Zootaxa 5739 (1): 004–007
https://www.mapress.com/zt/

Editorial

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

https://doi.org/10.11646/zootaxa.5739.1.3
http://zoobank.org/urn:lsid:zoobank.org:pub:89C457E6-A1E3-4479-ACF5-3919570A1844

Paleogene insects: fossil discoveries illuminating post-extinction terrestrial ecosystems

CHEN-YANG CAI[1,2*]
[1]*State Key Laboratory of Palaeobiology and Stratigraphy, Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, Nanjing 210008, China*
[2] *cycai@nigpas.ac.cn; https://orcid.org/0000-0002-9283-8323*
**Corresponding author*

The Paleogene (66–23 Ma) saw the dramatic aftermath of the Cretaceous–Paleogene mass extinction and the radiation of modern faunas. Paleogene climates were generally warm (culminating in the Early Eocene Climatic Optimum and transient hyperthermals such as the PETM) before cooling toward the Oligocene, and landscapes were often dominated by angiosperm forests. Insects radiated rapidly during this period of time, filling diverse niches and interacting with emerging ecosystems. Although Paleocene amber and compression fossil deposits are comparatively rare (Huang *et al*. 2022, 2024; Serio *et al*. 2025; Zhang *et al*. 2022), Eocene and early Oligocene fossil sites (including amber forests and lacustrine deposits) have yielded exceptionally rich insect faunas, preserving thousands of species across most major orders (Agnihotri *et al*. 2025; Cai 2025; Labandeira & Currano 2013; Wappler *et al*. 2012). For example, the Baltic amber (middle Eocene) alone is renowned as one of the richest fossil insect deposits in the world, containing well-preserved specimens of diverse insect orders (Alekseev *et al*. 2023; Cai *et al*. 2016). Similarly, lowermost Eocene amber from the Oise region of France preserves dozens of species from at least 17 orders, and early-middle Eocene lake beds in China, Denmark, Patagonia, and United States have revealed diverse fossil insects (Cai *et al*. 2017; Greenwalt & Sinclair 2024; Nel *et al*. 2023; Petrulevičius 2024). These records document the broad diversification of modern insect lineages in the Paleogene, and provide snapshots of past biogeography and ecology. The nine articles in this special issue, *Paleogene insects: Diversity and evolution*, sample this variety of deposits, taxa and regions. Together they showcase new data on insect diversity, sexual dimorphism, plant–insect interactions, and biogeographic links in the early Cenozoic.

Simonsen *et al*. (2025) describe *Danolestes moelleri*, the first fossil damselfly (Zygoptera, Lestoidea) from the Danish Fur Formation (earliest Eocene, Ypresian). The specimen was recovered from a silicified concretion of the PETM recovery interval. Comparisons show that *Danolestes* is allied to two extinct genera, *Priscalestes* (known from Western Europe) and *Promegalestes* (known from South America), highlighting unexpected biogeographic connections in the early Eocene. Indeed, this is only the second odonatan and the first damselfly described from the PETM deposits of Denmark. Such finds indicate a richer, more cosmopolitan Odonata fauna in the Fur lake environment than previously recognized. Moreover, the study provides a calibration point for phylogenetic models of Zygoptera and emphasizes the persistence of Mesozoic lineages into the Paleogene.

Azar (2025) reports the first female specimen of *Aradus superstes* Germar & Berendt, 1856 from Eocene Baltic amber. Flat bugs (Heteroptera: Aradidae) are well-known in Baltic amber. The newly described female of *A. superstes* provides new data on morphology and sexual dimorphism that were previously missing. This allows better diagnoses of *Aradus* species and reduces the risk of misidentifying solitary specimens (male or female) in the amber record.

Petrulevičius (2025) reports on a newly discovered male of the pentatomoid bug *Chinchekoala qunita* from the early Eocene Laguna del Hunco site of Patagonia, Argentina. Laguna del Hunco (~52 Ma) is famous for its richly preserved flora and fauna, including many insects. *Chinchekoala* is a rare pentatomoid lineage previously known only from a few specimens of *C. qunita* described by Petrulevičius (2016). The new male is assigned to the same species, allowing a fuller reconstruction of the bug's morphology. Interestingly, all *Chinchekoala* specimens so far show a consistent taphonomic pattern: fully articulated bodies but with most appendages (legs, wings, antennae)

 Accepted by D.-Y. Huang: 30 Dec. 2025; published: 31 Dec. 2025

missing or not preserved, except for genital structures. This suggests that the insects underwent a particular mode of preservation. Biogeographically, *Chinchekoala* was part of early Eocene pentatomoid fauna of Patagonia, which also includes other extant and extinct families. The new male adds to our taxonomic understanding and will inform reconstructions of bug evolution in Gondwanan South America.

Boderau *et al*. (2025a, b) report two new Hemiptera from Eocene Baltic amber. Using synchrotron X-ray tomography, they describe a new planthopper genus and species *Discotropiduchus junoi* (Tropiduchidae). Tropiduchid planthoppers today are mainly tropical, but their fossil record includes many Eocene species, especially in amber. *Discotropiduchus* differs markedly from any extant tropiduchid tribe, so the authors discuss possible affinities with known tribes. The discovery highlights the "remarkable diversity" of tropiduchids in Eocene forests and suggests there were extinct lineages missing from today's classification. The second paper documents a new fossil water-boatman (Micronectidae) in Baltic amber. Aquatic bugs are extremely rare in amber. Here the fossil is tentatively placed in the extant genus *Micronecta*. Both studies emphasize that even familiar amber deposits (like Baltic amber) still yield novel taxa and unexpected lifestyles. They also allow comparisons of Eocene ecological guilds: for instance, the presence of both terrestrial planthoppers and the aquatic Heteroptera suggests a fairly complete ecosystem in the amber forest.

Hebert *et al*. (2025a, b) contribute two studies of lowermost Eocene amber from Oise, France. First, they describe the oldest known *Leptosciarella* (Sciaridae), represented by a new species *L. menzeli*, and transfer a previously described Baltic amber species into *Leptosciarella*. Until now, the genus was known only from middle Eocene Baltic amber. These finds show that sciarid flies were already diverse in the earliest Eocene, implying that the family originated by the Cretaceous even though their Mesozoic record is scant. Second, they describe a new genus and species of Keroplatidae, *Eokelneria oisensis*, the first fossil of the tribe Robsonomyiini in the lowermost Eocene. Keroplatidae have a rich Eocene record (mostly Baltic amber) but no published record from Oise until now. Both papers extend the record of two sciaroid lineages into the Paleocene–Eocene boundary amber.

Wang *et al*. (2025) present a new assemblage of early Oligocene insects from the Ningming Basin, Guangxi Province, South China. Previous work showed the subtropical flora in Ningming and evidence for a nascent Asian monsoon by the Rupelian. Wang and coauthors report 98 specimens (5 orders) from newly discovered localities of Ningming. As documented in coeval deposits from North America (LaPolla 2023), ants (Formicidae) dominate the collection, but beetles, flies, wasps and other groups are also present. Importantly, they document four types of insect herbivory damage on fossil leaves, providing direct evidence of plant–insect interactions in the Oligocene monsoon forest. The palaeoenvironment inferred from leaves is consistent with previous palynological and CLAMP analyses of Ningming. This study expands our knowledge of the early Oligocene entomofauna of southern China, demonstrating that diverse insect communities lived under the warm, wet monsoon regime.

Finally, Ni *et al*. (2025) report two new Paleogene fossil insect localities in Henan Province, central China. Previous Chinese Paleogene insect finds are dominated by Eocene Fushun amber; insect compression fossils were few (Zhang *et al*. 2022). Ni and colleagues found abundant insects in two sedimentary formations: the middle–upper Eocene Hetaoyuan Formation (near Tanghe City) and the middle–upper Eocene Wulidun Formation (near Tongbai County). These deposits have yielded numerous compression fossils of insects and plants. Preliminary surveys indicate a diverse assemblage, demonstrating that central China harbours productive Eocene lacustrine sites. These newly discovered localities are poised to fill the geographic gaps in the fossil record of Paleogene insects across Asia, providing comparanda for both the coeval insect faunas preserved in Europea and their counterparts in North America. As Cenozoic insect-bearing deposits in China gain greater recognition, they will shed new light on the spatiotemporal dynamics of insect diversity and ecology across the Northern Hemisphere during the early Cenozoic.

Together, the papers in this issue illustrate the high biodiversity and broad geographic range of Paleogene insects. They include records of Odonata, Hemiptera, Diptera, Coleoptera, Hymenoptera and many other groups in amber and rock. New discoveries highlight how much remains to be learned about early Cenozoic entomofaunas. By synthesizing these contributions, the issue highlights the value of the Paleogene insects for understanding insect evolution—tracking the origins of modern lineages, their responses to climatic changes, and the assembly and rise of post-extinction terrestrial ecosystems.

References

Agnihotri, P., Singh, V.P., Singh, H., Grimaldi, D., Thakkar, M.G., Priya, T., Subramanian, K.A., Dutta, S. & Mishra, S. (2025) Eocene amber fossils reveal how complex trophic interactions shaped tropical rainforest biodiversity. *iScience*, 28 (9), 113430.
https://doi.org/10.1016/j.isci.2025.113430

Alekseev, V., Pankowski, M.V. & Bukejs, A. (2023) A new fossil species of *Nausibius* (Coleoptera: Silvanidae) in Rovno amber: a beetle from Eocene forests with congeners thriving in warehouses today. *Palaeoentomology*, 6 (6), 630–638.
https://doi.org/10.11646/palaeoentomology.6.6.5

Azar, D. (2025) Description of the female of *Aradus superstes* Germar & Berendt, 1856 from the Eocene Baltic amber (Hemiptera: Aradidae). *Zootaxa*, 5739 (1), 8–12.
https://doi.org/10.11646/zootaxa.5739.1.4

Boderau, M., Peng, A., Hoffeins, C., Fu, Y. & Nel, A. (2025a) The first occurrence of water boatmen family Micronectidae (Nepomorpha: Corixoidea) in Eocene Baltic amber. *Zootaxa*, 5739 (1), 75–82.
https://doi.org/10.11646/zootaxa.5739.1.12

Boderau, M., Peng, A., Jouault, C. & Nel, A. (2025b) Synchrotron X-ray tomography reveals a new genus of tropiduchid planthopper (Hemiptera: Fulgoromorpha) from Eocene Baltic amber. *Zootaxa*, 5739 (1), 60–68.
https://doi.org/10.11646/zootaxa.5739.1.10

Cai, C.Y. (2025) Rainforest ecology in the shade of deep time. *Trends in Ecology & Evolution*, 40 (10), 939–941.
https://doi.org/10.1016/j.tree.2025.09.006

Cai, C.Y., Huang, D.Y., Wu, F.X., Zhao, M. & Wang, N. (2019) Tertiary water striders (Hemiptera: Gerromorpha: Gerridae) from the central Tibetan Plateau and their palaeobiogeographic implications. *Journal of Asian Earth Sciences*, 175, 121–127. https://doi.org/10.1016/j.jseaes.2017.12.014

Cai, C.Y., Leschen, R.A., Liu, Y. & Huang, D. (2016) First fossil jacobsoniid beetle (Coleoptera): *Derolathrus groehni* n. sp. from Eocene Baltic amber. *Journal of Paleontology*, 89 (5), 762–767.
https://doi.org/10.1017/jpa.2015.65

Greenwalt, D.E. & Sinclair, B.J. (2024) The fossil record of female sexual ornamentation in Empididae (Diptera: Empidoidea), with description of four new species. *Palaeoentomology*, 7 (5), 611–627.
https://doi.org/10.11646/palaeoentomology.7.5.5

Hebert, F., Ngo Muller, V. & Nel, A. (2025a) The oldest representative of sciarid genus *Leptosciarella* (Diptera) from the lowermost Eocene amber of Oise (France). *Zootaxa*, 5739 (1), 42–52.
https://doi.org/10.11646/zootaxa.5739.1.8

Hebert, F., Ngô Muller, V. & Nel, A. (2025b) First Keroplatidae Robsonomyiini (Diptera: Sciaroidea) from the lowermost Eocene Oise amber (France). *Zootaxa*, 5739 (1), 53–59.
https://doi.org/10.11646/zootaxa.5739.1.9

Huang, D., Lian, X., Jouault, C., Gao, J. & Nel, A. (2022) First green lacewing (Insecta: Neuroptera: Chrysopidae) from the Paleocene Sanshui Basin of Guangdong, South China. *Historical Biology*, 34 (4), 704–712.
https://doi.org/10.1080/08912963.2021.1943381

Huang, D., Lian, X. & Nel, A. (2024) A new damselfly family from the Paleocene of the Sanshui Basin, South China (Odonata: Zygoptera). *Journal of Paleontology*, 98 (6), 1041–1047.
https://doi.org/10.1017/jpa.2024.43

Labandeira, C.C. & Currano, E.D. (2013) The fossil record of plant–insect dynamics. A*nnual Review of Earth and Planetary Sciences*, 41, 287–311.
https://doi.org/10.1146/annurev-earth-050212-124139

LaPolla, J.S. (2023) Fossil ants (Hymenoptera: Formicidae) of the early Oligocene Canyon Ferry Reservoir deposit. *Palaeoentomology*, 6 (4), 385–397.
https://doi.org/10.11646/palaeoentomology.6.4.10

Nel, A., Palazzo, G.J. & Aase, A. (2023) A new damselfly from the Lower Eocene Green River Formation (Odonata: Dysagrionidae). *Palaeoentomology*, 6 (4), 336–339.
https://doi.org/10.11646/palaeoentomology.6.4.5

Ni, Z., Nel, A., Ji, G. & Huang, D. (2025) Two new Paleogene insect fossil localities in southern Henan Province, central China. *Zootaxa*, 5739 (1), 69–74.
https://doi.org/10.11646/zootaxa.5739.1.11

Petrulevičius, J.F. (2016) A new pentatomoid bug from the Ypresian of Patagonia, Argentina. *Acta Palaeontologica Polonica*, 61 (4), 863–868.
https://doi.org/10.4202/app.00308.2016

Petrulevičius, J.F. (2024) A new species of *Treintamilun* (Odonata: Frenguelliidae) from the early Eocene of Laguna del Hunco, Patagonia, Argentina. *Palaeoentomology*, 7 (6), 715–718.
https://doi.org/10.11646/palaeoentomology.7.6.6

Petrulevičius, J.F. (2025) The male of the pentatomoid bug genus *Chinchekoala* from the Ypresian of Patagonia, Argentina. *Zootaxa*, 5739 (1), 36–41.
https://doi.org/10.11646/zootaxa.5739.1.7

Serio, M., Song, X.B., Hu, H., Cai, C.Y. & Huang, D.Y. (2025) Paleocene amber from Sanshui Basin. *Palaeoentomology*, 8 (2), 125–128.
https://doi.org/10.11646/palaeoentomology.8.2.2

Simonsen, T.J., Archibald, S.B., Rasmussen, J.A., Sylvestersen, R.L., Olsen, K. & Ware, J.L. (2025) *Danolestes moelleri* gen. et sp. nov., the first lestoid (Zygoptera: Odonata) from the early Ypresian Fur Formation of Denmark shows faunistic affinity to South America. *Zootaxa*, 5739 (1), 13–20.
https://doi.org/10.11646/zootaxa.5739.1.5

Wang, Y., Nel, A., Cai, C., Fu, Y., Liu, Q., Zeng, G., Lian, X. & Huang, D. (2025) New insect assemblage from the early Oligocene in Ningming Basin, Guangxi, China. *Zootaxa*, 5739 (1), 21–35.
https://doi.org/10.11646/zootaxa.5739.1.6

Wappler, T., Labandeira, C.C., Rust, J., Frankenhäuser, H. & Wilde, V. (2012) Testing for the effects and consequences of mid-Paleogene climate change on insect herbivory. *PLoS ONE*, 7 (7), e40744.
https://doi.org/10.1371/journal.pone.0040744

Zhang, Z.J., Wang, X., Liu, Z. & Zhang, X.Q. (2022) A brief report on the Paleocene insects from the Sanshui Basin of Guangdong, South China. *Palaeoentomology*, 5 (2), 167–172.
https://doi.org/10.11646/palaeoentomology.5.2.10