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Gedanoleria eocenica – a new genus and species from Eocene Baltic amber (Diptera: Heleomyzidae), with notes on heleomyzid-like flies from African copal

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ABSTRACT. A new genus and species of a handsome heleomyzid fly, *Gedanoleria eocenica* gen. nov., sp. nov. (Diptera: Heleomyzidae), is described from Baltic amber. The newly described genus is compared with similar extant and extinct genera. The heleomyzid-like flies described by MEUNIER from African copal are treated as nomina dubia. A checklist and a key to the genera of Heleomyzidae reported from fossil resins are also provided.

KEY WORDS: Heleomyzinae, Paleogene, succinite, African copal, taxonomy, fossils, key, checklist.

INTRODUCTION

Succinite or Baltic amber is the richest repository of fossil insects of all geological periods. So far, some 1250 Diptera species have been described from this material (SZADZIEWSKI et al. 2018). Even so, knowledge of the fauna of Eocene Baltic amber forests is still insufficient (only about 1% of extant species of dipterans). Therefore, studies of fossils, preserved as inclusions in amber, are important because they provide an additional scientific source for reconstructing the phylogeny and for understanding the present-day relationships of extant groups.

Among acalyptrate dipterans recorded in Baltic amber, Heleomyzidae or sun-flies are one of the richest families of flies (TSCHIRNHAUS & HOFFEINS 2009). Eight genera of Heleomyzidae have hitherto been recorded from Baltic amber (EVENHUIS 1994, 2014,

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WOŹNICA & PALACZYK 2005, WOŹNICA 2006a, 2007), and another seven heleomyzid species identified on the basis of compressions or impressions have been described (EVENHUIS 1994). Most of them are generally in a bad condition and only partially preserved: as the descriptions are rather basic, the material requires re-examination.

Like currently recorded fossil species, the majority of extinct taxa represented a variety of habitat preferences. Moreover, only two genera – *Suillia* ROBINEAU-DESVOIDY, 1830 and *Heteromyza* FALLÉN, 1820 – are also known in the recent fauna. They mostly inhabit wooded areas, where their larvae develop in decaying animal or fungal debris, e.g. birds' nests or basidiomycete fungi. All the fossil heleomyzid genera described from Baltic amber are monotypic. The present study yielded a new genus and species in a piece of Baltic amber deposited in the HOFFEINS collection. It is described here within the subfamily Heleomyzinae sensu PAPP (1998) but is not categorized in any of the tribes proposed by MCALPINE (1985).

MATERIAL AND METHODS

The specimen described below was found among the Acalyptratae inclusions studied in the collection of Christel and Hans Werner HOFFEINS (Hamburg, Germany). The inclusion is preserved in a polished piece of amber, yellowish in colour, and embedded in GTS-polyester resin. The photograph was taken with a Canon 600d digital camera attached to a Nikon SMZ stereomicroscope, using computer graphic techniques (Corel Draw X6) and the CombineZP photo stacking method. Figs. 2-4 are based on digital drawings produced with the Corel Designer X6 program during the examination of the original specimen. The morphological terminology and abbreviations follow those proposed by CUMMING & WOOD (2018) and WOŹNICA (2003, 2006b). This inclusion from the HOFFEINS Collection (CCHH) will be deposited at the Senckenberg Deutsches Entomologisches Institut, Müncheberg, Germany (SDEI). The colours of the inclusions in Baltic amber described below are not important and have no diagnostic value, as they are not well preserved or were altered during the process of fossilization (SZADZIEWSKI 1988).

RESULTS

Descriptions

Class Insecta LINNAEUS, 1758

Order Diptera LINNAEUS, 1758

Superfamily Sphaeroceroidea MACQUART, 1835

Family Heleomyzidae WESTWOOD, 1840
Subfamily: Heleomyzinae WESTWOOD, 1840

***Gedanoleria* gen. nov.**

Type species. ***Gedanoleria eocenica*** sp. nov.; present designation.

Diagnosis

Gedanoleria is readily distinguished among fossil and extant Heleomyzidae by the numerous dorsocentral setae (7), bare anepisternum, lack of scapular seta, one distinct proepimeral seta, and distinctly protruding cheek (see key). Female unknown.

Etymology

The generic name is a combination of Gedanum – the Latin appellation of Gdańsk – and the generic heleomyzid name *Leria*.

***Gedanoleria eocenica* sp. nov.**
(Figs. 1–4)

Diagnosis

As for the genus.

Description. Body dark brown, with silver dusting and shiny (Fig. 1). Body length: ca 2.3 mm (without antennae).

Head

Head ratio ca 1.3 with distinctly protruding cheek (Fig. 2). One vibrissa present, peristomal setulae well developed and distinctly larger than the other situated behind the eye border, in two irregular rows. Eyes big and slightly oval. Cheek small and protruding at the apex, cheek-eye ratio <0.2. Face slightly darker than genal area. Palpus pale, rounded apically, hypostom with some short setulae on lower margin.

Antenna

Scape and pedicel dark, almost blackish. Scape bare, without setae, pedicel with single big apical seta anterodorsally. First flagellomere large, round and black (first-flagellomere to cheek ratio ca 3.0). Arista pubescent, shorter than height of head. Frons covered by

Fig. 1. *Gedanoleria eocenica* **sp. nov**., male in lateral view.

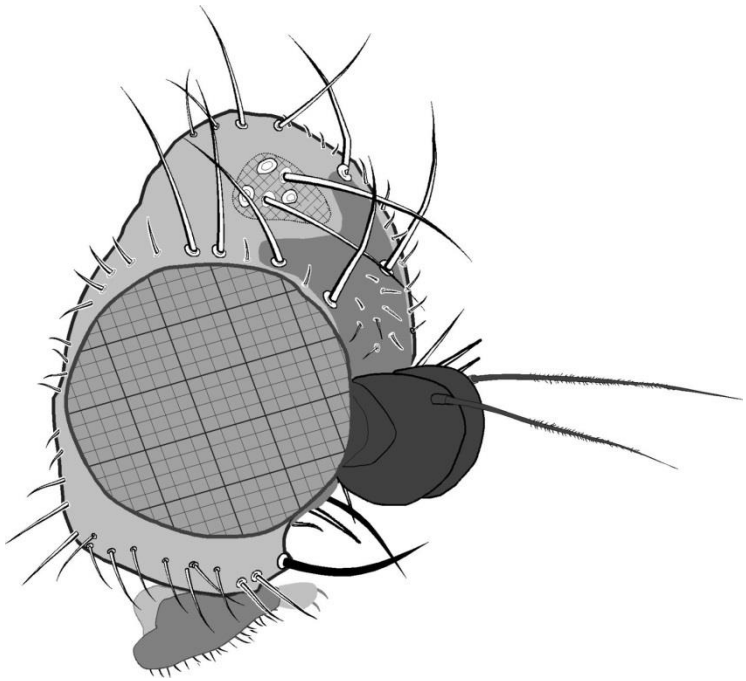

Fig. 2. ***Gedanoleria eocenica*** **sp. nov**., head in laterodorsal view.

a few, small setulae, entirely dark, almost blackish-brown, except the eye-margins (Fig. 2). Frontal plate elongated, with two equal orbital setae. Distance between setae the same as that from anterior orbital seta to frontal margin (Fig. 2). A pair of strong ocellar setae, two well-developed vertical setae, postocellars medium sized and cruciate.

Thorax

Prosternum elongated and bare. Mesonotum chaetotaxy typical of Heleomyzinae, except for the number of dorsocentrals and acrostichals. One well-developed postpronotal, two notopleurals, one presutural, one supra-alar and two post-alar setae present. Mesonotum sparsely setulose, with seven pairs of dorsocentral setae; none of them arising from spots (Fig. 3): one/two of them in presutural area, 5 to6 behind suture. Postsutural

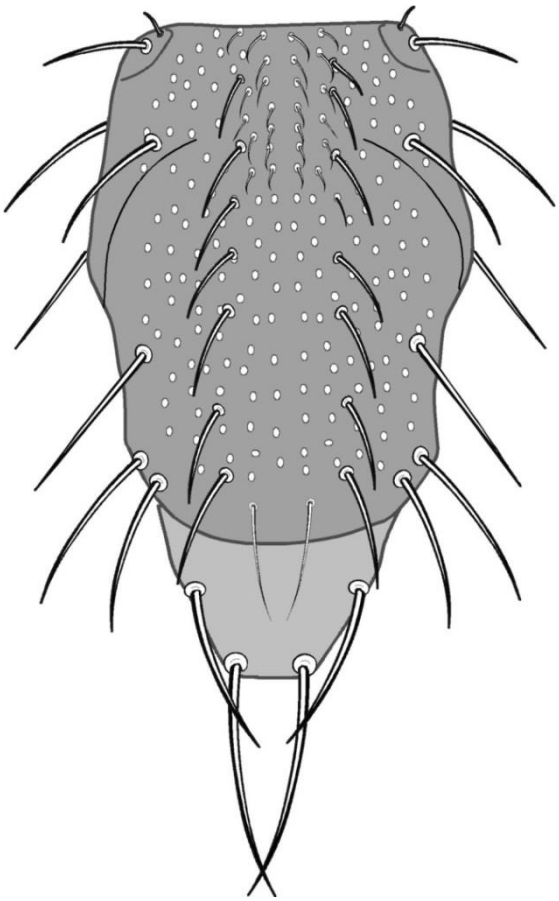

Fig. 3. *Gedanoleria eocenica* sp. nov., scheme of thoracic chaetotaxy in dorsal view.

Postsutural dorsocentral setae relatively strong, especially last three distally. A pair of prescutellar setae are well developed. Scutellum slightly elongated, not pointed apically, dark and bare, except for two pairs of scutellars, the proximal pair shorter than the distal one. Acrostichals in four irregular rows. Proepisternum setulose with one well-developed seta (missing on left side). One proepimeral seta with any additional setae in anterior corner of anepimeron. Anepisternum and meron entirely bare. Katepisternum entirely bare, except for setulose margins between coxae. Two katepisternal setae, posterior one much longer (anterior about 1/3 - ½ x posterior one) with a row of few setulae in front of them.

Wing (Fig. 4) longer than total length of body, ca 2.4 mm, width ca 1.0 mm. Wing membrane transparent, anal vein well developed. Costa with short, weak costal spines dorsally, especially anteriorly to subcostal break. Subcostal cell similar to that of non-*Orbellia* species, with subcostal vein ending before anterior cross-vein. Longitudinal veins pale, yellowish-brown. Cross-veins not darkened, r-m and dm-cu well developed. Medial vein ratio ca 1.45 (left wing). Haltere whitish, with an elongated and slightly sharpened knob at apex.

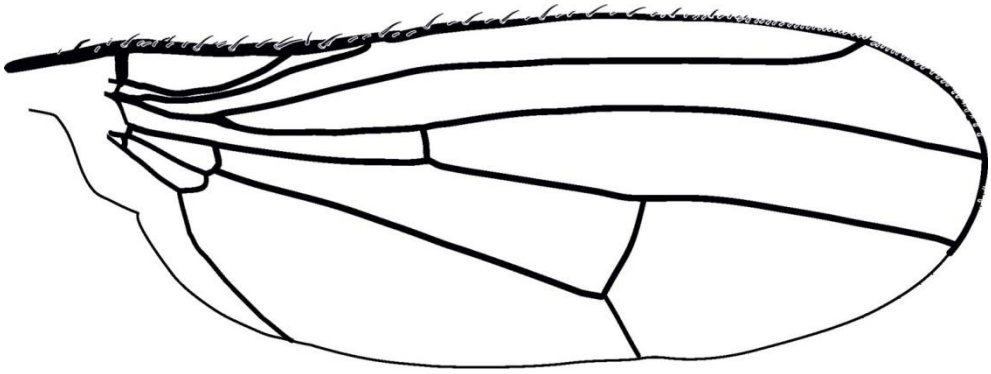

Fig. 4. *Gedanoleria eocenica* sp. nov., scheme of wing venation in lateral view.

Legs slender, mainly short setose. Fore femur with two rows of strong setae antero-, and posterodorsally. Mid femur with one row of setae well developed anterodorsally. Hind femur without dorsolateral setae. All tibiae short, setulose, each one with a single small preapical seta. Tarsomeres not darkened. First tarsomere of all tarsi much longer than second one (ca twice as long as second tarsomere). Claws much longer than small and whitish pulvilli.

Abdomen

Abdominal segments dark brown. Segments I-VI well developed; first five symmetrical, rather short and sparsely setulose, with weak lateral marginal setae. Segment VI slightly asymmetrical, with distinctly longer setae in distal half. Epandrium brown, rather small and rounded, short and sparsely setulose. Cerci long haired.

Type material

Holotype, male: No. 1665-3 / Baltic Amber / Coll. Christel and Hans Werner HOFFEINS //. *Gedanoleria eocenica* WOŹNICA, 2019 gen. et sp. n. [M] (red). Inclusion embedded in polyester block 11.65x10.65x4.0 mm.

Etymology. The specific epithet refers to the Eocene, the geological time of the species' origin.

DISCUSSION

The newly described genus is a typical representative of the subfamily Heleomyzinae in having the following characters: distinct preapical seta on all tibiae, wings with well-developed costal spines and anal vein reaching wing margin. It differs from all known fossil genera in having 7 pairs of dorsocentral setae. WOŹNICA (2006a) described the new genus *Protoorbellia* and mentioned the high variability in the number of dorsocentral setae in recent *Orbellia* species. According to GORODKOV's hypothesis (1972), the number of these setae in recent Heleomyzidae in all probability underwent oligomerization, which may now characterize the taxa included within Heleomyzini (GORODKOV 1984). The presence of a short arista and distinct proepimeral seta are plesiomorphic character states of the genus. The apomorphic characters are as follows: minute, hair-like acrostichals, and two big, equal orbital setae (as in recent *Heleomyza* species).

Checklist of Heleomyzidae described from fossilized tree resin (modified after EVENHUIS 1994)

Although Heleomyzid flies have often been included in lists of fossil taxa, only EVENHUIS (2014) and TSCHIRNHAUS & HOFFEINS (2009) provided checklists of fossil heleomyzid flies. Unfortunately, the former author did not include the taxa described by WOŹNICA (2005, 2006a, 2007), while the latter mentioned those only taxa described from amber. Prior to the present investigation, 12 species were classified within two subfamilies of Heleomyzidae (EVENHUIS 2014) and reported as extinct, known only from fossilized resin.

I have removed from the family other heleomyzid flies found as inclusions in copal from Accra, Zanzibar and Madagascar, described by Meunier, and treat them as *nomina dubia*. With just MEUNIER's original drawings and descriptions to hand, there is no basis upon which to determine which genus or even family they represent. According to the original description, *Helomyza humilis* MEUNIER, 1919 does not belong to Heleomyzidae. The elongated antennal segments (MEUNIER 1910: Fig. 7) are not of the heleomyzid-shape type; rather, they resemble those in Sciomyzidae. Also, neither *Leria* species (MEUNIER 1910: Figs 9, 12) are typical heleomyzid flies, so their classification in the genus *Heleomyza* FALLÉN, 1910 (EVENHUIS 1994), a typical Holarctic taxon, is unjustifiable: they are very small flies, with a body length of no more than 2 mm and a head chaetotaxy of the non-Sphaeroceroid type. According to the sketchy original description, the genus *Leriella* MEUNIER, 1908 resembles representatives of various Acalyptratae families. Re-examination of the types of these species would shed new light on their taxonomic position. Presumably, they will be removed from Heleomyzidae and transferred to other families of Diptera.

Subfamily Heleomyzinae

Genus *Balticoleria* WOŹNICA, 2007: 84.

Balticoleria michaeli WOŹNICA, 2007: 85. Baltic amber, Eocene, 56−33.9 Ma (WOŹNICA 2007, TSCHIRNHAUS & HOFFEINS 2009).

Genus *Chaetohelomyza* HENNIG, 1965: 148.

Chaetohelomyza electrica HENNIG, 1965. Baltic amber, Eocene, 56−33.9 Ma (HENNIG 1965, TSCHIRNHAUS & HOFFEINS 2009).

Genus *Electroleria* HENNIG, 1965: 150.

Electroleria alacris (MEUNIER, 1904: 25). Baltic amber, Bitterfeld amber, Eocene, 56−33.9 Ma (HENNIG 1965, 1969, TSCHIRNHAUS & HOFFEINS 2009).

Genus *Gedanoleria* WOŹNICA, 2019: 397.

Gedanoleria eocenica WOŹNICA, 2019. Baltic amber, Eocene, 56−33.9 Ma (present paper).

Genus *Heteromyza* FALLÉN, 1820a: 1.

Heteromyza dubia MEUNIER, 1904: 25. Baltic amber, Eocene, 56−33.9 Ma, Bitterfeld (MEUNIER 1904, HENNIG 1965, 1969, TSCHIRNHAUS & HOFFEINS 2009)

Genus *Paleoheleomyza* WOŹNICA et PALACZYK 2005: 374.

Paleoheleomyza kotejai WOŹNICA et PALACZYK 2005: 374. Baltic amber, Eocene, 56−33.9 Ma (WOŹNICA & PALACZYK 2005, TSCHIRNHAUS & HOFFEINS 2009).

Genus *Protoorbellia* WOŹNICA 2006: 148.

Protoorbellia hoffeinsorum WOŹNICA 2006: 148. Baltic amber, Eocene, 56−33.9 Ma (WOŹNICA 2006, TSCHIRNHAUS & HOFFEINS 2009).

Subfamily Suilliinae

Genus *Protosuillia* HENNIG, 1965: 145.

Protosuillia media (MEUNIER, 1904: 24): Baltic amber, Eocene, 56−33.9 Ma (HENNIG 1965, 1969, TSCHIRNHAUS & HOFFEINS 2009).

Genus *Suillia* ROBINEAU-DESVOIDY, 1830: 642.

Suillia major (MEUNIER, 1904: 22). Baltic amber, Bitterfeld amber, Eocene, 56−33.9 Ma, (HENNIG 1965, 1969, TSCHIRNHAUS & HOFFEINS 2009).

Nomina dubia

Helomyza humilis MEUNIER, 1910: 143. Afrotropical region: Tanzania (Zanzibar copal, Holocene, <1.6 Ma).

Leria insatiabilis MEUNIER, 1910: 145. Afrotropical region: Ghana (Accra copal, Holocene, <1.6 Ma).)

Leria insaturabilis MEUNIER, 1910: 144. Afrotropical region: Madagascar (Madagascan copal, Holocene <1.6 Ma).

Leriella crassifemorata MEUNIER, 1908: 6. Afrotropical region: Tanzania (Zanzibar copal, Holocene, <1.6 Ma).

Key to the identification of genera of the family Heleomyzidae reported from ambers

10 years ago, an amended key of HENNIG's Acalyptratae found in Baltic amber was presented by TSCHIRNHAUS & HOFFEINS (2009). They proposed a key which shows the high biodiversity of acalyptrate flies, with many species mentioned there as sp. nov. (species nova) that have never been described. The most valuable aspect of this key was to show the great richness and diversity of chaetotaxy of the fossil Acalyptratae flies, as is also the case in recent fauna. The key presented here includes only formally described heleomyzid genera.

1. Head with orbital plate oblique, medially directed anteriorly, clearly separated from eye margin. Thorax without postpronotal seta; Suilliinae. ..... 2.
–. Head with orbital plate not oblique, not medially directed anteriorly, running parallel to eye margin. Thorax with postpronotal seta; Heleomyzinae. ..... 3.
2. One orbital seta only present. ..... *Suillia* ROBINEAU-DESVOIDY, 1830.
–. Two orbital setae present. ..... *Protosuillia* HENNIG, 1965.
3. Presutural dorsocentral setae absent. ..... 4.
–. Presutural dorsocentral setae present. ..... 7.
4. Two or more katepisternal setae. ..... 5.
–. One katepisternal seta present. ..... 6.
5. Proepisternal seta absent, two katepisternal setae, mid tibia without posterodorsal setulae. ..... *Electroleria* HENNIG, 1965.
–. Proepisternal seta present, three katepisternal setae, mid tibia setulose posterodorsally. .. .. *Chaetohelomyza* HENNIG, 1965.
6. Subcostal cell ending behind the level of anterior cross-vein, no proepimeral seta. .... *Heteromyza* FALLÉN, 1820.
–. Subcostal cell ending at the level of anterior cross-vein, proepimeral seta well-developed. ..... *Balticoleria* WOŹNICA, 2007.
7. Two proepisternal setae, four pairs of dorsocentral setae present only. .... *Protoorbellia* WOŹNICA 2006.
–. One proepisternal seta, more than five pairs of dorsocentral setae. ..... 8.
8. Anepisternum bare, scapular seta absent, gena distinctly projected. .... *Gedanoleria* WOŹNICA gen. nov.
–. Anepisternum setulose, scapular seta present, gena not projected. .... *Paleoheleomyza* WOŹNICA & PALACZYK, 2005.

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