pouilloni* and the three Burmese amber *Sabatinca* species of Zhang et al.
205 (2017) belong to two clearly different groups of species on the basis of the shape of hind wing
206 vein R (Gibbs and Lees, 2014). The latter authors dated the separation of the *Sabatinca* groups
207 of species around 80 Ma, clearly more recent than these Burmese fossils. Thus these fossils
208 may help precise the dating of this genus’s origin and history.

209 The discovery of *Sabatinca pouilloni* sp. nov. confirms the rather important diversity of the
210 non-Glossata Lepidoptera during the Mesozoic, with no less than six clades:
211 †Eolepidopterigidae, †Mesokristenseniidae, †Ascololepidopterigidae, Micropterigidae, plus
212 the Agathiphagidae and Heterobathmiidae, still unknown in the fossil record, but certainly
213 present according to phylogenetic analysis (Sohn et al., 2015: fig. 2; Regier et al., 2015: fig. 2).
214 It is not currently possible to determine when the Mesozoic families became extinct and why
215 the Micropterigidae are still relatively more diverse (with ca. 160 extant species), than the
216 Agathiphagidae and Heterobathmiidae (two and three species, respectively). Micropterigidae
217 are either detritivores or bryophyte-feeders as larvae (Imada et al., 2011), Agathiphagidae live
218 on the gymnosperm genus *Agathis* (Araucariaceae) Only the Heterobathmiidae live on the
219 angiosperm genus *Nothofagus* (Fagaceae) (Kristensen and Nielsen, 1983), which was clearly
220 not a condition *sine qua non* for their diversification.

221

222 **Acknowledgements**

223 We sincerely thank two anonymous referees for their helpful remarks on the first version of the
224 paper. We also greatly thank Pr. Joel Minet for his help in the study of this moth.

225

226 **References**

- 227 Ansorge, J., 2002. Revision of the “Trichoptera” described by Geinitz and Handlirsch from the
228 Lower Toarcian of Dobbertin (Germany) based on new material. Proceedings of the 10th
229 International Symposium on Trichoptera, Postdam, Germany, July 30 – August 5, 2000. Nova
230 Supplementa Entomologica 15, 55–74.
- 231 Ansorge, J., 2003. Upper Liassic Amphiesmenoptera (Trichoptera + Lepidoptera) from
232 Germany – a review. Acta Zoologica Cracoviensia 46 (suppl. – Fossil Insects), 285–290.
- 233 Chapman, T.A., 1917. *Micropteryx* entitled to ordinal rank; Order Zeugloptera. Transactions of
234 the Entomological Society of London 1916, 310–314.
- 235 Clarke, C.E., 1920. New Lepidoptera. Transactions and Proceedings of the New Zealand
236 Institute 1920, 35.
- 237 Cockerell, T.D.A., 1919. Two interesting insects in Burmese amber. The Entomologist 52,
238 193–195.
- 239 Common, I.F.B., 1973. A new family of Dacnonympa (Lepidoptera) based on three new
240 species from Southern Australia, with notes on the Agathiphagidae. Journal of the Australian
241 Entomological Society 12, 11–23.
- 242 Common, I.F.B., 1990. Moths of Australia. Melbourne University Press, i–vi, 1–576.
- 243 Davis, D.R., 1978. A revision of the North American moths of the superfamily Eriocranioidea
244 with the proposal of a new family, Acanthopterocetidae (Lepidoptera). Smithsonian
245 Contributions to Zoology Supplement 251, 1–131.
- 246 Davis, D.R., Nielsen, E.S., 1980. Description of a new genus and two new species of
247 Neopseustidae from South America, with discussion of phylogeny and biological observations
248 (Lepidoptera: Neopseustoidea). Steenstrupia 6, 253–289.
- 249 Engel, M.S., Kinzelbach, R.K., 2008. A primitive moth from the earliest Eocene Fur Formation
250 (“Mo-clay”) of Denmark (Lepidoptera: Micropterigidae). Linzer Biologische Beiträge 40,

251 1443–1448.

252 Fabricius, J.C., 1775. *Systema entomologiae, sistens insectorvm classes, ordines, genera,*
253 *species, adiectis synonymis, locis, descriptionibvs, observationibvs. Kortii, Flensbvrge et*
254 *Lipsiae [= Flensburg & Leipzig], [32] + 832 pp.*

255 Gibbs, G.W., 2014. Micropterigidae (Insecta Lepidoptera). *Fauna of New Zealand* 72, 1–127.

256 Gibbs, G.W., Kristensen, N.P., 2011. *Agrionympha*, the long-known South African jaw moths:
257 a revision with descriptions of new species (Lepidoptera, Micropterigidae). *Zootaxa* 2764,
258 1–21.

259 Gibbs, G.W., Lees, D.C., 2014. New Caledonia as an evolutionary cradle: a re-appraisal of the
260 jaw-moth genus *Sabatinca* (Lepidoptera: Micropterigidae) and its significance for assessing the
261 antiquity of the island's fauna. pp. 239-266. *In*: Guilbert, E., Robillard, T., Jourdan, H.,
262 Grandcolas, P. (eds). *Zoologia Neocaledonica* 8. Biodiversity studies in New Caledonia.
263 *Mémoires du Muséum National d'Histoire Naturelle* 206.

264 Hashimoto, S., 2006. A taxonomic study of the family Micropterigidae (Lepidoptera,
265 Micropterigoidea) of Japan, with the phylogenetic relationships among the Northern
266 Hemisphere genera. *Bulletin of the Kitakyushu Museum of Natural History and Human*
267 *History, Series A Natural History* 4, 39–109.

268 Hashimoto, S., Mey, W., 2000. Establishment of a new genus *Vietomartyria* (Lepidoptera,
269 Micropterigidae) for *Paramartyria expeditionis* Mey. *Transactions of the Lepidopterological*
270 *Society of Japan* 52, 37–44.

271 Hering, M., 1925. Über die Gattung *Neopseustis* Meyrick (Lep.). *Mitteilungen aus dem*
272 *Zoologischen Museum in Berlin* 12, 143–147.

273 Herrich-Schäffer, G.A.W., 1855. Systematische Bearbeitung der Schmetterlinge von Europa,
274 Zugleich als Text, Revision und Supplement zu Jacob Hubner's Sammlung europäischer
275 Schmetterlinge. Regensburg, 5, 1–394.

276 Hinton, H.E., 1946. On the homology and nomenclature of the setae of lepidopterous larvae,
277 with some notes on the phylogeny of the Lepidoptera. Transactions of the Royal Entomological
278 Society of London 97, 1–37.

279 Huang, D.-y., Nel, A., Minet, J., 2010. A new family of moths from the Middle Jurassic
280 (Insecta: Lepidoptera). Acta Geologica Sinica, English Edition 84, 874–885.

281 Hübner, J., 1816–1826 [“1816”] 1825. Verzeichniß bekannter Schmettlinge [sic], Jacob
282 Hübner, Augsburg, 1–431 + [1]–2–72.

283 Imada, Y., Kawakita, A., Kato, M., 2011. Allopatric distribution and diversification without
284 niche shift in a bryophyte-feeding basal moth lineage (Lepidoptera: Micropterigidae).
285 Proceedings of the Royal Society (B) 278, 3026–3033.

286 Imada, Y., Kato, M., 2018. Descriptions of new species of *Issikiomartyria* (Lepidoptera,
287 Micropterigidae) and a new genus *Melinopteryx* gen. n. with two new species from Japan.
288 Zoosystematics and Evolution 94, 211–235.

289 Issiki, S.T., 1931. On the morphology and systematics of Micropterigidae (Lepidoptera,
290 Homoneura) of Japan and Formosa with some considerations on the Australian, European and
291 North American forms. Proceedings of the Zoological Society of London 101, 999–1039.

292 Kozlov, M.V., 1988. Palentologiya cheshuerkrulikh i voprosy filogenii otryada Papilionida
293 [Palaeontology of butterflies and problems in Papilionida order phylogeny.]. pp. 16–69. *In*:
294 Ponomarenko, A.G. (ed.). *Melovoj biotsenoticheskij krizis i evolutsiya nasekomykh*.
295 [Cretaceous biocoenotic crisis and insect evolution.] Nauka, Moscow. 1988, 1–230. [in
296 Russian.]

297 Kozlov, M.B., 1989. New Upper Jurassic and Lower Cretaceous Lepidoptera. Paleontological
298 Journal, 23, 34–39.

299 Kristensen, N.P., 1967. Erection of a new family in the lepidopterous suborder Dacnonypha.
300 Entomologiske Meddelelser 35, 341–345.

301 Kristensen, N.P., Nielsen, E.S., 1979. A new subfamily of Microlepidoptera from South
302 America. A contribution to the morphology and phylogeny of the Micropterigidae, with a
303 generic catalogue of the family (Lepidoptera: Zeugloptera). *Steenstrupia* 5, 69–147.

304 Kristensen, N.P., Nielsen, E.S., 1983. The *Heterobathmia* life history elucidated: immature
305 stages contradict assignment to suborder Zeugloptera (Insecta, Lepidoptera). *Journal of*
306 *Zoological Systematics and Evolutionary Research* 21, 101–124.

307 Kurz, M., 2015. On the systematic position of *Electrocrania* Kusnezov, 1941 with the
308 description of a new species from Baltic amber (Lepidoptera: Micropterigidae). *Zootaxa* 4044,
309 446–450.

310 Kusnezov, N.J., 1941. [A revision of the amber Lepidoptera.] Academy of Science of the
311 USSR, Paleontologicheskij Instituta, Akademiya nauk SSSR, Moscow and Leningrad, 1–136.
312 [In Russian, with English descriptions]

313 Mey, W., 2011. On the systematic position of *Baltimartyria* Skalski, 1995 and description of a
314 new species from Baltic amber (Lepidoptera, Micropterigidae). *In*: Shcherbakov, D.E., Engel,
315 M.S., Sharkey, M.J. (eds). *Advances in the systematics of fossil and modern insects: Honouring*
316 *Alexandr Rasnitsyn*. *ZooKeys* 130, 331–342.

317 Mey, W., Wichard, W., Müller, P., Wang, B., 2017. The blueprint of the Amphiesmenoptera –
318 Tarachoptera, new order of insects from Burmese amber (Insecta, Amphiesmenoptera). *Fossil*
319 *Record* 20, 129–145.

320 Meyrick, E., 1886. Descriptions of New Zealand micro-Lepidoptera. *Transactions and*
321 *Proceedings of the New Zealand Institute* 18, 162–183.

322 Meyrick, E., 1912. Lepidoptera Heterocera Fam. Micropterygidae. *Genera Insectorum* 132,
323 1–9.

324 Philpott, A., 1927. Notes and descriptions of New Zealand Lepidoptera. *Transactions of the*
325 *New Zealand Institute* 58, 80–90.

326 Poinar G.O.Jr., 2019. A new genus of moths (Lepidoptera: Gracillarioidea: Douglasiidae) in
327 Myanmar amber. *Historical Biology* 31, 898–902.

328 Rasnitsyn, A.P., 1983. [First find of a moth from the Jurassic.] *Doklady Akademii nauk SSSR*
329 269, 467–471.

330 Rasnitsyn, A.P., 1984. The first find of a Jurassic butterfly. *Transactions of the URSS Academy*
331 *of Sciences Earth Science Section* 269, 174–177.

332 Regier, J.C., Mitter, C., Kristensen, N.P., Davis, D.R., Van Nieuwerkerken, E.J., Rota, J.,
333 Simonsen, T.J., Mitter, K.T., Kawahara, A.Y., Yen, Shen-Horn, Cummings, M.P., Zwick, A.,
334 2015. A molecular phylogeny for the oldest (nonditrysian) lineages of extant Lepidoptera, with
335 implications for classification, comparative morphology and life-history evolution. *Systematic*
336 *Entomology* 40, 671–704.

337 Rebel, H., 1901. *Catalog der Lepidopteren des palaearktischen Faunengebietes*. Freidländer, H.
338 & Sohn, Berlin, 1–368.

339 Ross, A.J., 2019. Burmese (Myanmar) amber checklist and bibliography 2018.
340 *Palaeoentomology* 2, 22–84.

341 Shi, G.-g., Grimaldi, D. A., Harlow, G. E., Wang, J., Wang, J., Yang, M.-c., Lei, W.-y., Li, Q.-
342 l., Li, X.-h., 2012. Age constraint on Burmese amber based on U-Pb dating of zircons.
343 *Cretaceous Research* 37, 155–163.

344 Skalski, A.W., 1995. Study on the Lepidoptera from fossil resins. Part 11. *Baltimartyria*, a new
345 genus for *Micropteryx proavitella* Rebel, 1936, with redescription of this species (Lepidoptera,
346 Zeugloptera, Micropterygidae). *Amber and Fossils* 1, 26–37.

347 Sohn, J.-C., Labandeira, C., Davis, D., Mitter, C., 2012. An annotated catalog of fossil and
348 subfossil Lepidoptera (Insecta: Holometabola) of the world. *Zootaxa* 3286, 1–132.

349 Sohn, J.-C., Labandeira, C.C., Davis, D.R., 2015. The fossil record and taphonomy of butterflies
350 and moths (Insecta, Lepidoptera): implications for evolutionary diversity and divergence-time

351 estimates. *BMC Evolutionary Biology* 15, 1–15.

352 Stephens, J.F., 1829. The nomenclature of British insects: being a compendious list of such
353 species as are contained in the systematic catalogue of British insects, and forming a guide to
354 their classification. Balding and Cradock, London, 1–68.

355 Speidel, W., 1977. Ein Versuch zur Unterteilung der Lepidopteren in Unterordnungen. *Atalanta*
356 8, 119–121.

357 Tillyard, R.J., 1918. The Micropterygidae not of the jugate type. *Entomological News* 29, 90.

358 Van Nieukerken, E.J., Kaila, L., Kitching, I.J., Kristensen, N.P., Lees, D.C., Minet, J., Mitter,
359 C., Mutanen, M., Regier, J.C., Simonsen, T.J., Wahlberg, N., Yen, Shen-Horn, Zahiri, R.,
360 Adamski, D., Baixeras, J., Bartsch, D., Bengtsson, B.Å.; Brown, J.W., Bucheli, S.R., Davis,
361 D.R., De Prins, J., De Prins, W., Epstein, M.E., Gentili-Poole, P., Gielis, C., Hättenschwiler,
362 P., Hausmann, A., Holloway, J.D., Kallies, A., Karsholt, O., Kawahara, A.Y., Koster, S.,
363 Kozlov, M.V., Lafontaine, J.D., Lamas, G., Landry, J.-F., Lee, S., Nuss, M., Park, Kyu-Tek,
364 Penz, C., Rota, J., Schintlmeister, A., Schmidt, B.C., Sohn, Jae-Cheon, Solis, M.A., Tarmann,
365 G.M., Warren, A.D., Weller, S., Yakovlev, R.V., Zolotuhin, V.V., Zwick, A., 2011. Order
366 Lepidoptera Linnaeus, 1758. In: Zhang, Z.-Q. (Ed.) *Animal biodiversity: An outline of higher-*
367 *level classification and survey of taxonomic richness.* *Zootaxa* 3148, 212–221.

368 Whalley, P.E.S., 1978. New taxa of fossil and recent Micropterygidae with a discussion of their
369 evolution and a comment on the evolution of Lepidoptera. *Annals of the Transvaal Museum*
370 31, 71–90.

371 Walker, F., 1863. Crambites and Tortricites. List of the specimens of lepidopterous insects in
372 the collection of the British Museum, 28, 1–561.

373 Whalley, P.E.S., 1985. The systematics and palaeogeography of the Lower Jurassic insects of
374 Dorset, England. *Bulletin of the British Museum (Natural History), Geology* 39, 107–187.

375 Yin, Z.-w., Huang, D.-y., Azar, D., 2018. Last major gap in scydmaenine evolution filled

376 (Coleoptera: Staphylinidae), *Cretaceous Research* 84, 62–68.

377 Zhang, W.-t., Shih, C.-k., Labandeira, C.C., et al. 2013. New fossil Lepidoptera (Insecta:
378 Amphiesmenoptera) from the Middle Jurassic Jiulongshan Formation of Northeastern China.

379 *PLoS ONE* 8 (11) (e79500), 1–33.

380 Zhang, W.-t., Wang, J.-j., Shih, C.-k., Ren, D., 2017. Cretaceous moths (Lepidoptera:
381 Micropterigidae) with preserved scales from Myanmar amber. *Cretaceous Research* 78,

382 166–173.

383

384 **Fig. 1.** *Sabatinca pouilloni* Ngô-Muller and Nel sp. nov., holotype MNHN.F.A71311, habitus:

385 A. Dorsal view; B. Ventral view; C. Head, arrow maxillary palp. Scale bars = 1 mm (A-B); 0.2
386 mm (C).

387 **Fig. 2.** *Sabatinca pouilloni* Ngô-Muller and Nel sp. nov., holotype MNHN.F.A71311, wings:

388 A. Forewing costal part; B. Forewing; C. Hind wing. Scale bars = 1 mm.

389 **Fig. 3.** *Sabatinca pouilloni* Ngô-Muller and Nel sp. nov., holotype MNHN.F.A71311,

390 reconstructions of wings: A. Forewing; B. Hind wing. Scale bar = 0.5 mm.

391 **Fig. 4.** *Sabatinca pouilloni* Ngô-Muller and Nel sp. nov., holotype MNHN.F.A71311: A.

392 Antenna; B. Fore and mid legs (arrow). Scale bars = 0.2 mm.

393 **Fig. 5.** *Sabatinca pouilloni* Ngô-Muller and Nel sp. nov., holotype MNHN.F.A71311: A. Hind

394 leg; B. Terminalia. Scale bars = 0.2 mm.

395

A



B









