Journal of Paleontology, 96(2), 2022, p. 375–378

Published by Cambridge University Press
on behalf of The Paleontological Society
0022-3360/22/1937-2337
doi: 10.1017/jpa.2021.102

JOURNAL OF PALEONTOLOGY
A PUBLICATION OF THE Paleontological SOCIETY

The first described fossil Oedemeridae (Insecta: Coleoptera) from Baltic amber

Karol Szawaryn,[1]* Elżbieta Sontag,[2] and Daniel Kubisz[3]

[1]Museum and Institute of Zoology, Polish Academy of Sciences, Wilcza 64, 00-679, Warsaw, Poland <k.szawaryn@gmail.com>
[2]Laboratory of Evolutionary Entomology and Museum of Amber Inclusions, Department of Invertebrate Zoology and Parasitology, Faculty of Biology, University of Gdańsk, Wita Stwosza 59, 80-308, Gdańsk, Poland <elzbieta.sontag@ug.edu.pl>
[3]Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Sławkowska 17, 31-016, Kraków, Poland <kubisz@muzeum.pan.krakow.pl>

Abstract.—Molecular dating estimates the appearance of the family Oedemeridae in the Early Cretaceous. Several fossil representatives are known from Spanish (105 Ma) and Myanmar (99 Ma) ambers. The family also has been mentioned by several authors to occur in Eocene Baltic amber, but virtually no species was described until now. Here, we provide a description of the first fossil oedemerid species from Eocene Baltic amber, which is classified within subfamily Oedemerinae, in the extant genus *Oedemera* Olivier as *Oedemera* (s. str.) *girulskii* n. sp. The presence of appendiculate pretarsal claws and relatively large eyes separate the new species from its extant congeners.

UUID: http://zoobank.org/24b0b919-8684-4908-b002-9521b071dcc8.

Introduction

False blister beetles (Oedemeridae) are a cosmopolitan group of beetles classified within superfamily Tenebrionoidea (Lawrence and Ślipiński, 2010). Up to now, ~1500 species have been described, with the most diverse fauna in Oriental and Neotropical Realms (Vázquez, 1993; Švihla, 2008; Lawrence and Ślipiński, 2010). Adult oedemerids are known as pollen and nectar feeders and frequently can be observed on flowers. While most of the temperate zone fauna is diurnal in activity, most of the tropical species are nocturnal (Kubisz, 2006). Larvae of most of the species are wood borers and inhabit damp, rotten wood. The exception is tribe Oedemerini, whose larvae inhabit stems of herbaceous plants.

Family Oedemeridae is divided into three subfamilies: Polypriinae, Calopodinae, and Oedemerinae (Lawrence, 2005). Cladistic analysis (Lawrence, 2005) of a limited morphological dataset of adults reconstructs all subfamilies forming a trichotomy. Molecular dating places the origin of the family in the Early Cretaceous at 103 Ma (McKenna et al., 2015), 122 Ma (Zhang et al., 2018) or 140 Ma (McKenna et al., 2019). There are various hypotheses which group of oedemerids is the stem group (Švihla, 1986; Lawrence, 2005), but subfamily Oedemerinae is considered the most derived. However, McKenna et al. (2019), based on transcriptome analyses, reconstructed *Oedemera nobilis* (Scopoli, 1763) (the type species of *Oedemera* Olivier) as the most basal representative of the family Oedemeridae, and as a sister taxon to the clade formed by *Ditylus* Fischer (Oedemerinae, Ditylini), *Pseudolycus* Guérin-Méneville (Oedemerinae, Asclerini), and *Thelyphassa* Pascoe (Oedemerinae, Asclerini).

*Corresponding author

The fossil record of Oedemeridae is very scarce. Several fossils are known from compressions from Jurassic–Cretaceous of China that originally were assigned to Oedemeridae but nowadays are not considered as oedemerid taxa (Kubisz, 2006; Peris, 2017). Thus the oldest member of the Oedemeridae, *Darwinylus marcosi* Peris, 2017, was described from the Lower Cretaceous Spanish amber (late Albian, 105 Ma) and presumably represents the subfamily Oedemerinae. However, due to missing metatarsi, some authors suggest that the taxonomic position of this taxon should be revised (Batelka et al., 2018). Recently, Vitali and Ellenberger (2019) described a representative of the false blister beetles, *Sparedrus archaicus* Vitali and Ellenberger, from the Upper Cretaceous Myanmar amber (Cenomanian, 99 Ma), which was classified within the subfamily Calopodinae. Subsequently, Vitali and Legalov (2020) added four additional species from the same amber source that were assigned to the fossil genus *Ditysparedrus* Vitali and Legalov, also placed in the subfamily Calopodinae.

Representatives of Oedemeridae also were found in Eocene Baltic amber by several authors (Berendt, 1845; Helm, 1896; Klebs, 1910; Larsson, 1978; Willemstein, 1987), however, virtually no species have been described. Alekseev et al. (2019), after examination of the holotype and original description, suggested that *Neopolypria nigra* Abdullah, 1964, may be closely related to the extant genus *Polypria* Chevrolat (tribe Polypriini), thus it would be another representative of false blister beetles in Eocene Baltic amber. However, Alekseev et al. (2019) placed that taxon as Tenebrionidae incertae sedis without formal transfer to Oedemeridae. Nonetheless, Oedemeridae specimens imbedded in amber are considered very rare. Here, we provide description of the first undoubted Oedemeridae representative from Baltic amber based on a female specimen described as *Oedemera* (s. str.) *girulskii* n. sp.

Material and methods

This study is based on a Baltic amber piece that was found in secondary amber deposits in Yantarny of the Sambian Peninsula in the Kaliningrad region (Russia), Prussian Formation "Blue Earth" layers. For opinions about Baltic amber age, history of its deposition, and origin, see supplementary material discussion in Szwedo and Drohojowska (2016) or Wolfe et al. (2016), Grimaldi and Ross (2017), Kosmowska-Ceranowicz (2017), and Stebner (2018).

The material was polished manually with emery papers of different grain sizes and subsequently shined with polishing powder. The specimen was examined and photographed with a Leica M205A stereomicroscope with Leica DM 6000 digital camera attached to a Leica Application Suite LAS 3.7. Terminology used in this paper follows Švihla (1999). Adobe Photoshop CS5 was used to prepare graphics.

Repository and institutional abbreviation.—The type specimen examined in this study is deposited in the Museum of Amber Inclusions, Gdańsk, Poland (MAIG).

Systematic paleontology

Family Oedemeridae Latreille, 1810
Subfamily Oedemerinae Latreille, 1810
Tribe Oedemerini Latreille, 1810
Genus *Oedemera* Olivier, 1789

Type species.—*Necydalis caerulea* Linnaeus, 1767; designated by Latreille, 1810 = *Oedemera nobilis* (Scopoli, 1763).

Occurrence.—The genus *Oedemera* includes ~80 species distributed in the Palearctic and Oriental realms (Kubisz, 2006; Švihla, 2008).

†*Oedemera* (*Oedemera*) *girulskii* new species
Figure 1

Holotype.—Female, MAIG no. 6785 (ex. coll. R. Girulski), beetle is included in elongate, oval, transparent, yellow piece of amber, without syninclusions, with several gas vesicles.

Diagnosis.—No trace of the connection between elytral veins 3 and 4 separates the newly described taxon from the subgenus *Oncomera* Stephens, where these veins are joined by an additional transverse vein. Moreover, the new specimen's antennal insertions are broadly separated (placed near the inner eye margin), while in *Oncomera* they are distinctly separated from the inner eye margin and placed much closer to each other. *Oedemera* (s. str.) *girulskii* n. sp. can be distinguished easily from extant relatives of the subgenus *Oedemera* by its distinctly appendiculate pretarsal claws (which is not observed in extant taxa), and its relatively large eyes.

Occurrence.—Baltic Sea coast, Yantarny settlement (formerly Palmnicken), Sambian (Samland) Peninsula, Kaliningrad Oblast, Russia. Baltic amber from Eocene "Blue Earth" layers, predominantly Bartonian age (41–37 Ma) (for more details, see Material and methods).

Description.—Length 4.76 mm. Without evident traces of coloration, seems to be unicolorous (Fig. 1.1, 1.2). Head elongate (Fig. 1.3), slightly rostrate, covered with large punctures, rugose, across eyes wider than width of pronotum; frons between antennal insertions broad, about as wide as the length of antennomere 1 and wider than distance between inner eye orbits between eyes dorsally; eyes large, prominent, finely faceted, distinctly emargined around the antennal socket, distance in the midlength between eyes larger than width of a single eye, inner eye margins converging anteriorly; temples distinct, shorter than eye length; labrum slightly emargined anteriorly. Mandible bidentate apically (Fig. 1.4). Maxillary palpomeres 2 and 4 sub-equal in length (Fig. 1.4); terminal palpomere narrow, elongate, parallel-sided, with oblique apex. Antennae reaching about two-thirds of elytral length (Fig. 1.1); scape about as long as antennomere 3; pedicel elongate, about twice as long as wide, and about one-third as long as scape; antennomeres 3–10 progressively decreasing in length; antennomere 11 (Fig. 1.8) as long as antennomere 6, distinctly sinuate, with emargination on outer surface in the median part filled with numerous short sensillae.

Pronotum elongate (Fig. 1.1), widest just below anterior margin, with two anterior and one basal depressions; anterior and basal pronotal margins with distinct carinae. Scutellar shield distinct, semicircular. Elytra elongate, leaving two last abdominal segments uncovered, narrowing toward apex from its basal one-seventh, humeral calli well developed, subhumeral vein not confluent with lateral margin, lateral margin of elytron not emargined, sutural margin roundly emargined, elytral apices broadly rounded, without apical spine. Wings present. Supracoxal process of metaventrite exceeding metacoxa in lateral view. Terminal abdominal ventrite distinctly truncate or slightly emargined apically (Fig. 1.7).

Legs slender, protibiae not thickened (Fig. 1.6), pro-, meso-, and metatibiae with two apical spurs of different length (Fig. 1.5), pro- (Fig. 1.6) and mesotarsomere 1 about as long as tarsomeres 2–4 combined, pro- and mesotarsomeres 3 and 4 broadened apically, tarsomere 4 distinctly emargined, metatarsus shorter than metatibia, metatarsomere 1 more than twice as long as tarsomeres 2 and 3 combined; pro- (Fig. 1.6) and pretarsal claws of middle and hind legs (Fig. 1.9) distinctly appendiculate.

Etymology.—The species is named after Robert Girulski, gemologist, who collected the examined amber piece.

Remarks.—This is the first undoubted oedemerid species described from Baltic amber. Although, occurrence of representatives of false blister beetles was mentioned by previous authors (Berendt, 1845; Helm, 1896; Klebs, 1910), their amber collections were probably lost and are not available for study.

Discussion

As noted above, fossil Oedemeridae are rare, however, they have been recognized in Baltic amber by several authors. In this paper, we described for the first time a fossil representative of the genus *Oedemera* and the first representative of the family Oedemeridae from the Eocene amber deposit.

https://doi.org/10.1017/jpa.2021.102 Published online by Cambridge University Press

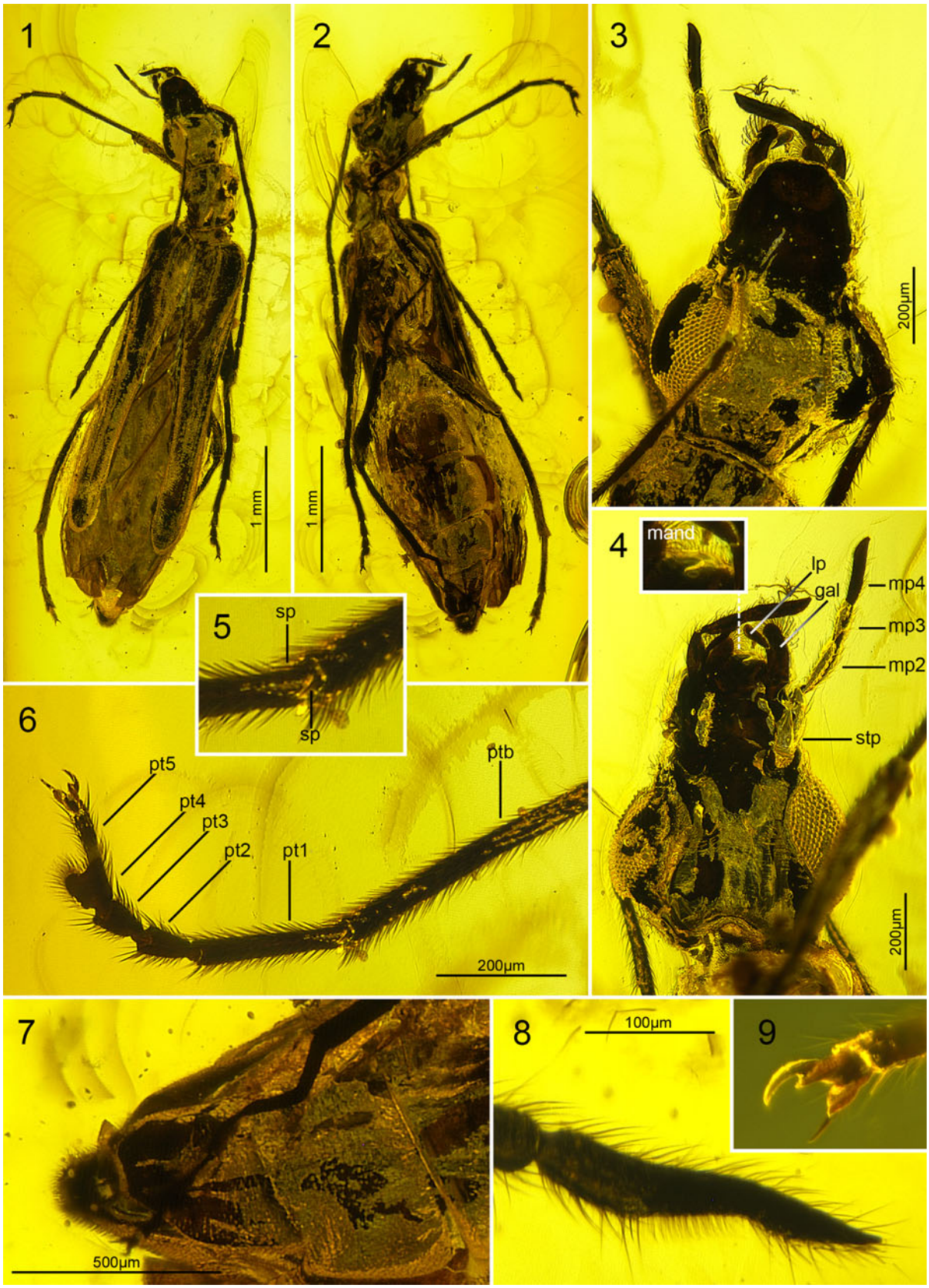

Figure 1. *Oedemera* (*Oedemera*) *girulskii* n. sp., from Baltic amber, MAIG 6785. (**1**) Habitus, dorsal; (**2**) habitus, ventral; (**3**) head, dorsal; (**4**) head, ventral, with magnification of the mandibular apex; (**5**) spurs on protibia; (**6**) protibia and protarsus; (**7**) terminal ventrites of abdomen; (**8**) terminal antennomere; (**9**) pretarsal claw of hind leg. gal = galea, lp = labial palp, mand = mandible, mp2–4 = maxillary palpomere 2–4, pt1–5 = protarsomere 1–5, ptb = protibia, sp = spur, stp = stipes.

https://doi.org/10.1017/jpa.2021.102 Published online by Cambridge University Press

Oedemera girulskii n. sp. in general appearance resembles modern species of the genus *Oedemera*. It possesses characters defined by Švihla (1999) as "primitive" (e.g., short frons, convex eyes, profemora not thickened, subhumeral elytral vein not confluent with lateral elytral margin), but also several "advanced" characters (e.g., strongly emarginate terminal antennomere, supracoxal process extending beyond metacoxae, shortened elytra not covering terminal abdominal segments, and last ventrite in female emarginate). Nonetheless, this mixture of morphological features does not allow assignment of this fossil species to any of the already defined species groups within the genus *Oedemera*.

Placement of *O. girulskii* n. sp. in *Oedemera* is supported by elytra narrowing apically, presence of two apical spurs on protibiae, and elytral veins not transversely connected (transverse connection is present in the subgenus *Oncomera* Stephens). On the other hand, the presence of appendiculate tarsal claws is a very unusual morphological feature that is neither observed in any extant representatives of the genus nor in the entire tribe Oedemerini (as defined by Švihla, 1986). However, this character is present in another tribe of Oedemerinae-Asclerini, which is more diverse, includes more genera, and is regarded as a more basal lineage (Švihla, 1986), while Oedemerini are more advanced. That may suggest that fossil *Oedemera girulskii* n. sp. with appendiculate tarsal claws represents a plesiomorphic state, which then evolved into simple, non-appendiculate tarsal claws in extant representatives of the genus.

Acknowledgments

We would like to thank R. Girulski for providing the type specimen. M. Kościesza (Museum and Institute of Zoology, PAS, Warsaw) is acknowledged for providing necessary literature. We also would like to thank two anonymous reviewers and the editors for their constructive comments.

References

Abdullah, M., 1964, New heteromerous beetles (Coleoptera) from the Baltic amber of eastern Prussia and gum copal of Zanzibar: Transactions of the Royal Entomological Society of London, v. 116, p. 329–346.

Alekseev, V.I., Pollock D.A., and Bukejs A., 2019, Two new fossil representatives of Eurypinae (Coleoptera: Tenebrionoidea: Mycteridae) from Eocene Baltic amber and placement of *Neopolypria nigra* Abdullah, 1964: Zootaxa, v. 4551, p. 67–078.

Batelka, J., Engel, M.S., and Prokop, J., 2018, A remarkable diversity of parasitoid beetles (Ripiphoridae) in Cretaceous amber, with a summary of the Mesozoic record of Tenebrionoidea: Cretaceous Research, v. 90, p. 296–310.

Berendt, G.C., 1845, Die im Bernstein befindlichen organischen Reste der Vorwelt gesammelt, in Verbindung mit Mehreren bearbeitet. Erster Band. Abtheilung I. Der Bernstein und die in ihm befindlichen Pflanzenreste der Vorwelt: Berlin, Nicolai, 125 p.

Grimaldi, D.A., and Ross, A.J., 2017, Extraordinary Lagerstätten in amber, with particular reference to the Cretaceous of Burma, *in* Fraser, N.C., and Sues, H.-D., eds., Terrestrial Conservation Lagerstätten. Windows into the Evolution of Life on Land: Edinburg, Dunedin Academic Press, p. 287–342.

Helm, O., 1896, Beiträge zur Kenntnis der Insecten des Bernsteins: Schriften der Naturforschenden Gesellschaft zu Danzig, v. 9, p. 220–231.

Klebs, R., 1910, Über Bernsteineinschlüsse in allgemeinen und die Coleopteren meiner Bernsteinsammlung: Schriften der Physikalisch-Ökonomischen Gesellschaft zu Königsberg, v. 51, p. 217–242.

Kosmowska-Ceranowicz, B., 2017, Bursztyn w Polsce i na świecie. Amber in Poland and in the World. Second Edition: Warszawa, Wydawnictwa Uniwersytetu Warszawskiego, 305 p.

Kubisz, D., 2006, Oedemeridae i Scraptiidae Polski (Coleoptera, Tenebrionoidea). Monografie Faunistyczne 24: Kraków, Wydawnictwa Instytutu Systematyki i Ewolucji Zwierząt, PAN, 165 p.

Larsson, S.G., 1978, Baltic amber—a palaeobiological study: Entomonograph, v. 1, p. 1–192.

Latreille, P.A., 1810, Considérations Générales sur l'Ordre Naturel des Animaux Composant les Classes des Crustacés, des Arachnides, et des Insectes : avec un tableau méthodique de leurs genres, disposés en familles: Paris, Schoell, 444 p.

Lawrence, J.F., 2005, *Dasytomima*, a new genus of Australian Oedemeridae and its relationship to *Polypria* Chevrolat (Coleoptera: Tenebrionoidea): Annales Zoologici, v. 55, p. 663–676.

Lawrence, J.F., and Ślipiński, S.A., 2010, Oedemeridae Latreille, 1810, *in* Leschen, R.A.B., and Beutel, R.G., eds., Handbook of Zoology, Arthropoda: Insecta: Volume 2: Morphology and Systematics (Elateroidea, Bostrichiformia, Cucujiformia partim): New York, Berlin, Walter de Gruyter, p. 674–681.

Linnaeus, C., 1767, Systema Naturae per regna tria naturae, secundum Classes, Ordines, Genera, Species, cum characteribus, differentiis, synonymis, locis. Editio Duodecima, Reformata. Tom. I. Pars II: Holmiae, Laurentii Salvii, p. 533–1327.

McKenna, D.D., Wild, A.L., Kanda, K., Bellamy, C.L., Beutel, R.G., et al., 2015, The beetle tree of life reveals that Coleoptera survived end of Permian mass extinction to diversify during the cretaceous terrestrial revolution: Systematic Entomology, v. 40, p. 835–880.

McKenna, D.D., Shin, S., Ahrens, D., Balke, M., Beza-Beza, C., et al., 2019, The evolution and genomic basis of beetle diversity: Proceedings of the National Academy of Sciences, v. 116, p. 24729–24737.

Olivier, G.A., 1789, Encyclopédie méthodique. Histoire Naturelle. Insectes., Vol. 4: Paris, Panckoucke, 331 p.

Peris, D., 2017, Early Cretaceous origin of pollen-feeding beetles (Insecta: Coleoptera: Oedemeridae): Cladistics, v. 33, p. 268–278.

Scopoli, J.A., 1763, Entomologia Carniolica exhibens Insecta Carnioliae indigena et distributa in ordines, genera, species, varietates, Methodo Linnaeana: Vindobonae [Vienna], Trattner, 420 p.

Stebner, F., 2018, Age of Baltic amber, *in* Szadziewski, R., Pytlos, R., and Szwedo, J., eds., Baltic Amber—Treasure of the Bay of Gdańsk: Gdańsk, Związek Miast i Gmin Morskich, p. 23–26.

Švihla, V., 1986, Revision of the generic classification of the Old World Oedemeridae (Col.): Acta Entomologica Musei Nationalis Pragae, v. 41B, p. 141–238.

Švihla, V., 1999, Revision of the subgenera *Stenaxis* and *Oedemera* s. str. of the genus *Oedemera* (Coleoptera: Oedemeridae): Folia Heyrovskyana, suppl. 4, p. 1–117.

Švihla, V., 2008, Family Oedemeridae Latreille, 1810, *in* Löbl, I., and Smetana, A., eds., Catalogue of Palaearctic Coleoptera 5. Tenebrionoidea: Stenstrup, Denmark, Apollo Books, p. 353–369.

Szwedo, J., and Drohojowska, J., 2016, A swarm of whiteflies—the first record of gregarious behaviour from Eocene Baltic amber: The Science of Nature, v. 103, 35. https://doi.org/10.1007/s00114-016-1359-y.

Vázquez, X.A., 1993, Coleoptera Oedemeridae, Pyrochroidae, Pythidae, Mycteridae. Fauna Iberica, vol. 5: Madrid, Museo Nacional de Ciencias Naturales, 181 p.

Vitali, F., and Ellenberger, S., 2019, *Sparedrus archaicus* n. sp., the first false blister beetle (Coleoptera, Oedemeridae) from Burmese amber: Baltic Journal of Coleopterology, v. 19, p. 23–27.

Vitali, F., and Legalov, A.A., 2020, A new fossil genus of false blister beetles (Coleoptera: Oedemeridae) from mid-Cretaceous Burmese amber: Biosis: Biological Systems, v. 1, p. 109–115.

Willemstein, S.C., 1987, An evolutionary basis for pollinatory ecology: Leiden Botanical Series, v. 10, p. 3–425.

Wolfe, A.P., McKellar, R.C., Tappert, R., Sodhi, R.N.S., and Muehlenbachs, K., 2016, Bitterfeld amber is not Baltic amber: Three geochemical tests and further constraints on the botanical affinities of succinite: Review of Palaeobotany and Palynology, v. 225, p. 21–32.

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

Accepted: 28 September 2021