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Current knowledge of Coleoptera (Insecta) from the Lowermost Eocene Oise amber

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Abstract
The paper provides an overview on fossil Coleoptera from the Lowermost Eocene Oise amber of the Paris Basin (circa 53 million years old). At present 45 beetle families have been found from this source. This fossil "fauna" has some peculiarities in comparison with other amber deposits. Some of these families are not recorded in older outcrops (Pselaphidae, Smicripidae, Coccinellidae, Ciidae). Some subfamilies and tribes of other groups have their oldest representatives recorded in Oise, i.e., Eurygeniinae (Anthicidae), Inopeplinae (Salpingidae), Trinodini (Dermestidae), Megatominae (Dermestidae), Attageninae (Dermestidae), Brontinae (Silvanidae), Synchitini (Zopheridae) and Opatrini (Tenebrionidae). The genera defined in the "Oise fauna" show various geographical links with relatives in the recent fauna. These alternative links support that the faunistic composition of the early Eocene had a weak zonal differentiation. *Scirtes circumcisus* sp.n., Boleopsidae fam.n., *Boleopsis polinae* gen. et sp.n. and *Antiphloeus stramineus* gen. et sp.n. are described. The synonymy of the genera *Scirtes* Latreille, 1796 and *Eohelodites* Hong, 2002 is proposed.

Keywords
New taxa; fossil record; paleofauna

Introduction

Amber inclusions from the Lowermost Eocene site of Oise (Paris basin, circa 53 million years old) are significant for the study of Paleogene insects. The analysis of Coleoptera from this outcrop is important because its biotic composition is very different from those of the two other large amber deposits with more or less comparable age (Baltic and Rovno amber). The Oise amber and the Paleocene lacustrine outcrop of Menat (56 Myr old) originated from the time of climatic stasis and at the earlier stages of the transition from the "thermoera" to the "crioera" with the beginning of the

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Paleogene global climatic changes (from the thermal maximum in the Paleocene-Eocene to the global cooling trend in the Middle Eocene to Late Oligocene). Combining the data from the Oise amber and Menat deposits makes it possible to reconstruct the faunistic situation for the Coleoptera in Europe at the climatic Rubicon between the Paleocene and Eocene.

Biota of Oise

The Oise amber deposit is located near the town Creil at the place known as 'Le Quesnoy' (Creil, Oise, France). These Sparnacian beds are made up of a succession of lenticular bodies showing two main facies: clayey sands rich in frequently pyritised lignite, together with amber; and grey clayey sands with less lignite (1–12% of the sediment). These facies reflect a hypoxic environment. The dominance of an arborescent amber-producing species and the presence of freshwater suggest a semi-deciduous forest (Nel et al. 2004; Brasero et al. 2009). The climate at that time was hot with wet and dry seasons, which corresponds to a sub-tropical palaeoenvironment (De Franceschi & De Ploëg 2003). The producing amber tree is *Aulacoxylon sparnacense* (Combretaceae or Caesalpiniaceae), which could be close to the extant plants Terminalia L. (Combretaceae) or Leguminosae-Caesalpiniaceae (De Franceschi & De Ploëg 2003). Brasero et al. (2009) gave the most recent update of the entomofaunistic composition of the Oise amber, but the recent efforts in describing the beetles make the present paper necessary. Diptera and Hymenoptera (mainly Chalcidoidea) are the most frequently encountered orders, corresponding to the general pattern in Cenozoic amber. Beetles seem to dominate the family diversity of the Oise amber, but this has to be moderated by the fact that groups like Hemiptera and Hymenoptera have been less investigated than Coleoptera.

Coleoptera of Oise

This paper is the twelfth contribution to the knowledge of the fauna of Coleoptera from the Lowermost Eocene French amber collected in Oise falls (Batelka et al. 2006; Bílý & Kirejtschuk 2007; Kirejtshuk & Nel 2008, 2009, 2012; Kirejtshuk et al. 2010a,b,c; Montreuil & Nel 2010; Moseyko et al. 2010; Kovalev et al. 2012). It is a preliminary global analysis of the diversity of this order in this outcrop. However, the further research planned to be continued should bring new findings which will increase our knowledge and allow improving and correcting the current generalizations.

During the last years of study, more than 500 beetles have been found. Most of them were prepared for preliminary identification. Some were studied in detail and described. The family attributions and species descriptions already achieved make some preliminary generalizations possible. Nevertheless it is scarcely possible to compare this beetle taphocenosis with the other resources in a proper way because of the impossibility to find equilibrium in representation for some statistical treatment, although some

specific comparisons (particularly those with data on Coleoptera from Baltic amber) seem to be allowable.

As in most cases of comparatively large amber deposits, the beetle inclusions from the Oise amber contain basically the groups associated with arboreal habitats. In the first turn they are members of the families Cupedidae, Micromalthidae, Carabidae (probably Lebiini), Buprestidae, Eucnemidae, Throscidae, Nitidulidae (Cybocephalinae), Laemophloeidae, Silvanidae, Coccinellidae, Ciidae, Mordelidae, Rhipiphoridae, Scraptiidae, Aderidae, Chrysomelidae, Zopheridae, Anthribidae, etc. These groups correspond with comparatively warm climatic circumstances and probably subtropical or paratropical equable climates of the thermo-era (greenhouse climate), which seemed to be characterized not only by somehow warm and even temperature regime without significant seasonal changes but also by a more or less considerable humidity. Most components of the beetle fauna in Oise amber fit quite well to the mentioned conditions. In particular all representatives of chrysomelid Eumolpinae and Alticinae from Oise amber belong to the groups that inhabit arboreal and shrubby canopy and are associated with foliage (Moseyko et al. 2010).

At the same time a considerable proportion of specimens from the Dermestidae, Anobiidae, Nitidulidae: Cybocephalinae, and Melyridae found in the examined source have their modern relatives in more arid areas of the recent Paleotropics. They are evidences of comparatively dry circumstances present on the site of deposition. Besides, the recent relatives of the tenebrionid *Eupachypterus eocenicus* Kirejtshuk, Nabozhenko & Nel, 2010 inhabit arid and subarid landscapes. Thus, the latter could live in comparatively dry places but in forests because, in contrast to the recent members of the tribe Opatrini, it demonstrates a unique structure of its eyes, protibiae and tibial spurs, which could be interpreted as adaptations to life on trees or bushes rather than soil-dwelling (Kirejtshuk et al. 2010c). A scarcity of representatives of aquatic groups is quite usual among amber inclusions: only some specimens of Scirtidae have been found in the considered source. Adults of this family in the recent fauna are generally dwellers on coastal and forest vegetation.

The genera defined in the "Oise fauna" show various geographical links with relatives in the recent fauna. These alternative links support that the faunistic composition of the early Eocene had a weak zonal differentiation. This situation evolved into strong changes in the later time and produced a cause for further faunistic separation into the recent zoogeographical regions. The smicripid genus *Smicrips* was described from Oise amber, while its recent species are currently spread in the South of USA, Mexico, Central America, and Cuba. Besides, this family was recently found also in Upper Eocene Baltic amber (Gorski 2012: http://www.amberabg.com/b_systematyka/smicripidae_zd1.html). The Oise Eumolpinae show some links with groups of the recent Indo-Malayan fauna. The comparatively abundant anthicid fossil species *Oisegenius antiquus* Kirejtshuk & Nel, 2008 is regarded as a relative of the rather small recent genus *Eurygenius* Ferté-Senectère, 1849, which is distributed in both East and West Hemispheres. The same, perhaps, pertains to the salpingid genus *Eopeplus* Kirejtshuk & Nel, 2009 related to the recent genus *Inopeplus* Smith, 1851, widespread in intertropics and subtropics. At the same time the scarabaein Oise amber genus

Lebateuchus Montreuil, Genier & Nel, 2010 can have "Gondwanian roots", having close relation to the recent Paleotropical *Haroldius* Boucomont, 1914 (Montreuil et al. 2010). The comparatively small family Kateretidae is now distributed almost over the World with the largest diversity in the Holarctic, although it is absent in Capean and Madagascar regions. However one species of it (*Heterhelus expressus* Kirejtshuk & Nel, 2008) recorded from Oise amber is related to the recent boreal groups and another (*Eoceniretes yantaricus* Kirejtshuk & Nel, 2008) is more similar to a genus from the Lower Cretaceous Lebanese amber (*Lebanoretes andelmani* Kirejtshuk & Azar, 2008). The buprestid *Phylanthaxoides gallicus* Bílý & Kirejtschuk, 2007 manifests a greater similarity to its recent Indo-Malayan relatives. The throscid *Trixagus majusculus* Kovalev, Kirejtshuk & Nel, 2010 from Oise amber is somewhat larger than its recent congeners spread in all recent zoogeographical regions (except Antarctica).

The inclusions already studied contain specimens of some families which are not recorded in older outcrops (Pselaphidae, Smicripidae, Coccinellidae, Ciidae). In addition, the Oise amber has yielded the oldest representatives for some subfamilies and tribes, i.e. Thomassetiini (Bupretidae), (Bupestidae), Polycestinae (Buprestidae), Eurygeniinae (Anthicidae), Inopeplinae (Salpingidae), Trinodini (Dermestidae), Megatominae (Dermestidae), Attageninae (Dermestidae), Brontinae (Silvanidae), Synchitini (Zopheridae), Opatrini (Tenebrionidae), Eumolpinae (Chrysomelidae) and Alticinae (Chrysomelidae). The studied species show more or less Cenozoic characteristics according to their generic attributions and close relationships; although in most cases they represent isolated genera that are now extinct. Nevertheless, some groups demonstrate that at the time of deposition their level of differentiation was already comparable with that in the recent period (Scirtidae, Hydrophilidae, Scydmaenidae, Cholevidae, Kateretidae, Smicripidae and Rhipiphoridae). Some beetle groups could be interpreted as relic and are still present in the recent fauna. They already seemed to have a narrower distribution during the early Eocene in comparison with the faunas of previous periods (Cupedidae, Micromalthidae), although both *Cupes* Fabricius, 1801 and *Micromalthus* LeConte, 1878 are known only from the Cenozoic but not from the Mesozoic.

Proportions of specimens from different families in this deposits have some peculiarities. In contrast to the composition of Baltic amber beetle fauna, there are only a small number of representatives from Carabidae, Staphylinidae, Pselaphidae, Scydmaenidae, Elateridae, and Mordellidae. Cantharidae Latreille, 1802 are absent from Oise amber but numerous in Baltic amber, while the families Dermestidae, Corylophidae and Aderidae are much more abundant in Oise amber than in other deposits. Finally, the families Scirtidae, Chrysomelidae and Curculionidae show a comparable representation in both Oise and Baltic/Rovno amber.

Materials and Methods

Many specimens recovered among inclusions from Lowermost Eocene French amber are deposited in the Laboratoire de Paléontologie, Muséum National d'Histoire Naturelle, Paris (hereafter MNHN). For their study ordinary optic equipment was

used, in particular the stereomicroscope Olympus SCX9 and inverted microscope Olympus CK 40 in the MNHN, and also the stereomicroscope Leica MZ 16.0 in the Zoological Institute of the Russian Academy of Sciences, St. Petersburg (hereafter ZIN). Some specimens were tomographed by X-rays and reconstructed in 3-dimensional view on the AST-RX platform in the MNHN. All holotypes of the new species are deposited in the MNHN. A more detailed review of the fossil record on the families here considered can be found in Kirejtshuk & Ponomarenko (2012).

Strata

Lowermost Eocene, in amber, circa 53 million years old, Sparnacian, level MP7 of the mammal fauna of Dormaal.

Locality

Farm Le Quesnoy, Chevrière, region of Creil, Oise department (north of France).

Families of Coleoptera from Oise amber in MNHN

1. Cupedidae Laporte, 1836 – 1 specimen of the genus *Cupes* Fabricius, 1801 (Kirejtshuk et al. 2010c).
2. Micromalthidae Barber, 1913 – 2 specimens of the genus *Micromalthus* LeConte, 1878 (Kirejtshuk et al. 2010c).
3. Carabidae Latreille, 1802 – 2 specimens; one of them is member of the tribe Tachyini Motschulsky, 1862 and another is probably of Lebiini Lacordaire, 1854.
4. Staphylinidae Latreille, 1802 – 2 specimens; one of them apparently belongs to the subfamily Tachyporinae MacLeay, 1825.
5. Pselaphidae Latreille, 1802 – 1 specimen.
6. Scydmaenidae Leach, 1815 – 3 specimens.
7. Ptiliidae Erichson, 1845 – 1 specimen.
8. Cholevidae Kirbi, 1837 – 1 specimen of subfamily Cholevinae s. str.
9. Hydrophilidae Latreille, 1802 – 1 specimen.
10. Scirtidae Fleming, 1821 – 11 specimens; most of them placed to the genus *Cyphon* Paykull, 1799 including three specimens described by Kirejtshuk & Nel (2008) and one specimen has been assigned to the genus *Scirtes* Illiger, 1807 and is described here.
11. Scarabaeidae Latreille, 1802 – 1 specimen of the genus *Lobateuchus* Montereuil, Genier et Nel, 2010 (Scarabaeinae s. str.; Ateuchini Perty, 1830) described in Montreuil et al. (2010).
12. Elateridae Leach, 1815 – 9 specimens; including two mummies and two fragmented beetles only with visible underside.
13. Eucnemidae Eschscholtz, 1829 – 6 specimens of different preservations.
14. Throscidae Laporte, 1840 – 1 specimen, belonging to the genus *Trixagus* Kugelann, 1794 and described by Kovalev et al. (2012).
15. Buprestidae Leach, 1815 – 3 specimens, one of them belonging to the genus *Phylanthaxoides* Bily et Kirejtschuk, 2007 (Buprestinae s. str.; Thomassetiini

Bellamy, 1987) described by Bily & Kirejtschuk (2007), another with an appearance like that in recent species of *Anthaxia* Eschscholtz, 1829 (Buprestinae; Anthaxiini Gory et Laporte, 1839) and one specimen with an appearance like that in recent species of *Acmaeodera* Eschscholtz 1829 (Polycestinae Lacordaire, 1857; Acmaeoderini Kerremans, 1893).

16. Dermestidae Latreille, 1804 – 77 specimens, including mummies and fragmented ones; 38 specimens belonging to the genus *Oisenodes* Kirejtshuk, Háva et Nel, 2010 (Trinodinae Casey, 1900) (17 specimens described by Kirejtshuk et al. 2010a); most of the other specimens apparently belonging to the genera *Anthrenus* Geoffroy, 1762 and *Megatoma* Herbst, 1791 (Megatominae Leach, 1815), and also *Attagenus* Latreille, 1802 (Attageninae Casey, 1900).
17. Anobiidae Fleming, 1821 – 11 specimens and also 1 mummy of beetle dorsum.
18. Cleridae Latreille, 1802 – 2 specimens (both from Clerinae s. str.).
19. Malachiidae Fleming, 1821 – 6 specimens; all belonging to the genus *Colotus* Erichson, 1840; including five specimens of two species described by Kirejtshuk & Nel (2008).
20. Boleopsidae fam. n. – 1 specimen here described in the genus *Boleopsis* gen. n.
21. Kateretidae Erichson, 1837 – 2 specimens of the species from the genera *Hetherelus* Jacquelin du Val, 1858 and *Eoceniretes* Kirejtshuk et Nel, 2008 described by Kirejtshuk & Nel (2008).
22. Nitidulidae Latreille, 1802 – 9 specimens; all belong to the genus *Pastilocenicus* Kirejtshuk et Nel, 2008 (Cybocephalinae Jacquelin du Val, 1858); including six specimens described as three species by Kirejtshuk & Nel (2008).
23. Smicripidae Horn, 1880 – 1 specimen, belonging to the genus *Smicrips* LeConte, 1878 and described by Kirejtshuk & Nel (2008).
24. Laemophloeidae Ganglbauer, 1899 – 5 specimens.
25. Silvanidae Kirby, 1837 – 2 specimens, including one here described in the genus *Antiphloeus* gen. n. (Brontinae Blanchard, 1845, Telephonini Casey, 1884).
26. ? Cryptophagidae Kirby, 1826 – 2 specimens.
27. Phalacridae Leach, 1815 – 3 specimens.
28. Coccinellidae Latreille, 1807 – 11 specimens; including 9 representatives of the genera *Rhyzobius* Stephens, 1829 (Coccidulinae Mulsant, 1846) and *Nephus* Mulsant 1846 (Scymninae Mulsant, 1846) described by Kirejtshuk & Nel (2012).
29. Corylophidae LeConte, 1852 – 19 specimens.
30. Endomychidae Leach, 1815 – 1 specimen, belonging to the genus *Palaeoestes* described by Kirejtshuk & Nel (2009).
31. Latridiidae Erichson, 1842 – 7 specimens; most of them belonging to the genus *Corticaria* Marshall, 1802 and two specimens described by Kirejtshuk & Nel (2009).
32. Ciidae Leach, 1819 – 1 specimen.
33. Salpingidae Leach, 1815 – 1 specimen, belonging to the genus *Eopeplus* Kirejtshuk et Nel, 2009 (Inopeplinae Grouvelle, 1908) described by Kirejtshuk & Nel (2009).

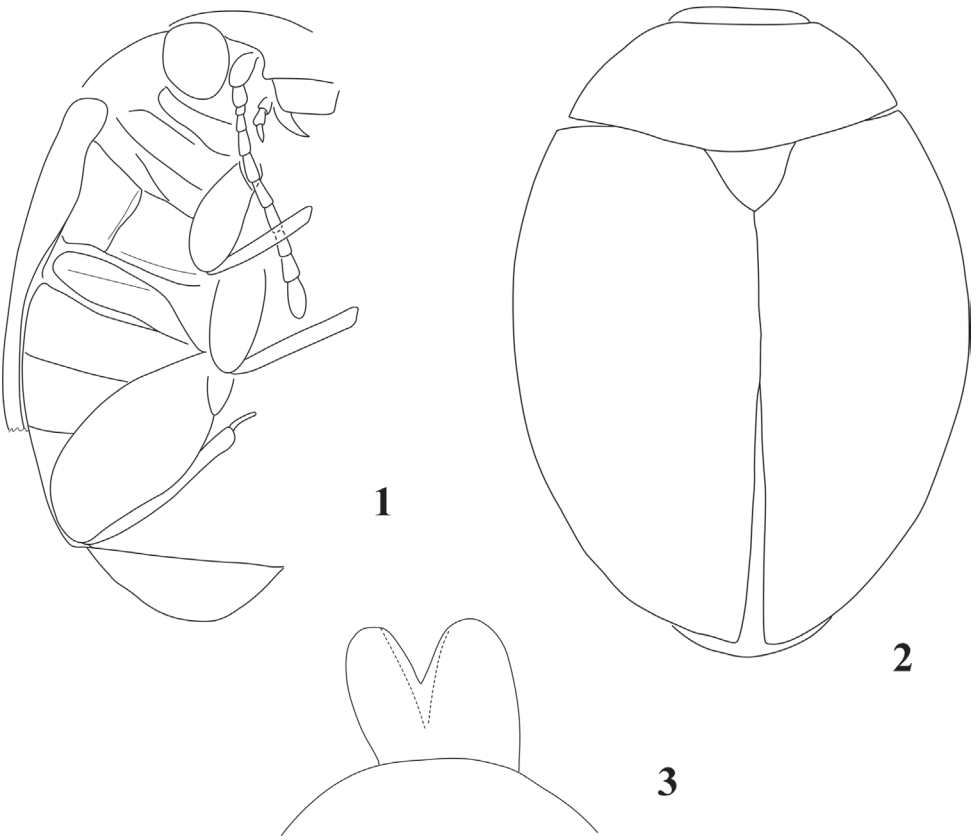
34. Tenebrionidae Latreille, 1802 – 2 specimens; one of them belonging to the genus *Eupachypterus* Kirejtshuk, Nabozhenko et Nel, 2010 (Tenebrioninae; Opatrini Brullé, 1832) described by Kirejtshuk et al., (2010b) and another of the subfamily Alleculinae Laporte, 1840.
35. Scraptiidae Gistel, 1848 – 1 fragmented specimen.
36. Ripiphoridae Gemminger, 1870 – 1 specimen, belonging to the genus *Macrosiagon* Hentz, 1829 (Ripiphorinae) published by Batelka et al. (2006).
37. Mordellidae Latreille, 1802 – 11 specimens including mummies and incomplete specimens.
38. Anthicidae – 11 specimens; mostly of the genus *Oisegenius* Kirejtshuk et Nel, 2008, including 3 specimens described by Kirejtshuk et Nel (2008).
39. Mycteridae Latreille, 1819 – 1 specimen of the genus *Bertinotus* Kirejtshuk et Nel, 2009 (Eurypinae J. Thomson, 1860) described by Kirejtshuk et Nel (2009).
40. Zopheridae Solier, 1834 – 4 specimens, of the tribe Synchitini Erichson, 1845 (Colydiinae Billberg, 1820).
41. Aderidae Csiki, 1909 – 79 specimens, including mummies and incomplete ones belonging to some genera needed to be revised.
42. Chrysomelidae Latreille, 1802 – 16 specimens; mostly belonging to some species of the genus *Crepidocnema* Moseyko, Kirejtshuk et Nel, 2010 (Alticinae Newman, 1834; Althicini s. str.); two specimens belonging to the two genera *Crepidocnema* and *Acolaspoides* Moseyko, Kirejtshuk et Nel, 2010 (Eumolpinae Hope, 1840) described by Moseyko et al. (2010).
43. Cerambycidae Latreille, 1802 – 1 fragmented specimen in bad condition.
44. Anthribidae Billberg, 1820 – 1 specimen.
45. Brentidae Billberg, 1820 – 9 specimens, including mummies and incomplete ones; all belonging to the subfamily Apioninae Schönherr, 1823.
46. Curculionidae Latreille, 1802 – 15 specimens, including mummies and incomplete ones.

Systematics

Family Scirtidae Fleming, 1821
Genus *Scirtes* Illiger, 1807
Type species. *Scirtes* Illiger, 1807

Remarks

Heuss (2008) proposed a key to genera for the members of Scirtidae recovered in Baltic amber, in which the only genus with saltatory posterior legs was included (*Scirtes* Latreille, 1796). Ruta & Yoshimoto (2010a) revised the complex of the recent genera related to *Scirtes* (*Curtoscirtes* Pic, 1924; *Exochomoscirtes* Pic, 1916; *Ora* Clark, 1865; *Scirtes*; *Sulcatoscirtes* Pic, 1952). Ruta (2010) supposed that the Indo-Malayan *Mescirtes* Motschulsky, 1863 and the Neotropical *Prionoscirtes* Champion, 1897 could be regarded as synonyms and well characterized by antennae different from those in



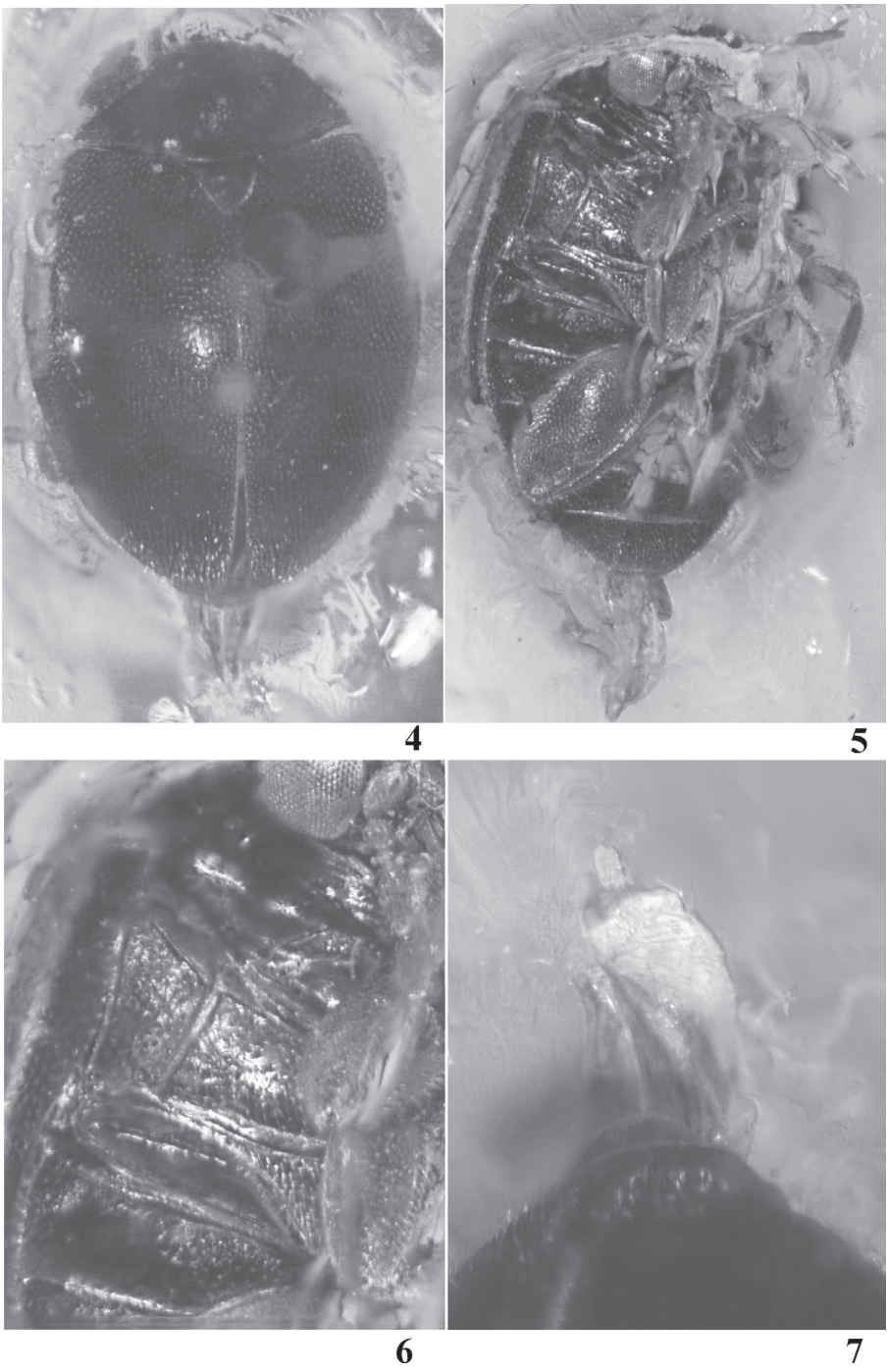
Figs 1–3. *Scirtes circumcisus* sp.n. (Scirtidae), holotype, ♀. (1) Body, ventral view. (2) Idem, dorsal view. (3) Sternite VIII, ventral view. Length of specimen 2.2 mm.

Scirtes, particularly in the proportion in basal antennomeres and apical dilatation of antennomeres forming serrate or pectinate structure. Hong (2002a, b) proposed some fossil genera and species with saltatory posterior legs from the Lower Eocene Fushun amber, which are not accessible for study. Their interpretation is rather problematical. *Eohelodites orbiculatus* Hong, 2002 seems to be a member of *Scirtes* except for its meso- and metacoxae drawn as very small and widely separated (which could be error), and also median part of the posterior edge of the metaventrite is drawn far behind the base of posterior legs. Besides, *Sinodryops ovalifemoralis* Hong, 2002 and *Expansifemoralia orientalis* Hong, 2002 differ from *Scirtes* in the striate elytra (could be somewhat like those in *Sulcatoscirtes*), as other characters of both species from Fushun amber for sure comparison. See also below the taxonomical notes.

Scirtes circumcisus sp.n. (Figs 1-7)

Diagnosis

The new species here described looks like recent members of the genus *Scirtes* because of general appearance and its saltatory posterior legs. This genus includes about 350



Figs 4–7. *Scirtes circumcisus* sp.n. (Scirtidae), holotype, ♀. (4) Body, dorsal view. (5) Idem, lateroventral view. (6) Thorax, lateroventral view. (7) Abdominal apex and genitalia, dorsal view. Length of specimen 2.2 mm. This figure is published in colour in the online edition of this journal, which can be accessed via http://booksandjournals.brillonline.com/content/1876312x.

recent species which are sometimes regarded as having uncertain relationships (Ruta & Yoshitomo, 2010b). However, the ratio of the basal antennomeres of the new species with very small antennomere 3 is more similar to that in species of some other genera of the family (*Elodes* Latreille, 1796, etc.). If the not very thick and not so long metafemur and the transverse (not inclined) metacoxae of *S. circumcisus* sp.n. are taken into consideration, it could be more reasonable to regard the generic attribution of this new species as preliminary.

Material

Holotype "7448", ♀, complete specimen is included in the oblique end of the multifacetted stick of homogenous amber (21 mm long and 4 mm thick) with diffusely dispersed small pieces of dark organic matter; although one plane of border between different layers goes along the sides of the specimen and some small cracks are located along underside of the specimen (because of the latter and some patches of the "milky cover" along the ventral surface of the specimen, the mouthparts and many other structures of the left side are not clearly visible).

Description

Holotype, ♀. Body 2.2 mm long, 1.4 mm wide, 0.8 mm high; oval, rather convex dorsally and ventrally; dorsum subunicolorous with some shine, underside dark bronze with reddish appendages and with a strong bronze shine; dorsum with well conspicuous, suberect and comparatively long yellow greyish hairs 2–3 times as long as distance between their insertions; underside with somewhat sparser and shorter hairs; elytral sides fringed with more conspicuous hairs.

Head and pronotum with distinct punctures, somewhat larger than eye facets in diameter, interspaces between them 1.0–1.5 puncture diameters and smoothly alutaceous. Elytra with somewhat larger and sparser punctures, interspaces between them about as great as 2–3 puncture diameter and smoothly alutaceous. Underside with punctures almost as large as eye facets or slightly larger; interspaces between them on thoracic sclerites and metacoxae 1.0–1.5 puncture diameters and more or less smoothed to finely and densely microreticulate; those on ventrites much less than a puncture diameter and with very dense, fine and relief microreticulation.

Head oval and well exposed dorsally, not clearly visible because of position of the beetle in amber, apparently somewhat shorter than wide, with rather large oval eyes reaching prothoracic segment ventrally, occuput and frons subflattened; labrum apparently quadrangular and transverse (about 1.5 times as wide as long); mandibles not clearly visible and apparently with sharp apex; mentum invisible; ultimate maxillary palpomere subconical and acute at apex, rather narrowing apically, about three times as long as wide; labial palpi invisible. Antennae about 2/3 as long as body, scape about as long as ultimate antennomere, antennomere 2 about as long as antennomere 4, antennomere 3 shortest, antennomeres 5–9 subequal in length and sucylindrical, antennomere 10 about as long as previous one and somewhat widened apically.

Pronotum with anterior edge slightly emarginate at anterior angles and rather convex posterior edge, all angles rounded at top, widest at somewhat projecting posterior angles, slightly and gradually narrowing anteriorly, posterior and lateral edges not bordered; disk rather convex. Scutellum moderately large and looking almost like equilateral triangle. Prosternum moderately convex and short, its anterior part and process invisible. Procoxae strongly transverse and moderately projecting below. Metaventrite rather short, medially convex and only slightly shorter in the middle, with paracoxal line before metacoxae which is not interrupted in the middle and rather convex; submesocoxal line regularly follow inner edge of metepisternum and posterior edge of mesocoxal cavity. Metepisterna very wide, rectilinearly widening anteriorly. Abdominal ventrites more or less comparable in length, hypopygidium very widely rounded at posterior edge; epipleura very distinct, at base about half as wide as metepisterna and about 2.5 times as wide as scape; pygidium very widely rounded and somewhat exposed from under elytral apices. Elytra only slightly longer than wide combined, longest at suture, gently arcuate at sides; their apices apparently forming a joint arc, moderately convex at disk and rather steeply sloping (but not subvertically) at sides, adsutural lines not traced.

Metacoxae contiguous and transverse, with very long femoral plates at median part. Tibiae slightly compressed; somewhat narrower than scape; spur of mesotibia slightly longer than width of tibia and thin; spur of metatibia much more than twice as long as tibiae and moderately thick. Femora of usual shape, pro- and mesofemora about four times as wide as tibiae and metafemur twice wider than pro- and mesotibiae. Tarsomere 1 longest (particularly in posterior legs); tarsomere 4 moderately wide and lobed; claws narrow and moderately long.

Ventrite VIII bilobed and heavily sclerotized.

Etymology

The epithet of the new species from Latin “circumcisus” (cut, isolated, detached) refers to some isolation of it from the congeners.

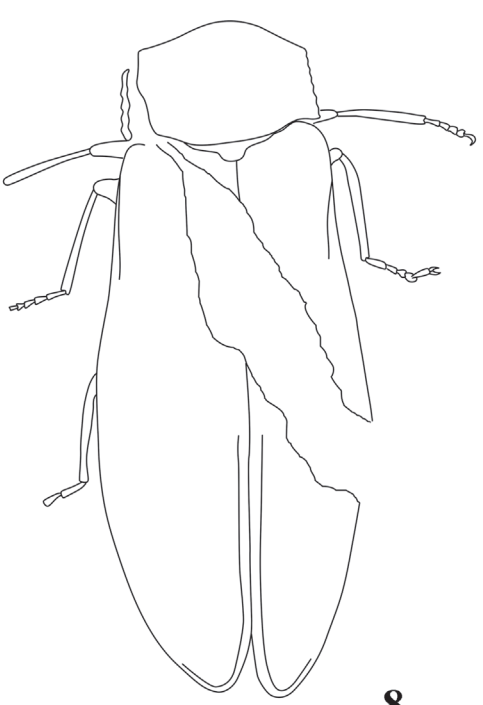
Family Boleopsidae fam.n.
Type genus *Boleopsis* gen.n.

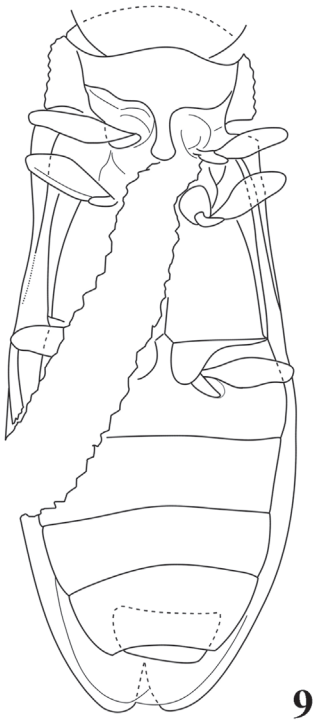
Included genera

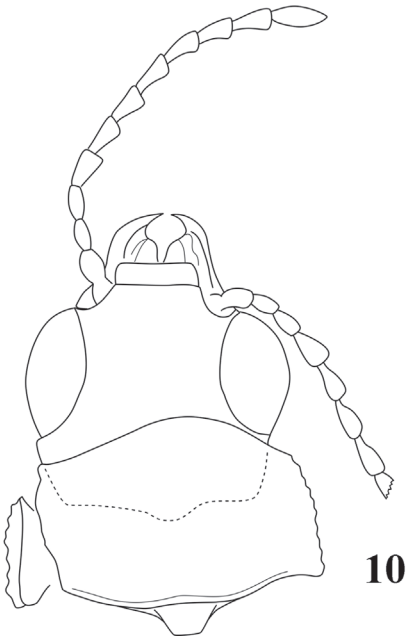
Only type genus.

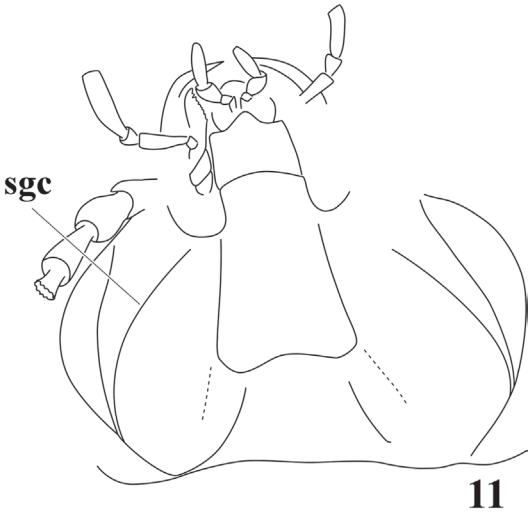
Remarks

The family rank for *Boleopsis* gen.n. is proposed based on the very abnormal combination of its characters and following the tradition accepted among specialists studying the superfamily Cleroidea. There are some serious contradictions between the interpretations of the lineage based on morphological (Crowson 1964; Majer 1994; Kolibáč 2004; etc.) and those based on molecular data (Bocakova et al. 2012, etc.) and data from fossils (Kirejtshuk & Ponomarenko 1990; Kirejtshuk et al. 2010d; Ponomarenko & Kirejtshuk 2012, etc.; also see below).









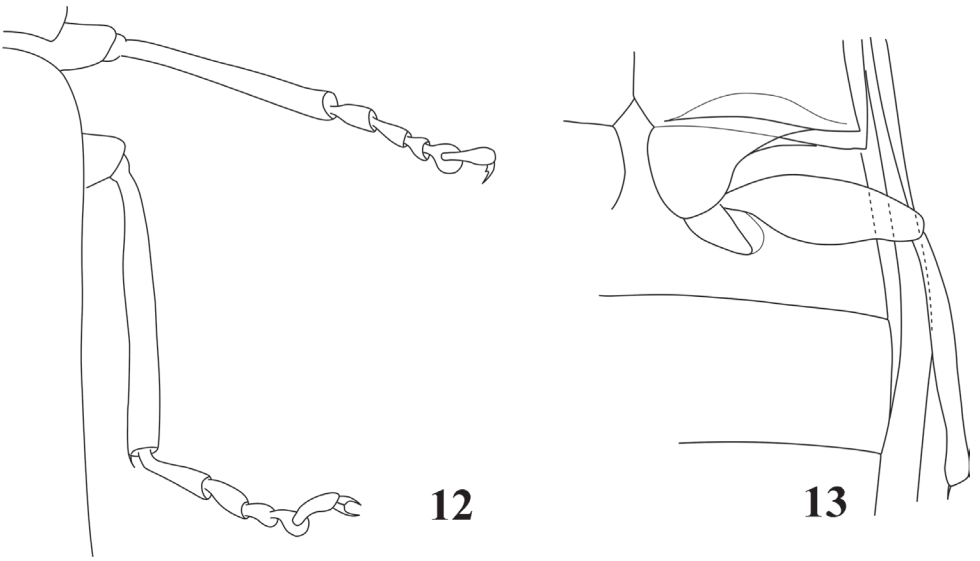
Figs 8–11. *Boleopsis polinae* gen. et sp.n. (Boleopsidae fam.n.), holotype. (8) Body, dorsal view. (9) Idem, ventral view. (10) Head and pronotum, dorsal view. (11) Head, ventral view. Abbreviation: sgc – subgenal carina. Length of specimen 2.6 mm.

Diagnosis

Body of medium-size, elongate, weakly convex to subflattened dorsally and ventrally. Integument extremely finely and sparsely punctured, smoothed on interspaces, finely and almost inconspicuously pubescent and with fringed pronotal and elytral sides. Head prognathous and arcuately narrowing posteriorly, with very large eyes having transverse diameter from above much greater than from below; anterior part of frons isolated into transverse stripe ("clypeus"); underside of epicranium with a subarcuate carina between posterior edge of eye and hypostomal sinus. Labrum bilobed and with a deep median excision. Mandibles strong and apparently with simple apices. Gular sutures widely separated and divergent posteriorly. Mentum subpentagonal and moderately large. Ultimate labial palpomere comparatively long and subcylindrical. Maxillae with moderately long palpi and cylindrical ultimate palpomere. Antennae 11-segmented and moderately long, subfiliform to subserrate. Pronotum transverse, with anterior edge convex, posterior one bisinuate and widely bordered, lateral edges finely undulate. Scutellum subtrapeziform. Elytra complete, longest at suture and with apices rounded (not angular) and forming a deep sutural angle. Prosternum with distinct pronotosternal sutures and clear process between procoxae; procoxal cavities widely transverse and open posteriorly. Procoxae transverse, not projecting below and with exposed protrachantin. Mesoventrite comparable in length with prosternum before procoxae and somewhat shorter than metaventrite. Mesepimera reaching oval mesocoxal cavity. Metaventrite with clear discrimen. Metepisterna rather narrow. Metacoxae extend laterally beyond outer edge of metepisterna and strongly prolonged posteriorly at median part. Abdomen with five ventrites. Elytral epipleura distinct at base and becoming obsolete before the middle. Metatrochanter lobed. Tibiae very narrow and long with thin spurs. Tarsi five-segmented; tarsomere 4 lobed; tarsal claws slightly dentate at base.

Comparison

This new family has the rather expressed cleroid characters, including the metacoxae extending laterally beyond the outer edge of metepisterna, mesepimera reaching mesocoxal cavity and others. It is characterized by the head prognathous and arcuately narrowing posteriorly (without neck), transverse diameter of eyes from above much greater than from below, underside of epicranium with a subarcuate subgenal carina between posterior edge of eye and hypostomal sinus, elyra complete, longer than wide combined, longest at suture and their apices rounded (not angular), five abdominal ventrites exposed and dentate tarsal claws. All these peculiarities make it possible to assign it to the melyrid-lineage of the superfamily Cleroidea (Majer 1994; Kolibáč 2004). The subgenal carina and peculiar position of eyes (located mostly on dorsal side) are very bright special features of this new family. There are no groups with a much flattened body known in this lineage, somewhat except Acanthocnemidae Crowson, 1964 which are slightly convex dorsally but not very subflattened. However, the species of *Acanthocnemus* Perris, 1866 (recent) and probably *Acanthocnemoides* Zherichin, 1977 (Upper Cretaceous Taimyr amber, West Siberia), in contrast to the new species, have



Figs 12–13. *Boleopsis polinae* gen. et sp.n. (Boleopsidae fam.n.), holotype. (12) Pro- and mesotarsi, dorsal view. (13) Metacoxa and posterior leg, ventral view. Length of specimen 2.6 mm.

the more or less convex body, unilobed labrum, reduced gular sutures, loose three-segmented antennal club, pit just in front of each procoxal cavity, seriate punctuation on elytra, metacoxa oblique and not enlarged medially; and also the latter have not subgenal oblique carinas on underside of the head, large lobe on the tarsomere 4 and dentate claws.

The new family differs from the other families of the melyrid-lineage in addition to the very flattened body, subgenal carinas and particular position of eyes in the following peculiarities:

– Dasytidae Laporte, 1840 in the five abdominal ventrites exposed (known in fossils from the Lower Cretaceous Lebanese amber: see Kirejtshuk & Azar 2013);
– Malachiidae Fleming, 1821 in the lack of extrusible glands on thorax and abdomen, elytra completely covering abdomen (known in fossils from the Lower Cretaceous Lebanese amber: see Kirejtshuk & Azar 2013);
– Mauroniscidae Majer, 1995 in the lack of antennal club, bilobed labrum, distinct pronotosternal sutures, strongly transverse metacoxae (not oblique), five abdominal ventrites exposed, lobed tarsomere 4, dentate claws (known only from the recent fauna);
– Melyridae Leach, 1815 in the tarsomere 1 longer than tarsomere 2 (known from Upper Eocene Baltic amber after Klebs 1910);
– Prionoceridae Lacordaire, 1857 in the small body, not rostrate head, not emarginate eyes, mentum and ligula normally setose, not transformed antennae, bilobed labrum (known from the Lower Eocene Hat Creek amber (British Columbia, Canada) after Lawrence et al. 2008).

Frequently, species of the genus *Phycosetis* Pascoe, 1875 (Phycosetidae Crowson, 1952) known only from the recent fauna are regarded as closely related to the

melyrid-lineage (Crowson 1964; Lawrence et al. 2011). However, Majer (1994) disagrees with this opinion. Nevertheless, *Boleopsis polinae* gen. et sp.n. greatly differs from these species in the very flattened elongate body, dorsum without scale vestiture, 11-segmented and not clubbed long antennae, transverse procoxae widely open posteriorly, mesepimera reaching oval mesocoxal cavity, very narrow metepisterna and transverse metacoxae.

Remarks

The melyrid-lineage is thought to be one of most archaic groups of Cleroidea according to cladistic analyses of structural characters (Kolibáč 2004), although this interpretation strongly conflicts with the fossil record (e.g., Kirejtshuk 2012; Kirejtshuk & Ponomarenko 2012) and molecular comparison (Bocakova et al. 2012). According to the fossil record (published and unpublished data), Lower Jurassic deposits of the family Peltidae represent the oldest members of the superfamily (Kirejtshuk & Ponomarenko 2012). Having taken into consideration the peltin-liked forms and species of Paranrexidae Kirejtshuk, 1994 this group represents a considerable portion of Jurrassic beetles (Kirejtshuk 1994; Kirejtshuk et al. 2010d; Kolibáč & Huang 2011), while other lineages of the superfamily appeared in fossils later and they had a rather limited representation in the Mesozoic deposits (see Kirejtshuk & Azar 2013).

Among cleroids beyond the groups of melyrid-lineague the families Metaxinidae (recent) and, perhaps, Parandrexidae, including *Mathesius liaoningensis* Kolibáč & Huang, 2011 (Mesozoic) show a certain similarity with *Boleopsis polinae* gen. et sp.n. in a somewhat subflattened body and other external structures (shape of head, distinct lateral pronotal carinas, tibiae, tarsi, etc.), but the new species differs from both in the characteristic eyes, subgenal carinas and widely lobed tarsomere 4; and also from the first in the tarsomere 1 longer than the following ones, widely transverse procoxae, five exposed ventrites, trochanter and femora without long setae, finer to obsolete puncturation of integument; and from the second in the smaller head, bilobed labrum, shorter mandibles, metacoxae with strongly projecting median part and lobed metatrochanter.

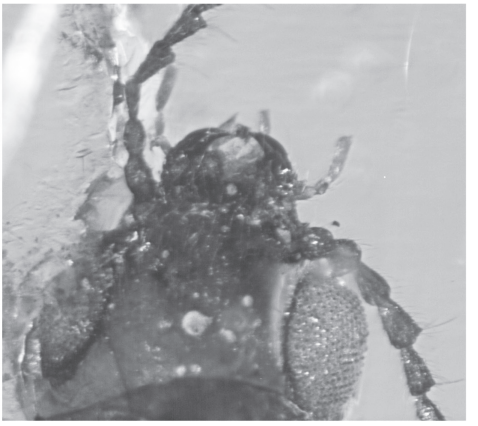
Boleopsis gen.n.
Type species *Boleopsis polinae* sp.n.

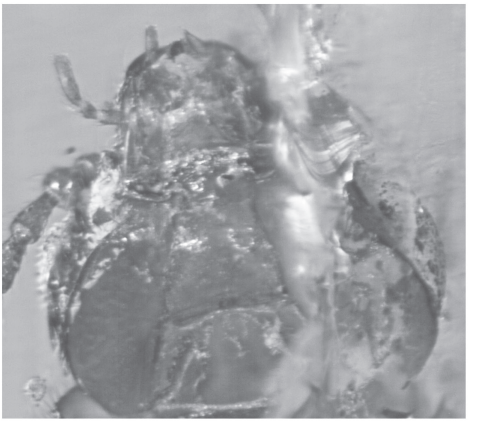
Etymology

Greek "*bole*" (βολή, throwing, casting, fling, pelt, projection, sling, throw) and "opsis" (οωις – appearance, sight, view) referring to somehow a very isolated position of this group. The gender is feminine.

Remarks

This new genus is represented by the only species and, therefore, its description overlaps the description of the new species ("*descriptio generica specifica*").





Figs 14–17. *Boleopsis polinae* gen. et sp.n. (Boleopsidae fam.n.), holotype. (14) Body, dorsal view. (15) Idem, ventral view. (16) Head, dorsal view. (17) Head, ventral view. Length of specimen 2.6 mm. This figure is published in colour in the online edition of this journal, which can be accessed via http://booksandjournals.brillonline.com/content/1876312x.

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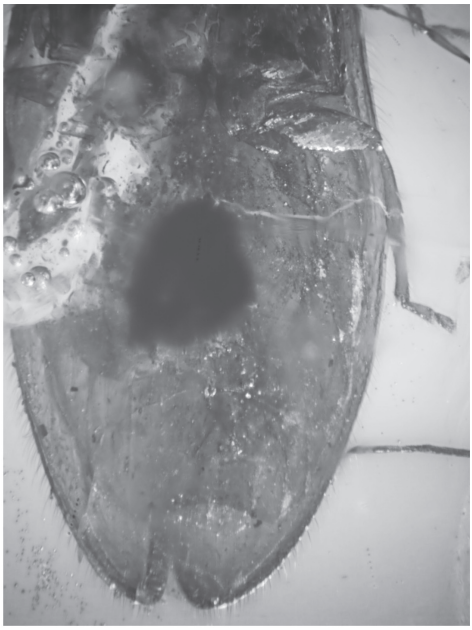

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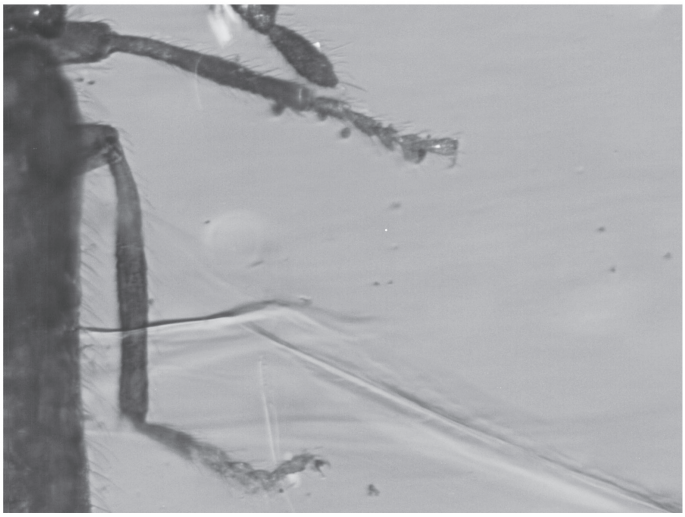

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Figs 18–20. *Boleopsis polinae* gen. et sp.n. (Boleopsidae fam.n.), holotype. (18) Head and thorax, ventral view. (19) Posterior part of body, ventral view. (20) Pro- and mesotibiae, pro- and mesotarsi, dorsal view. Length of specimen 2.6 mm. This figure is published in colour in the online edition of this journal, which can be accessed via http://booksandjournals.brillonline.com/content/1876312x.

Boleopsis polinae sp.n. (Figs 8–20)

Material

Holotype "1389", sex unknown; the specimen of good preservation but obliquely torn in the middle by the crack is included into a flat piece of amber (6.5 × 3.6 mm)

together with some cracks and few small pieces of organic dark matter, and one large black piece of organic matter is located beneath the middle of abdomen, which is embedded into Canada Balsam between round microscope cover slides. The specimen is broken by an oblique crack completely separating anterior and posterior parts of body; besides, part of body along this crack obliquely tearing the body, the right leg, left protarsus, and part of left meso- and metatarsi are missing.

Description

Holotype. Body 2.6 mm long, 1.1 mm wide, about 0.1 mm high. Elongate, rather slightly convex dorsally and ventrally; unicolorous brownish with slightly darker anterior part of head and mandibles; dorsum without clear shine; underside somewhat shining; dorsum with moderately dense, slightly conspicuous and subrecumbent brownish to yellowish hairs about half as long as distance between their insertions; side of pronotum and elytra fringed apparently by somewhat longer and denser hairs (longer than distance between their insertions); underside with almost inconspicuous and fine pubescence.

Head and pronotum with extremely small and sparse punctures, much smaller than eye facets in diameter (about half), interspaces between them 2–4 puncture diameters and smoothly alutaceous. Elytra with somewhat sparser punctures, interspaces smoothly alutaceous. Underside with indistinct obsolete punctures, more or less smoothed to finely and densely microreticulate; although in some places punctures looking like those on dorsal sclerites.

Head subtriangular, subflattened, somewhat longer than distance between rather large eyes with moderately large facets; from above longitudinal diameter of its eyes twice greater than transverse one, but from below longitudinal diameter is much more than four times as great as transverse one; anterior part of frons isolated as a transverse stripe ("clypeus"); antennal insertions located before eyes and without dilatation of frons over them. Labrum well exposed, projecting far anteriorly, bilobed and with a deep median excision. Mandibles well raised, with regularly curved outer edge, sharply acute and apparently simple apices. Gular sutures very distinct, divergent posteriorly and reaching posterior edge of epicranium. Mentum subpentagonal, about 1.5 times as wide as long. Hypostomal sinuses rather wide and well exposed. Ligula somewhat shorter than mentum. Labial palpi three-segmented; ultimate palpomere subcylindrical, about three times as long as thick, and twice longer than penultimate palpomere. Maxillae with four-segmented palpi, antennomere 2 rather long and three times longer than palpomere 3, palpomere 4 longest and narrow (more than four times as long as thick). Antennae about 1.5 times as long as width of pronotum and reaching mesocoxae; with flagellomeres somewhat widened inwards and, therefore, looking like subserrate, scape strongly swollen and about as long as each of antennomeres 3–10, pedicel (antennomere 2) shortest and spheric, ultimate antennomere longest and subacute at apex.

Pronotum about 1.5 times as wide as long, gradually narrowing from base, gently and regularly convex on the whole surface; with anterior edge nearly regularly convex, posterior one bisinuate and widely bordered, lateral edges finely undulate; anterior angles rounded and posterior angles subacute and somewhat projecting posteriorly.

Scutellum transverse, moderately large, subtrapeziform, and with arcuate posterior angles. Elytra about twice as long as wide combined, longest at suture and completely covering abdominal apex, gently arcuate at sides and widest behind the middle; their apices rounded and forming a deep sutural angle, adsutural lines well expressed along the suture and continuing to lateral sides; gently and regularly convex on the whole surface.

Prosternum with anterior orifice only somewhat smaller than epicranium; pronotosternal sutures reaching anterior edge; before procoxae about 1.5 times as long as procoxae; its process as wide as scape, somewhat extended behind procoxae and rounded at apex; procoxal cavities widely transverse and open posteriorly. Procoxae with exposed trochantin. Distance between coxae in all pairs comparable and as great as width of antennomeres. Mesoventrite flat and forming the same plane with metaventrite and some angle with plane of prosternum. Mesepimera reaching mesocoxal cavity by comparatively wide stripe. Metaventrite moderately long (about 1.25 times as long as mesoventrite), medially convex, without submesocoxal lines but with paracoxal line before metacoxae interrupted in the middle and rather convex, its posterior edge between metacoxae angularly excised. Metepisterna very narrow at posterior end and rectilinearly widening anteriorly. Metacoxae narrowly separated and transverse, very short at lateral part and rather prolonged at median part and looking like subquadrangular process. Abdominal ventrites 1–4 more or less comparable in length, although ventrite 1 somewhat longer and ventrite 3 somewhat shorter; hypopygidium subtrapezoid with subtruncate apex and mostly invaginated into the previous abdominal segment. Elytral epipleura very distinct, at base about as wide as metepisterna in anterior part and much wider than prosternal process and scape.

Pro- and mesotrochanter apparently slightly elongate; metatrochanter lobed. Tibiae very narrow (narrower than antennae) and long, with thin spurs. Femora of usual shape, about four times as wide as tibiae. Tarsi slightly wider than tibiae, tarsomere 1 longest (posterior leg) or subequal with tarsomere 5; subcylindrical tarsomere 2 somewhat longer than slightly lobed tarsomere 3; tarsomere strongly lobed; claws moderately long, narrow and dentate at base.

Etymology

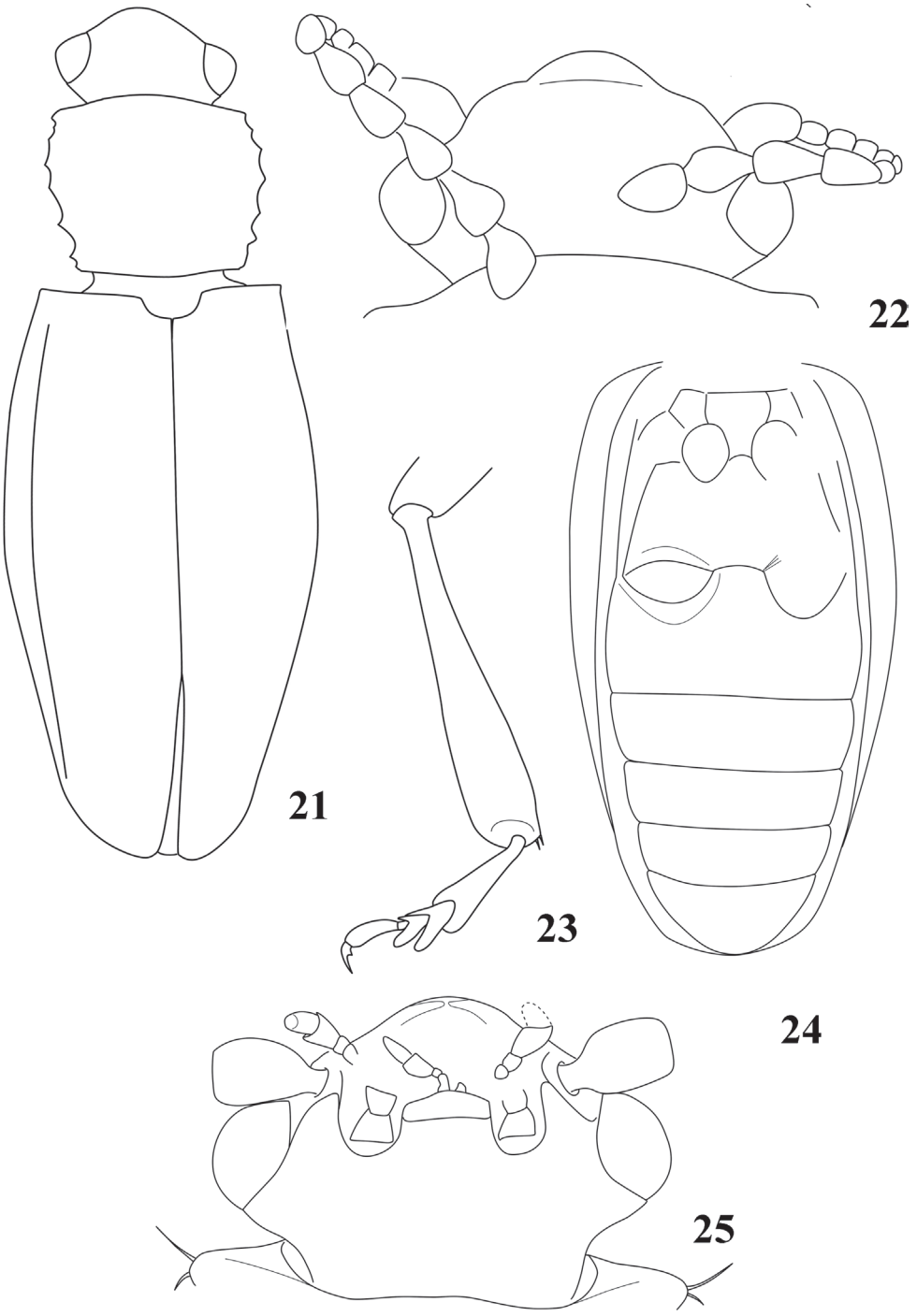
The species is named in honor of the daughter of the senior author, Polina A. Kirejtshuk, who helped in the preparation of the illustration for this and other papers.

Family Silvanidae Kirby, 1837
Subfamily Brontinae Blanchard, 1845
Tribe Telephanini LeConte, 1861

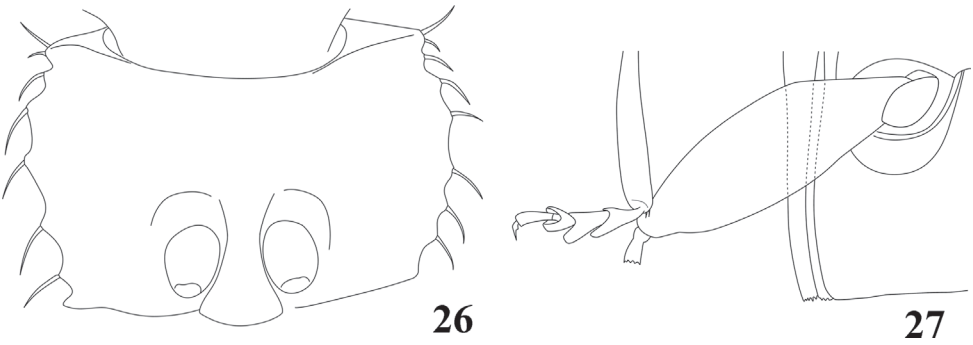
Genus *Antiphloeus* gen.n.
Type species *Antiphloeus stramineus* sp.n.

Diagnosis and comparison

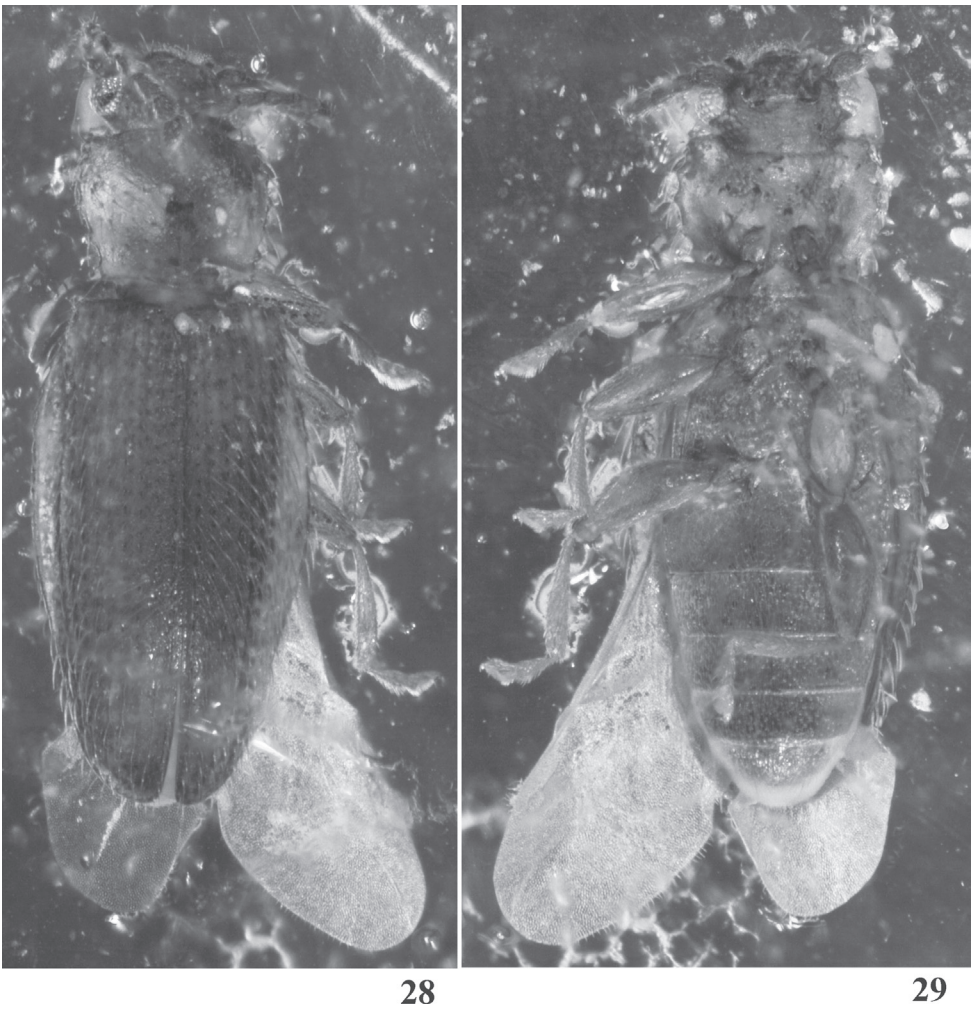
The new genus is characterized by absence of scutellary striola, absence of longitudinal frontal groove, undulate to subspinose lateral pronotal edges, posteriorly closed



Figs 21–25. *Antiphloeus stramineus* gen. et sp.n. (Silvanidae), holotype. (21) Body, dorsal view. (22) Head, dorsal view. (23) Metatibia and tarsus, dorsal. (24) Pterothorax and abdomen, ventral view.(25) Head, ventral view. Length of specimen 2.8 mm.



Figs 26–27. *Antiphloeus stramineus* gen. et sp.n. (Silvanidae), holotype. (26) Prothorax, ventral view. (27) Mesotibia, mesotarsus, metacoxa and metafemur, ventral view. Length of specimen 2.8 mm.



Figs 28–29. *Antiphloeus stramineus* gen. et sp.n. (Silvanidae), holotype. (28) Body, dorsal view. (29) Body, ventral view. Length of specimen 2.8 mm. This figure is published in colour in the online edition of this journal, which can be accessed via http://booksandjournals.brillonline.com/content/1876312x.

procoxae, narrowly separated pro- and mesocoxae and lobed tarsomere 3 and very easily recognizable among recent members of the tribe Telephonini (Thomas & Nearns 2008). It seems to be closely related to the recent genus *Telephanus* Erichson, 1845 from the Western Hemisphere sharing with the latter many external characters, differs from the latter in the much shorter antennae with proportions in antennomeres, more transverse pronotum with broadly undulate to shortly spinose sides (although pronotum of some *Telephanus* species very similar to that in the new genus), much finer punctuation of dorsum and lack of clear longitudinal rows of punctures on elytra, wider subexplanate sides and epipleura of elytra, very even underside of head, shorter maxillary palpi and more widely separated all pairs if coxae.

Etymology

The name of this new genus is formed from the Greek "*Anti*"(άντί, against, instead (of), "*phloeus*" (φλοίος, bark, shell, husk (of grain) ; peel (of fruits and vegetables); pod (of legumes, бобовых) ; scale (of fish)) referring that the new genus is different from all other genera with the root "*phloeus*" in their names. The gender is masculine.

Remarks

The metatarsomeres 3 of the type species of the new genus are very small and together with the previous look like conjoined (giving an impression that the tarsal formula of this new species is 5–5–4).

This form represents the oldest fossil of the subfamily Brontinae and first fossil of the tribe Telephanini. Another representative of the subfamily is known from Baltic amber (Kirejtshuk 2011).

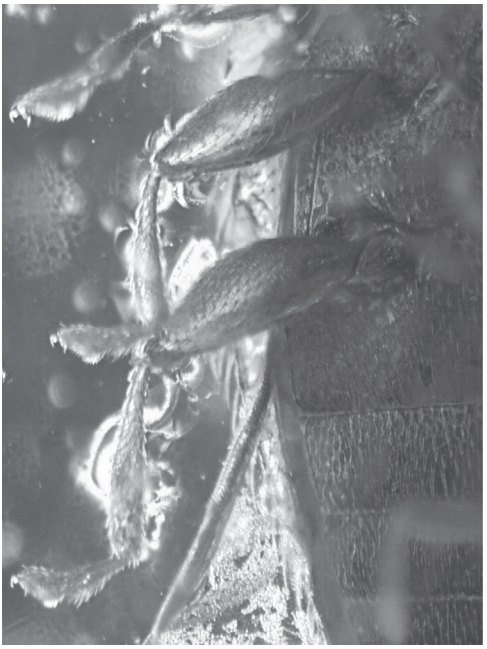
Antiphloeus stramineus sp.n. (Figs 21–32)

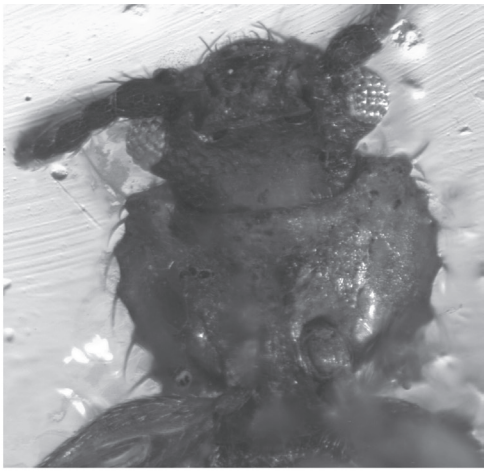
Material

Holotype "PA-15066", sex unknown; the complete specimen of very good preservation is included in a flat parallel-sided piece of homogeneous amber (6 × 9 mm) together with one partly ruined spider and one very small and wingless specimen of Psocoptera at the surface of the amber piece both of which are faced to the underside of beetle. The piece of amber contains also some pieces of small and dark organic matter.

Description

Holotype. Body 2.8 mm long, 1.1 mm wide, about 0.3 mm high. Elongate, moderately convex dorsally and ventrally; unicolorous straw reddish to straw yellowish; at most with a weak fat shine; dorsum with sparse and thick suberect reddish setae somewhat longer than one flagellomere and about twice as long as distance between their insertions; side of pronotum and elytra fringed by larger setae (about twice as long as one flagellomere) and becoming shorter posteriorly; underside with well conspicuous and fine, rather dense, subrecumbent reddish grey hairs 2–3 times as long as distance between their insertions.





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Figs 30–31. *Antiphloeus stramineus* gen. et sp.n. (Silvanidae), holotype. (30) Lateral part of pterothorax, base of abdomen and legs, ventral view. (31) Head and prothorax, ventral view. Length of specimen 2.8 mm. This figure is published in colour in the online edition of this journal, which can be accessed via http://booksandjournals.brillonline.com/content/1876312x.

Head, pronotum and elytra with distinct and sparse punctures, about as large as eye facets in diameter, interspaces between them 4–6 puncture diameters and smoothly alutaceous; however, on elytra punctuation slightly denser and with some trace of arrangement of longitudinal rows. Underside with distinct and fine punctures, markedly smaller than eye facets, interspaces between them about as great as puncture diameter or somewhat greater, more or less smoothed to finely and densely microreticulated (although punctuation on head denser and coarser, and on ventrite 1 looking like obsolete and microsculpture more relief).

Head subtriangular, subflattened, apparently not longer than distance between moderately large eyes with moderately coarse facets; without any longitudinal depressions; anterior part of frons isolated as a transverse stripe ("clypeus"); antennal insertions located before eyes and without clear dilatation of frons over them. Labrum apparently exposed, but not visible. Mandibles small and slightly exposed, with regularly curved outer edge and sharply acute simple apices. Gular sutures not expressed. Mentum strongly transverse more than four times as wide as long. Hypostomal sinuses rather wide and well exposed. Labial palpi three-segmented; ultimate palpomere subconical, about three times as long as thick and about 1.5 times as long as penultimate palpomere. Maxillae with four-segmented palpi, ultimate and penultimate palpomeres longest and ultimate subconical and about twice as long as thick. Antennae submoniliform, nearly twice as long as width of pronotum; with flagellomeres somewhat

increasing distally; scape strongly swollen and longest, pedicel (antennomere 2) as large as following flagellomere, antennomeres 7–11 somewhat longer than previous flagellomeres, ultimate antennomere acute at apex.

Pronotum somewhat wider than long, widest in anterior third, gently and regularly convex at disk and subexplanate at sides; with anterior edge slightly and nearly regularly convex, posterior one almost straight and narrowly bordered, lateral edges broadly undulate to almost spinose; anterior and posterior angles rounded and not projecting. Scutellum strongly transverse, moderately large, subtrapeziform and with arcuate posterior angles. Elytra somewhat less than twice as long as wide combined, longest at suture and completely cover abdominal apex, gently arcuate at sides and widest before the middle; their apices rounded and forming a small sutural angle, adsutural lines slightly expressed in distal half.

Prosternum without clear pronotosternal sutures; before procoxae about 1.5 times as long as procoxae; its process as wide as scape in narrowest place and widening apically, somewhat extended procoxae, joined with prohypomera and widely rounded at apex; procoxal cavities oval. Mesoventrite flat and forming the same plane with metaventrite and prosternum. Distance between mesocoxae subequal and distance between metacoxae twice as great as that between procoxae.

Metaventrite moderately long (slightly longer than prosternum before procoxae), medially convex, without submesocoxal lines and discrimen, its posterior edge between metacoxae with shallow arcuate to angular excision. Metepisterna very narrow at posterior end, rectilinearly widening anteriorly. Metacoxae suboval widely separated and transverse. Abdominal ventrite 1 longest, ventrites 2 and hypopygidium subequal in length and each of them a little longer than each of ventrites 3 and 4; hypopygidium rounded at apex. Elytral epipleura very distinct and expressed along whole elytral sides, widest before the middle and gradually becoming narrower posteriad.

Trochanter of elongate type. Tibiae narrow and subtriangular with rounded preapical angle, about as wide as scape and with very small and thin spurs. Femora of usual shape, 2.5–3.0 times as wide as tibiae. Tarsi about as wide as tibiae, tarsomere 1 longest (particularly in posterior leg) and widened apically; tarsomeres 2 and 3 widely lobed; tarsomere 4 shortest and almost concealed between lobes of previous one; ultimate tarsomere as long as two previous combined; claws moderately long, narrow and dentate at base.

Etymology

The epithet of this new species refers to the coloration of it (straw reddish to straw yellowish).

Taxonomic notes

The generic name *Eohelodites* was proposed for the species from Fushun amber (Hong 2002a,b) which is scarcely different from characteristic recent members of *Scirtes* and *Exochomoscirtes* after many characters that can interpreted not ambiguously (Ruta

& Yoshitomi 2010a,b, etc.), although some characters were drawn by the author of the original description of the fossil species certainly with mistakes (see above the Diagnosis to *Scirtes circumcisus* sp.n.). Because the type specimen of *Eohelodites orbiculatus* Hong, 2002 is not accessible and presumably lost (according to the personal communication of Ren Dong), it is thought reasonable to regard one of generic names proposed for the recent species as very probable synonym of *Eohelodites*. Because the differences between *Scirtes* and *Exochomoscirtes* in fossil species can be scarcely studied (the second differs from the first in the ultimate maxillary palpomere widened, especially in females), it is thought also preferable to choose the first name for a synonymization:

Scirtes Illiger, 1807 = *Eohelodites* Hong, 2002, syn.n.

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