Palaeoentomology 006 (5): 455–458
https://www.mapress.com/j/pe/

Correspondence

ISSN 2624-2826 (print edition)
PALAEOENTOMOLOGY
ISSN 2624-2834 (online edition)

https://doi.org/10.11646/palaeoentomology.6.5.4
http://zoobank.org/urn:lsid:zoobank.org:pub:1EA27455-9F77-4D46-AA68-C7C8A0B38C7F

An unusual artematopodid beetle from Early Cretaceous Wealden amber (Coleoptera: Elateroidea: Artematopodidae)

ERIK TIHELKA[1], EDMUND A. JARZEMBOWSKI[2, 3], DANY AZAR[2, 4], DI-YING HUANG[2] & CHEN-YANG CAI[2, *]
[1]*School of Earth Sciences, University of Bristol, Life Sciences Building, Tyndall Avenue, Bristol, BS8 1TQ, UK*
[2]*State Key Laboratory of Palaeobiology and Stratigraphy, Nanjing Institute of Geology and Palaeontology, and Centre for Excellence in Life and Paleoenvironment, Chinese Academy of Sciences, Nanjing 210008, China*
[3]*Department of Earth Sciences, The Natural History Museum, Cromwell Road, London SW7 5BD, UK*
[4]*Lebanese University, Faculty of Science II, Natural Sciences Department, Fanar - El-Matn, PO Box 26110217, Lebanon*
wn20250@bristol.ac.uk; https://orcid.org/0000-0002-5048-5355
jarzembowski2@live.co.uk; https://orcid.org/0000-0001-8772-4375
danyazar@ul.edu.lb; https://orcid.org/0000-0002-4485-197X
dyhuang@nigpas.ac.cn; https://orcid.org/0000-0002-5637-4867
cycai@nigpas.ac.cn; https://orcid.org/0000-0002-9283-8323
**Corresponding author*

The soft-bodied plant beetles, Artematopodidae, is a small family of Elateroidea represented today by some 70 described species grouped into nine genera (Lawrence, 2005, 2010). Together with another species-poor clade, Omethidae + Telegeusidae, artematopodids are sister to the remaining members of the diverse superfamily Elateroidea (Cai *et al.*, 2022; Douglas *et al.*, 2021; Kundrata *et al.*, 2014; McKenna *et al.*, 2015; Zhang *et al.*, 2018). They are distinguished from the remaining elateroids most strikingly by a tongue-like process on the apicoventral region of the elytra and apparent obligate bryophagy in at least some species (Lawrence, 2010). In contrast to their relatively low species-richness in modern habitats, artematopodids were considerably more morphologically disparate and diverse in the Mesozoic, being known from the Middle Jurassic of Inner Mongolia in northeastern China (Cai *et al.*, 2015), the Lower Cretaceous Yixian and Shouchang Formations of China (Cai *et al.*, 2015, 2020; Li *et al.*, 2021), amber from northern Myanmar (Li *et al.*, 2022), and an undescribed species has been reported from mid-Cretaceous amber from France (Peris *et al.*, 2016). Most Mesozoic artematopodids show a striking resemblance with the extant subfamily Artematopodinae and have been recovered as closely related to the extant genera *Brevipogon* Lawrence and *Ctesibius* in phylogenetic analyses (Cai *et al.*, 2020). Representatives of the subfamily Electribiinae are further known from Eocene Baltic and Miocene Mexican ambers (Crowson, 1973; Hörnschemeyer, 1998; Wu *et al.*, 2015), while fossils resembling the subfamily Allopogoniinae date to the Cretaceous (Li *et al.*, 2022).

Here we describe the first Mesozoic artematopodid beetle from Laurasia based on an inclusion preserved in Wealden amber of the Isle of Wight (early Barremian, ~125 Ma). The fossil, despite its somewhat fragmentary preservation, possesses a clearly discernable combination of unusual characters, and represents the first fossil coleopteran described from the Wealden amber of the Isle of Wight and indeed from British amber.

Geological setting. The Cretaceous period marks the first widespread appearance of amber in the stratigraphic record and the Wealden amber found at the Isle of Wight in southern England is among the oldest fossiliferous ambers in the world (Delclòs *et al.*, 2023). Locally known as 'chiltonchineite', the amber occurs *in situ* in the early Barremian (~125 Ma) Wessex Formation and is exposed by marine erosion at a beach by Chilton Chine in the Isle of Wight (Nicholas *et al.*, 1993). The fossiliferous horizon corresponds to pdb L6 in Fig. 4 of Gale (2019). The amber occurs sporadically in a plant-debris horizon seasonally deposited on a river floodplain following wildfire and rainstorms. The locality and horizon have been described by Nicholas *et al.* (1993). Geochemical analyses indicate Pinaceae or Cheirolepidiaceae as the likely botanical source of the fossil resin (Bray & Anderson, 2008).

Arthropod inclusions in Wealden amber are rare, but include chironomids and other dipterans, hymenopterans, a cockroach, and a spider (Baranov *et al.*, 2019; Jarzembowski, 1995; Jarzembowski *et al.*, 2008; Perkovsky *et al.*, 2021; Selden, 2002). Unlike the Wealden adpression fossil fauna, beetles are not common in the assemblage; a single beetle specimen has been discovered to date from a total of about 21 inclusions, which is the subject of the present contribution.

Material and methods. The specimen was polished with different grades of sandpaper of gradually finer grits and polishing powder and then affixed in glass wells filled with Canada Balsam as in Azar *et al.* (2003). Photographs were taken using a Canon EOS 5D Mark III digital camera,

Submitted: 14 Oct. 2023; accepted by J. Szwedo: 22 Oct. 2023; published: 30 Oct. 2023

equipped with a Canon MP-E 65 mm macro lens (F2.8, 1–5X), and with an attached Canon MT-24EX twin flash. For fluorescence microscopy, a Zeiss Axio Imager 2 microscope equipped with a mercury lamp and set to the rhodamine mode was used. The type specimen (NIGP203316) is due to be deposited in the amber collection of the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences in Nanjing, China.

Order Coleoptera Linnaeus, 1758
Family Artematopodidae Lacordaire, 1857
Subfamily *incertae sedis*

Genus *Valdopogon* Tihelka & Cai **gen. nov.**
urn:lsid:zoobank.org:act: F95C29BA-00DC-440E-AB4C-55D098C4451E

Type species. *Valdopogon simpsoni* **sp. nov.**; by present designation.

Etymology. A combination of *Valdi-*, from "Wealden", and the extant genus *Brevipogon*, masculine in gender.

Diagnosis. Body oval-shaped, tapering posterior of elytral humeri. Elytra sparsely punctate, lacking distinct puncture rows. Abutting abdominal ventrites distinctly undulose, ventrite I about as long as ventrite II. Pads on tarsomeres 3 and 4 bilobed.

Valdopogon simpsoni Tihelka & Cai **sp. nov.**
(Figs 1, 2)
urn:lsid:zoobank.org:act: 216164BF-BF10-406F-AC06-4BA41C8798FD

Material. Holotype, NIGP203316. The holotype is a fragment of the beetle's torso, preserving the posterior portion of the pronotum and anterior portion of the abdomen.

Etymology. The species is named in honour of Mr. Martin Simpson, palaeontologist and fossil collector, who found the amber and donated it for our study.

Diagnosis. As for the genus (*vide supra*).

Type locality and horizon. Early Barremian (~125 Ma) amber fragment derived from plant debris bed L6 exposed above the Chilton Chine Sandstone at Chilton Chine, Wessex Formation, southwestern coast of Isle of Wight, UK.

Description. Body oval-shaped, incomplete fragment 3.49 mm long, 1.73 mm wide at elytral humeri. Body surface punctate, with recumbent setae. Colour uniformly dark bronze to black.

Head and prothorax not preserved. Pronotum anteriorly slightly narrower than elytral humeri. Lateral pronotal margin smooth. Anterior pronotal angles slightly acute. Base of pronotum without distinct grooves or cavities. Procoxal cavities strongly transverse, moderately narrowly separated, broadly open posteriorly.

Mesoventrite short. Mesocoxae globular, open laterally, separated by approximately twice their length. Metaventrite longer than mesoventrite, convex, lacking transverse suture or postcoxal lines; discrimen incomplete. Metacoxae contiguous, meeting epipleura laterally.

Elytra tapering posterior of elytral humeri. Epipleura developed throughout preserved elytral length. Elytral surface sparsely punctate and clothed in recumbent setae, particularly at margin, without distinct striae.

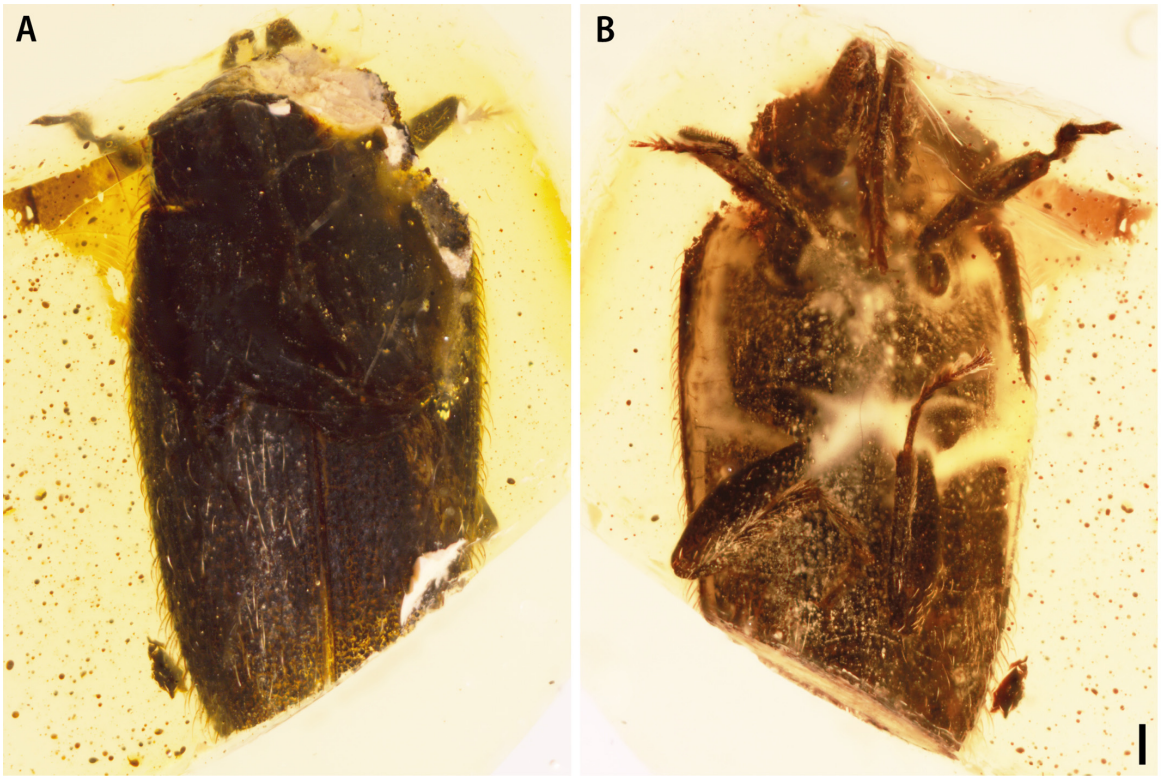

FIGURE 1. Habitus photographs of *Valdopogon simpsoni* **gen. et sp. nov.** (holotype, NIGP203316) under reflected light. **A**, Dorsal view. **B**, Ventral view. Scale bar = 200 μm.

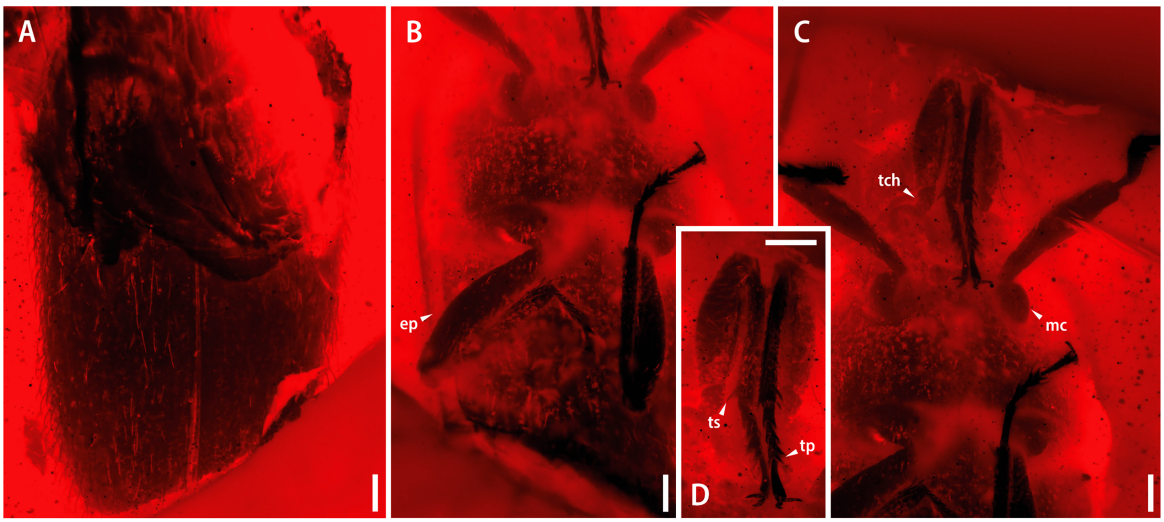

FIGURE 2. Morphological details of *Valdopogon simpsoni* **gen. et sp. nov.** (holotype, NIGP203316) under red epifluorescence. **A**, Fragment of elytra. **B**, Metaventrite and abdominal ventrites. **C**, Pro- and mesothorax. **D**, Detail of prothoracic legs. Abbreviations: ep, epipleura; mc, mesocoxa; tch, trochanter; tp, bilobed tarsal pad; ts, tibial spur. Scale bars = 200 μm.

Legs moderately long and slender. Femora broadest in apical third. Tibia with two equal and short spurs. Tarsi shorter than tibiae, ratio of mesotarsomere lengths (in mm): 0.24 : 0.07 : 0.07 : 0.05 : 0.20. Tarsomeres 3 and 4 with deeply bifid ventral membranous lobe. Claws simple.

Ventrites gradually narrowing posteriorly, lacking setose tufts. Ventrites I–III of equal length, ~0.4 mm, sutures between ventrites I–V curved, most distinct posteriorly. Only basal portion of ventrite V preserved.

Discussion. Despite its fragmentary nature, *Valdopogon simpsoni* **gen. et sp. nov.** can be confidently assigned to the family Artematopodidae based on the combination of lobed tarsomeres 3 and 4, slightly excavate metacoxae with metacoxal plates narrow and complete, and strongly curved sutures between abdominal ventrites IV and V (Cai *et al.*, 2015). Nonetheless, it differs from extant artematopodids in several important characters. The genus is unique among artematopodids with its equally long abdominal ventrites I and II, while in all other taxa the basal ventrite is distinctly shorter. Furthermore, the sutures between ventrites I–V are wavy; in other artematopodids they are typically straight or only the junction between ventrites IV and V is concave. In contrast to extant artematopodids that have 11 or 12 puncture rows on each elytron (10 in the Cretaceous genera *Bipogonia* and *Carinibipogonia*), the new fossil lacks distinct punctate rows on the elytra, which superficially resembles *Ctesibius*, where the striation is indistinct (Lawrence, 2005; Li *et al.*, 2022). A further shared character between the two genera is the slightly acute posterior pronotal angles. Despite the similarity to the subfamily Artematopodinae, we refrain from formally classifying *Valdopogon* **gen. nov.** While the unusual genera *Allopogonia* (Allopogoninae) and *Electribius* (Electribiinae) have been recovered as the earliest-diverging members of the family in phylogenetic analyses, these are contingent upon adequate character polarization, which is challenging for early-diverging families such as Artematopodidae separated from its closest relatives, the soft-bodied Omethidae and Telegeusidae, by a large morphological gap.

The new fossil adds to our understanding of the morphological disparity of artematopodids. With extant artematopodids restricted to the New World, Italy, and East Asia, *V. simpsoni* **gen. et sp. nov.** represents the first described Laurasian taxon from the Mesozoic. Altogether, it indicates a broader biogeographical range and greater morphological diversity of the family in the Cretaceous than at the present time.

Acknowledgements

We are grateful to two anonymous reviewers for their constructive criticism. This work was supported by the National Natural Science Foundation of China (42222201, 42288201) and the Second Tibetan Plateau Scientific Expedition and Research project (2019QZKK0706), PIFI, and is a contribution to IGCP 679.

References

Azar, D., Perrichot, V., Néraudeau, D. & Nel, A. (2003) New psychodids from the Cretaceous ambers of Lebanon and France, with a discussion of *Eophlebotomus connectens* Cockerell, 1920 (Diptera, Psychodidae). *Annals of the Entomological Society of America*, 96, 117–126. https://doi.org/10.1603/0013-8746(2003)096[0117:NPFTCA]2.0.CO;2

Baranov, V., Giłka, W., Zakrzewska, M. & Jarzembowski, E. (2019) New non-biting midges (Diptera: Chironomidae) from Lower Cretaceous Wealden amber of the Isle of Wight (UK). *Cretaceous Research*, 95, 138–145. https://doi.org/10.1016/j.cretres.2018.11.012

Bray, P.S. & Anderson, K.B. (2008) The nature and fate of natural resins in the geosphere XIII: a probable pinaceous resin from the early Cretaceous (Barremian), Isle of Wight. *Geochemical*

Transactions, 9, 3.
https://doi.org/10.1186/1467-4866-9-3

Cai, C.Y., Fu, Y.Z. & Huang, D.Y. (2020) A large artematopodid beetle (Coleoptera: Elateroidea: Artematopodidae) from the Early Cretaceous of China and its systematic position. *Cretaceous Research*, 105, 103986.
https://doi.org/10.1016/j.cretres.2018.10.009

Cai, C.Y., Tihelka, E., Giacomelli, M., Lawrence, J.F., Ślipiński, A., Kundrata, R., Yamamoto, S., Thayer, M.K., Newton, A.F., Leschen, R.A.B., Gimmel, M.L., Lü, L., Engel, M.S., Bouchard, P., Huang, D.Y., Pisani, D. & Donoghue, P.C.J. (2022) Integrated phylogenomics and fossil data illuminate the evolution of beetles. *Royal Society Open Science*, 9, 211771.
https://doi.org/10.1098/rsos.211771

Cai, C.Y., Lawrence, J.F., Ślipiński, A. & Huang, D.Y. (2015) Jurassic artematopodid beetles and their implications for the early evolution of Artematopodidae (Coleoptera). *Systematic Entomology*, 40, 779–788.
https://doi.org/10.1111/syen.12131

Crowson, R.A. (1973) On a new superfamily Artematopoidea of polyphagan beetles, with the definition of two new fossil genera from the Baltic Amber. *Journal of Natural History*, 7, 225–238.
https://doi.org/10.1080/00222937300770181

Delclòs, X., Peñalver, E., Barrón, E., Peris, D., Grimaldi, D.A., Holz, M., Labandeira, C.C., Saupe, E.E., Scotese, C.R., Solórzano-Kraemer, M.M., Álvarez-Parra, S., Arillo, A., Azar, D., Cadena, E.A., Dal Corso, J., Kvaček, J., Monleón-Getino, A., Nel, A., Peyrot, D., Bueno-Cebollada, C.A., Gallardo, A., González-Fernández, B., Goula, M., Jaramillo, C., Kania-Kłosok, I., López-Del Valle, R., Lozano, R.P., Meléndez, N., Menor-Salván, C., Peña-Kairath, C., Perrichot, V., Rodrigo, A., Sánchez-García, A., Santer, M., Sarto i Monteys, V., Uhl, D., Viejo, J.L. & Pérez-de la Fuente, R. (2023) Amber and the Cretaceous resinous interval. *Earth-Science Reviews*, 243, 104486.
https://doi.org/10.1016/j.earscirev.2023.104486

Douglas, H.B., Kundrata, R., Brunke, A.J., Escalona, H.E., Chapados, J.T., Eyres, J., Richter, R., Savard, K., Ślipiński, A., McKenna, D. & Dettman, J.R. (2021) Anchored phylogenomics, evolution and systematics of Elateridae: are all bioluminescent Elateroidea derived click beetles? *Biology*, 10, 451.
https://doi.org/10.3390/biology10060451

Gale, A. (2019) Correlation, age and significance of Turonian Chalk hardgrounds in southern England and northern France: The roles of tectonics, eustasy, erosion and condensation. *Cretaceous Research*, 103, 104164.
https://doi.org/10.1016/j.cretres.2019.06.010

Hörnschemeyer, T. (1998) New species of *Electribius* Crowson 1973 (Coleoptera: Artematopodidae) from Baltic amber. *Paläontologische Zeitschrift*, 72, 299–305.
https://doi.org/10.1007/BF02988360

Jarzembowski, E. (1995) The first insects in Cretaceous (Wealden) amber from the UK. *Geology Today*, 11, 41–42.

Jarzembowski, E., Azar, D. & Nel, A. (2008) A new chironomid (Insecta: Diptera) from Wealden amber (Lower Cretaceous) of the Isle of Wight (UK). *Geologica Acta*, 6, 285–291.
https://doi.org/10.1344/105.000000257

Kundrata, R., Bocakova, M. & Bocak, L. (2014) The comprehensive phylogeny of the superfamily Elateroidea (Coleoptera: Elateriformia). *Molecular Phylogenetics and Evolution*, 76, 162–171.
https://doi.org/10.1016/j.ympev.2014.03.012

Lawrence, J.F. (2005) *Brevipogon*, a new genus of North American Artematopodidae (Coleoptera), with a key to world genera. *Coleopterists Bulletin*, 59, 223–236.
https://doi.org/10.1649/749

Lawrence, J.F. (2010) Artematopodidae Lacordaire, 1857. *In*: Leschen, R.A.B., Beutel, R.G. & Lawrence, J.F. (Eds), *Handbuch der Zoologie/Handbook of Zoology.* Band/Volume IV Arthropoda: Insecta Teilband/Part 38. Coleoptera, Beetles. Volume 2. Morphology and systematics (Polyphaga partim). W. DeGruyter, Berlin, pp. 42–47.
https://doi.org/10.1515/9783110911213.42

Li, Y.D., Huang, D.Y. & Cai, C.Y. (2021) Revisiting the systematic positions of two *Notocupes* species from the Lower Cretaceous of South China (Coleoptera: Polyphaga). *Zootaxa*, 5005 (1), 86–90.
https://doi.org/10.11646/zootaxa.5005.1.7

Li, Y.D., Kundrata, R., Huang, D.Y. & Cai, C.Y. (2022) First Artematopodidae from mid-Cretaceous amber of northern Myanmar (Coleoptera: Elateroidea). *Zootaxa*, 5129 (2), 257–271.
https://doi.org/10.11646/zootaxa.5129.2.6

McKenna, D.D., Wild, A.L., Kanda, K., Bellamy, C.L., Beutel, R.G., Caterino, M.S., Farnum, C.W., Hawks, D.C., Ivie, M.A., Jameson, M.L., Leschen, R.A.B., Marvaldi, A.E., Mchugh, J.V., Newton, A.F., Robertson, J.A., Thayer, M.K., Whiting, M.F., Lawrence, J.F., Ślipiński, A., Maddison, D.R. & Farrell, B.D. (2015) The beetle tree of life reveals that Coleoptera survived end-Permian mass extinction to diversify during the Cretaceous terrestrial revolution. *Systematic Entomology*, 40, 835–880.
https://doi.org/10.1111/syen.12132

Nicholas, C.J., Henwood, A.A. & Simpson, M. (1993) A new discovery of early Cretaceous (Wealden) amber from the Isle of Wight. *Geological Magazine*, 130, 847–850.
https://doi.org/10.1017/S0016756800023207

Peris, D., Ruzzier, E., Perrichot, V. & Delclòs, X. (2016) Evolutionary and paleobiological implications of Coleoptera (Insecta) from Tethyan-influenced Cretaceous ambers. *Geoscience Frontiers*, 7, 695–706.
https://doi.org/10.1016/j.gsf.2015.12.007

Perkovsky, E.E., Olmi, M., Müller, P., Guglielmino, A., Jarzembowski, E.A., Capradossi, L. & Rasnitsyn, A.P. (2021) A review of the fossil Embolemidae (Hymenoptera: Chrysidoidea), with description of seven new species and history of the family. *Cretaceous Research*, 121, 104708.
https://doi.org/10.1016/j.cretres.2020.104708

Selden, P.A. (2002) First British Mesozoic spider, from Cretaceous amber of the Isle of Wight, southern England. *Palaeontology*, 45, 973–983.
https://doi.org/10.1111/1475-4983.00271

Wu, H., Coty, D. & Ding, M. (2015) First artematopodid beetle in Mexican amber and its biogeographic implications (Coleoptera, Artematopodidae). *Alcheringa*, 39, 508–513.
https://doi.org/10.1080/03115518.2015.1041306

Zhang, S.Q., Che, L.H., Li, Y., Liang, D., Pang, H., Ślipiński, A. & Zhang, P. (2018) Evolutionary history of Coleoptera revealed by extensive sampling of genes and species. *Nature Communications*, 9, 205.
https://doi.org/10.1038/s41467-017-02644-4