

The oldest representatives of the family Coccinellidae (Coleoptera: Polyphaga) from the Lowermost Eocene Oise amber (France)

Древнейшие представители семейства Coccinellidae (Polyphaga: Coleoptera) из нижнеэоценового янтаря Уаз (Франция)

A.G. KIREJTSHUK* & A. NEL

А.Г. КИРЕЙЧУК*, А. НЕЛЬ

A.G. Kirejtshuk, Zoological Institute of the Russian Academy of Sciences, 1 Universitetskaya Emb., St Petersburg 199034, Russia; CNRS UMR 7205, Muséum National d'Histoire Naturelle, CP 50, Entomologie, 45 Rue Buffon, F-75005, Paris, France. E-mails: kirejtshuk@gmail.com, agk@zin.ru. *Corresponding author.

A.Nel, CNRS UMR 7205, Muséum National d'Histoire Naturelle, CP 50, Entomologie, 45 Rue Buffon, F-75005, Paris, France. E-mail: anel@mnhn.fr

In the paper two new species of the genus *Rhyzobius* Stephens, 1829 (*R. antiquus* sp. nov. and *R. graciosus* sp. nov.) and one new species of the genus *Nephus* Mulsant 1846 (*N. subcircularis* sp. nov. without a certain subgeneric placement) from the Lowermost Eocene amber of Oise are described. A short review of known fossil records of the family Coccinellidae is given.

В статье описаны два новых вида из рода *Rhyzobius* Stephens, 1829 (*R. antiquus* sp. nov. и *R. graciosus* sp. nov.), а также один новый вид рода *Nephus* Mulsant 1846 (*N. subcircularis* sp. nov. без определенной подродовой принадлежности) из нижнемелового янтаря Уаз. Приводится краткий обзор сведений по ископаемым семейства Coccinellidae.

Key words: Lowermost Eocene, amber, Oise, France, Coleoptera, Coccinellidae, Coccidulini, Scymnini, new species

Ключевые слова: нижний эоцен, янтарь, Уаз, Франция, Coleoptera, Coccinellidae, Coccidulini, Scymnini, новые виды

INTRODUCTION

The paper is the tenth contribution to the knowledge of the fauna of Coleoptera from the Lowermost Eocene French amber collected in Oise falls (Batelka et al., 2006; Bílý & Kirejtshuk, 2007; Kirejtshuk & Nel, 2008, 2009; Moseyko et al., 2010; Kirejtshuk et al., 2010a,b; Kovalev et al., 2012).

The family Coccinellidae Latreille, 1807 is known in fossils only from some Cainozoic resources, and no amber specimen has been described till now. All indications of Coccinellidae in the Jurassic cannot be regarded as subject of consideration, because for now the reliable cucujoids appear in the fossil record not earlier than at the beginning of the Cretaceous. Hieke & Pietrzeniuk (1984)

and Kubisz (2000) mentioned this family without any more precise attribution from the Eocene Baltic amber, and Grimaldi & Engel (2005) published pictures of an adult and a larva from the Miocene Dominican amber, while Gersdorf (1969) reported a compression print of this family among sediments from the Upper Pliocene of Wiltershausen (Niedersachsen, Germany).

Besides, among the inclusions from Baltic amber Berendt (1845), Menge (1856), Klebs (1910), Larsson (1978) and Hieke & Pietrzeniuk (1984) indicated the genera *Coelopterus* Mulsant, 1853 and *Pharus* Mulsant, 1850 (Sticholotidinae Weise, 1901), *Scymnus* Kugelann, 1794 (Coccidulinae Mulsant, 1846), *Platynaspis* L. Redten-

bacher, 1843 (Chilocorinae Mulsant, 1846), and *Coccinella* Linnaeus, 1758 (Coccinellinae Latreille, 1807). The subfamily Coccidulinae was also recorded in the Lower/Middle Miocene of Shanwang Basin [Shandong, China: *Scymnus* cf. *kawamurai* Ohta, 1929 (by Zhang, 1989) and *Hippodamia olbia* J. Zhang, Sun et X. Zhang, 1994] and in the Oligocene of Brunnstatt (Haut-Rhine, Elsas, France: *Scymnus angulatus* Förster, 1891). The subfamily Chilocorinae was also recorded in the Earliest Oligocene of Florissant (Colorado, USA: *Chilocorus ulkei* Scudder, 1900) and also from Brunnstatt [*Chilocorus foersteri* Ukrainsky, 2010 (= *politus* Förster, 1891, non Mulsant, 1850) and *C. inflatus* Förster, 1891].

Finally, the subfamily Coccinellinae was mentioned for Florissant [*Adalia subversa* Scudder, 1900 (also by Wickham, 1912); *Anatis resurgens* Wickham, 1917; *Coccinella florissantensis* Wickham, 1914; *C. sodoma* Wickham, 1913], the Oligocene of Brunnstatt [*Aphidecta marginata* (Foerster, 1891); *Adalia* sp. (by Théobald, 1937)], the Latest Oligocene of Rott am Siebengebirge [Germany: *Coccinella antiqua* Heyden et Heyden, 1862; *C. bituminosa* Heyden et Heyden, 1866; *C. fossilis* C. Heyden et L. Heyden, 1866; *C. krantzi* C. Heyden et L. Heyden, 1866; *C. prisca* Schlechtendal, 1894; *Sospita haagi* (C. Heyden et L. Heyden, 1866); *Lasia primitiva* C. Heyden et L. Heyden, 1866], the Late Miocene of Oeningen [Baden-Wurtemberg, Germany: *Coccinella amabilis* Heer, 1865; *C. andromeda* Heer, 1847; *C. colorata* Heer, 1865; *C. heeri* Ukrainsky, 2010 (= *decempustulata* Heer, 1879, non Linnaeus, 1758); *C. hesione* Heer, 1847; *C. perses* Heer, 1847; *C. ponomarenkoi* Ukrainsky, 2010 (= *spectabilis* Heer, 1865, non Faldermann, 1835)], and the Pliocene of Willershausen [*Halysia* sp., *Harmonia* sp. and *genus incertus* (Gersdorf, 1969)]. Thus, the species described in this paper represent the oldest members of the family known at present. A more detailed review of this coleopterous family in the fossil record can be taken from Ponomarenko & Kirejtshuk (2012).

MATERIAL AND METHODS

Many specimens recovered among inclusions from the Lowermost Eocene French amber are deposited in the Laboratoire de Paléontologie, Muséum National d'Histoire Naturelle, Paris (MNHN). For this study ordinary optic equipment was used, in particular the stereomicroscope Olympus SCX9 and inverted microscope Olympus CK 40 in the Paris museum, and also the stereomicroscope Leica MZ 16.0 in the Zoological Institute, St Petersburg. All the holotypes and most paratypes of the new species are deposited in the Paris museum, one paratype of *Rhyzobius antiquus* sp. nov. ("PA 245") is deposited in the Zoological Institute of the Russian Academy of Sciences (St Petersburg).

The general classification of the family Coccinellidae has several versions; the ideas developed by Sasaji (1968) and Kovár (1996) were used in the paper. The recent monograph on the genus *Rhyzobius* (Tomaszewska, 2010) was rather an important source of information on the species of this genus in addition to the recent specimens from the collections of the Paris museum and the Zoological Institute, St Petersburg.

Type strata. Lowermost Eocene, circa – 53 Myr, Sparnacian, level MP7 of the mammal fauna of Dormaal.

Type locality. Farm Le Quesnoy, Chevrrière, region of Creil, Oise department (north of France).

RESULTS

Order COLEOPTERA

Family COCCINELLIDAE Latreille, 1807

Subfamily COCCIDULINAE Mulsant, 1846

Tribe COCCIDULINI Mulsant, 1846

Genus *Rhyzobius* Stephens, 1829

Type species: *Nitidula litura* Fabricius, 1787.

Notes. The specimens considered here were assigned to the genus *Rhyzobius* be-

cause of (a) large and coarsely faceted eyes, (b) relatively long antenna with flattened, three-segmented club, (c) deeply split tarsal claws and other features. All the specimens are rather similar. Three specimens, which are visible in the dorsoventral plane, have differences in some characters that could be considered as diagnostic ones for two separate species. The remaining four specimens are visible in pieces of amber from the lateral view and cannot be completely compared with the first three specimens. Nevertheless, these four specimens are placed in one of the two new species recognized among the specimens with the underside exposed because they have characteristic pronotal sides. The recent species of this genus are spread in all continents except Antarctica, and the greatest diversity of the genus is known from Australia.

These new species differ from most recent congeners (about 60 recent species are recorded in the genus after the recent revision by Tomaszewska, 2010) in the shape of pronotum which is comparatively wide at base, its posterior angles with an almost clear top, sides nearly gradually narrowing anteriorly and forming an even continuous line with sides of elytra [in most recent members of the genus the pronotal base is markedly narrower than the elytral base; usually pronotal sides at base are more or less straight or sometimes the pronotum is subquadrangular; posterior and anterior pronotal angles are more or less rounded]. The new species have uniform and comparatively short pubescence on the dorsum, although many recent pubescent species of the genus demonstrate two types of hairs: shorter and semirecumbent hairs are intermixed with longer and erect ones. In general, the combination of the diagnostic characters of the new species, except those of the shape of pronotum and pubescence considered above, is quite unique and includes the unicolorous dark and elongate oval body of medium size, dense and comparatively fine dorsal puncturation, raised microsculpture on interspaces between punctures, charac-

teristic shape of antennal club, configuration of submeso- and submetacoxal lines. The new species are somewhat similar to *Rhyzobius confinis* Lea, 1902, particularly by the somewhat brownish abdomen, characters of puncturation and sculpture of integument, configuration of submeso- and submetacoxal lines and shape of antennal club. However, in contrast to the latter, the new species have the rather smaller body size, pronotum with nearly bisinuate base and only slightly narrower than elytral ones, almost distinct posterior angles and gradually narrowing anteriorly, shorter hairs on the dorsum and antennal club more distinctly oblique at apex. Nevertheless, a somewhat similar pronotum is known in some other recent species. *Rhyzobius cyaneus* Blackburn, 1889 (MNHN: "Eber. N. Gallyd. S.") is, in contrast to both new species, characterized by much larger and more slender body, bluish dorsum, yellow abdomen, longer pubescence with erect hairs, different configuration of submeso- and submetacoxal lines, different antennal club and ultimate maxillary palpomere. *Rhyzobius pulchellus* (Montrouzier, 1861) (MNHN: "New Caledonia, Mueo, 19.V.1928, J.D.A. Cockerell, on Citrus") differs from the new species in the lighter and more slender body, unbordered pronotal base, longer pubescence with erect hairs, smoothed interspaces between markedly larger and sparser dorsal punctures, configuration of submeso- and submetacoxal lines, shape of antennal club and ultimate maxillary palpomere, much shorter ultimate tarsomere. *Rhyzobius trimeni* Casey, 1899 (MNHN: "Leap" and "Cape Town, Dr Martin") differs from the new species in the somewhat larger body, yellow spots at anterior pronotal angles and elytral base, longer pubescence with erect hairs, configuration of submeso- and submetacoxal lines, shape of antennal club and ultimate maxillary palpomere, much shorter ultimate tarsomere. Finally, *Rhyzobius javeli* Mulsant, 1899 (MNHN: "Leap" and "Cape Town, Dr Martin") differs from the new species in somewhat larger, markedly

more slender and much lighter body, unbordered pronotal base, longer tarsal lobes, longer pubescence with erect hairs.

Remarks on probable bionomy. Like the recent congeners, the two new species described here could be predaceous or could have some associations with colonies of scale insects that appeared before the Cainozoic.

***Rhyzobius antiquus* sp. nov.**

(Figs 1–6, 9–13)

Holotype. ‘PA 11862’, male with slightly exposed genital capsule; complete specimen is included in a small irregular elongate amber parallelepiped (8.0 mm in length and about 3.0 mm in width of one facet) with many small pieces of organic matter and small gas bubbles diffusely spread throughout it; besides, there are a very small specimen of Nematocera and a very small larva of Thysanoptera near the posterior half of the beetle underside; most sclerites of the beetle are covered with “milky” cover.

Paratypes. ‘PA 972’, female; broken specimen with somewhat exposed apex of the left wing but with most part of dorsal sclerites missing is included in a very small irregular elongate amber parallelepiped, which is embedded in “Canada Balsam” medium and fixed between two square coverslips. ‘PA 245’, probably female; nearly complete specimen with somewhat exposed apices of both hind wings is included together with a small immature dipteran larva below the left part of the beetle underside in a very small irregular elongate amber parallelepiped with many small gas bubbles, which is embedded in “Canada Balsam” and fixed between two rectangular coverslips. ‘PA 5388’, female; complete specimen is included in an amber bar (length 11 mm), semicircular in cross-section and with a flat plane of 5 mm in width, also including many layers and many small pieces of organic matter, very small cracks; the beetle is visible laterally and most of its sclerites are covered with “milky” cover of different thickness. ‘PA 4840’, sex unknown; specimen with broken distal part of the body, which is out of a rather clear piece of amber, is included in a small irregular elongate amber parallelepiped (8.0 mm in length and about 4.0 mm in width of the widest facet); around the beetle there are some very small cracks, particularly at head and prothorax.

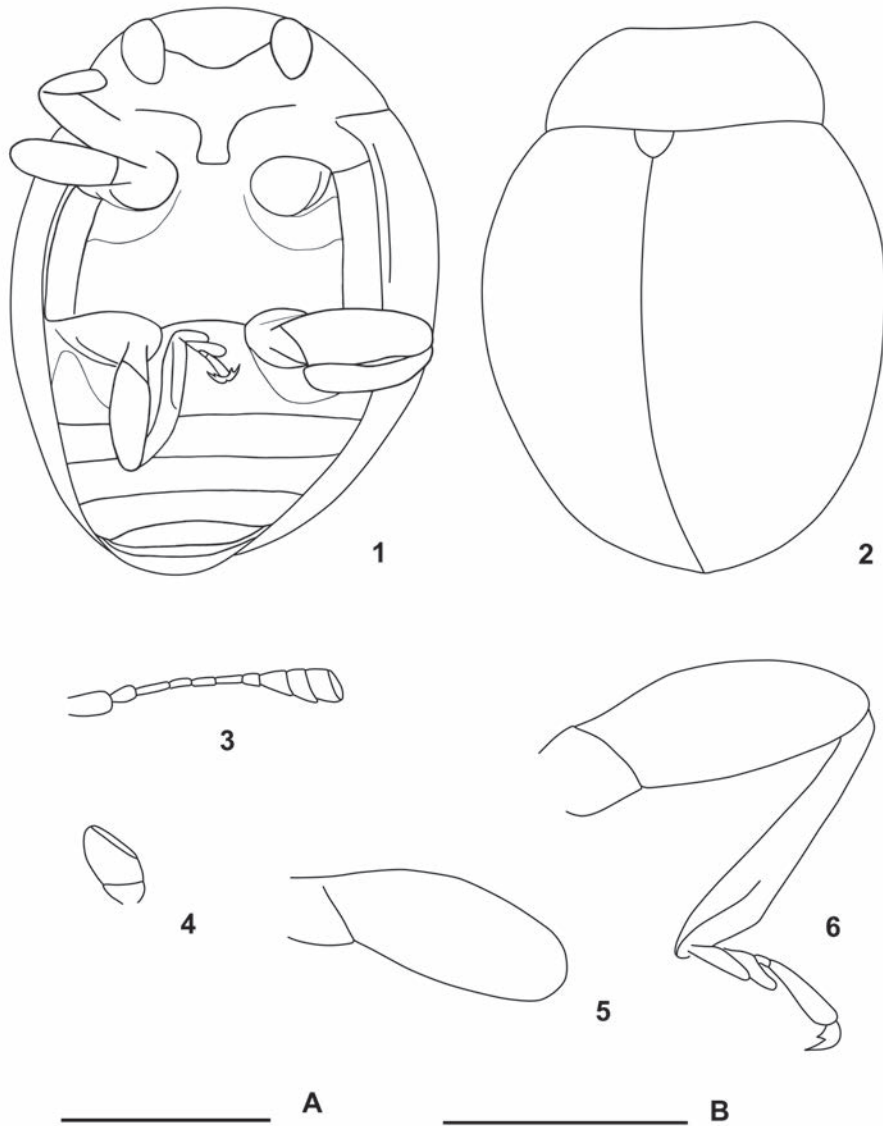
Additional specimen. ‘PA 5162’, sex unknown, badly preserved specimen with right half of its body destroyed is included together with 1 specimen of Trichoptera, 1 specimen of Ephemeroptera, 1 specimen of Hemiptera, 1 specimen of Fulgoroidea and some separate organs or sclerites of different insects in mostly unpolished elongate amber piece with mixture of layers, many small gas bubbles and different grains of organic matter. The beetle is obscured with an ephemeropteran wing and not clearly visible.

The specimen ‘PA 11862’ is chosen as the holotype because it is the most complete (although the piece of amber including it and two other insects also contains many small gas bubbles making it difficult to observe the whole beetle but allowing one to study most structures separately). The mandibles, palpi, procoxae and procoxal process of all the specimens examined are not visible because of the “milky” cover. However, the labial and maxillary palpi of the paratype ‘PA 245’ can be more or less clearly observed, whereas only the maxillary palpi are more or less visible in other specimens.

Diagnosis. This new species differs from the other congener from the same resource in the more oval body, shape of pronotum, narrower prosternal process, greater relative distance between mesocoxae and configuration of submeso- and submetacoxal lines. The pronotum of this new species, in contrast to that in *R. gratiosus* sp. nov., is comparatively narrow at base and with more arcuate sides. The holotype of this new species has a clear line along the inner edge of epipleura, while the paratype have well visible epipleura (‘PA 245’) and the holotype of *R. gratiosus* sp. nov. do not demonstrate such feature.

Etymology. The epithet of the new species is the Latin adjective meaning “ancient” or “archaic”.

Description. *Holotype, male.* Length 2.8, width 2.0, height 1.2 mm. Oval, strongly convex dorsally and moderately ventrally; unicolorous dark brown to blackish with brown to brownish appendages and abdomen; dorsum with rather dense and diffusely spread, long, very thin, moderately conspicuous brownish, subrecumbent hairs (3–5 times as long as the distance between



Figs 1–6. *Rhyzobius antiquus* sp. nov. **1, 2**, body of holotype ('PA 11862'); **3**, antenna of paratype ('PA 972'); **4**, labial palpus of paratype ('PA 245'); **5**, mesofemur of paratype ('PA 972'); **6**, hind leg of paratype ('PA 972'). Ventral (1, 3, 4) and dorsal (2) view. Scale bars: 1.0 mm; A – to figs 1, 2; B – to figs 3–6.

their roots), pronotal and elytral sides without clear cilia; underside with somewhat similar pubescence consisting of less conspicuous hairs (which are somewhat sparser on thoracic sclerites). Sculpture and puncturation of integument mostly not visible because of "milky" cover, although

surface of some places of elytra and thoracic sclerites with very fine and sparse punctures, interspaces between them finely and smoothly alutaceous.

Head transverse and somewhat declined (subhypognathous) and scarcely visible dorsally, much narrower than pronotum,

with very large and coarsely faceted eyes bearing clear interfacetal setae. Mandibles very small and scarcely exposed from under frons. Pronotum slightly narrower than combined elytral base, about twice as wide as long, widest at base and gradually arcuately narrowing anteriorly towards widely rounded anterior angles, moderately and gently vaulted; its anterior edge slightly emarginate; its posterior edge indistinctly bordered, strongly convex at the middle and slightly emarginate at sides; posterior angles with distinct top. Scutellum looking like a subequilateral triangle. Elytra somewhat shorter than wide combined, longest at suture and nearly regularly arcuate along sides, rather steeply sloping laterally (with lateral edges visible dorsally) and with extremely narrowly explanate edges, adsutural lines not visible. Pygidium with widely rounded to subtruncate apex. Anal sclerite well exposed from under pygidial apex.

Most part of underside not clearly visible because of optical aberration in different layers of amber and rather thick "milky cover". Procoxae moderately large, transverse and moderately narrowly separated. Prosternal median part whether is isolated from lateral parts and process subparallel-sided or slightly widened at apex, where it is about one-third as wide as the distance between metacoxae. Mesocoxae apparently subtransversely oval and widely separated (somewhat less widely separated than metacoxae). Metaventrite subflattened along the middle, posterior edge between coxae straight. Submesocoxal line distinct and deviating from posterior edge of mesocoxal cavity at its median part, then arcuately joining to the inner edge of metepisterna before the middle of the latter. Metepisterna moderately narrow and subparallel-sided. Metacoxae transversely oval, somewhat less wide than the distance between them. Abdominal ventrite 1 longest, submetacoxal lines arcuately deviating from posterior edge of the cavity and returning to the latter at outer edge – this line reaching distal fifth of the ventrite; ventrite 2 and hypo-

pygidium comparable in length and somewhat longer than each of ventrites 3 and 4, posterior edge of hypopygidium transverse to shallowly emarginate. Epipleura gently outlined, at anterior third their plane with a curve visible laterally and in anterior half with a line along inner edge.

Legs well developed, moderately narrow and long, diffusely covered with comparatively short setae. Tibiae moderately compressed, comparable in width and shape, narrowing at apex by a comparatively wide isolated stripe reaching place of insertion of tarsus. Femora of usual shape and slightly compressed, about 2.5 times as wide as protibiae. Tibial spur not raised. Tarsi tetramerous and moderately long, about 2/3 as long as tibiae, tarsomeres 1 and 2 with very wide lobes and wider than tibiae; ultimate tarsomeres much longer than tarsomeres 1 and 2 combined; claws strongly dentate, about 1/4 as long as ultimate tarsomere, apex of dens nearly reaching apex of claw.

Paratypes. 'PA 972': length 3.0 mm. Head slightly convex and with frons slightly extending beyond the anterior edge of eyes and clear left maxillary palpus. Labrum far projecting anteriorly, slightly less than twice as wide as long and truncate at anterior edge. Antennae narrow and about as long as head width, 3 segmented club (with widest ultimate segment) comprising nearly 2/7 of total length, flagellomeres between pedicel and club subcylindrical and comparable in length, rather elongate. Hypopygidium widely rounded at apex. 'PA 245': length 2.7, width 1.8 mm. Specimen nearly subunicolorous blackish. Distances between pro-, meso- and metacoxae as 1:3:4; labial comparatively short and wide, with ultimate palpomere obliquely transverse at apex. 'PA 388': length 2.6, height 1.1 mm. Dorsum with more conspicuous and somewhat longer pubescence. 'PA 4840': length 2.6, width 1.6, height 1.0 mm; dorsal pubescence much less conspicuous than that in other specimens of the type series; submesocoxal line almost not returning anteriorly at the edge of metepisternum.

Additional specimen. 'PA 5162', length nearly 3.0 mm; the general outline of body, puncturation and sculpture of the dorsum, and particularly posterior angles of pronotum are rather similar to those of other specimens of *R. antiquus* **sp. nov.**, however, the dorsal hairs are clearly longer and seem to have some difference in length as in many recent species.

***Rhyzobius gratiosus* sp. nov.**

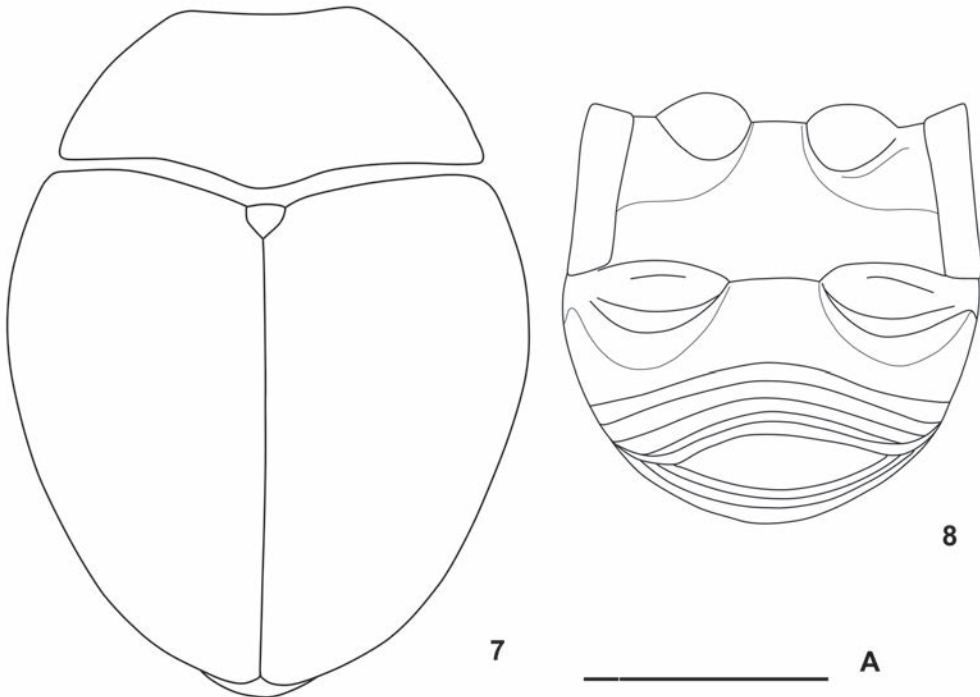
(Figs 7–8, 14–15)

Holotype. 'PA 1290', probable female (abdominal apex not visible clearly); complete specimen is included in a flat piece of amber of irregular triangular shape (17, 11 and 14 mm) consisting of many layers, with two incomplete cracks going from the dorsum towards the flat plane of the amber piece; most sclerites of the beetle are covered with "milky" cover.

Diagnosis. See the diagnosis of the previous new species.

Etymology. The epithet of this new species is formed from the Latin "*gratia*" (grace or graceful) and "*-osus*" (means abundance of).

Description. *Holotype* (taking into consideration a great similarity of this new species to the previous one, most characters shared by both species are omitted in the description below). Length 2.6, width 1.7, height about 1.2 mm. Elongate oval, strongly convex dorsally and moderately ventrally; unicolorous dark brown to blackish with slightly lighter tarsi; dorsum with rather dense and diffusely spread, long, very thin, moderately conspicuous brownish, subrecumbent hairs (3–5 times as long as the distance between their roots), pronotal and elytral sides without clear cilia; underside with somewhat similar pubescence consisting of less conspicuous hairs. Sculpture and puncturation of integument mostly not visible because of "milky" cover, although



Figs 7–8. *Rhyzobius gratiosus* **sp. nov.**, holotype ('PA 1290'). 7, body, dorsal view; 8, metatorax with abdomen, ventral view. Scale bar: 1.0 mm.

surface of some places of elytra and thoracic sclerites with very fine and sparse punctures, interspaces between them finely and smoothly alutaceous.

Pronotum at base about as wide as combined elytral base, about twice as wide as long, widest at base and gradually, nearly rectilinearly narrowing anteriorly to widely rounded anterior angles, moderately and gently vaulted; its anterior edge slightly emarginate; its posterior edge indistinctly bordered, strongly convex at the middle and slightly emarginate at sides; posterior angles with distinct top. Scutellum subcardiform. Elytra about as long as wide combined. Pygidium widely rounded at apex. Prosternal median part not isolated from lateral parts and process slightly widened to apex, where it is at least half as wide as the distance between metacoxae. Submesocoxal line distinct and deviating from posterior edge of mesocoxal cavity at its median part, then arcuately joining to the inner edge of metepisterna behind the middle of the latter. Abdominal ventrite 1 longest, submetacoxal lines arcuately deviating from posterior edge of the cavity and returning to the latter at outer edge – this line reaching distal fourth of the ventrite. Epipleura in anterior half without a clear line along inner edge.

Subfamily **SCYMNINAE** Mulsant, 1846

Tribe **SCYMNINI** Mulsant, 1846

Genus ***Nephus*** Mulsant 1846

Type species: *Sphaeridium quadrimaculatum* Herbst, 1783.

Notes. The species described here has submeso- and submetacoxal lines similar to the species of the genus *Nephus* rather than other genera with small members. This genus includes about two hundred recent species and is divided into various subgenera. Like other congeners, the new species is characterized by the incomplete submetacoxal line (not reaching the lateral edge of ventrite 1), pseudotrimerous tarsi (with a very small intercalary tarsomere) and ab-

sence of both projection of anterior edge and longitudinal ridges of its prosternum. The characters accessible in the specimen examined do not make it possible to find a strict subgeneric attribution for it.

Remarks on probable bionomy. Like the recent congeners, the new species described here could be predaceous or could have some associations with colonies of paraneopteran groups (including aphids and scale insects) which could also exist in the early Eocene (while pseudococcids seem to have appeared later).

***Nephus* (subgenus incertus)**

***subcircularis* sp. nov.**

(Figs 16–20)

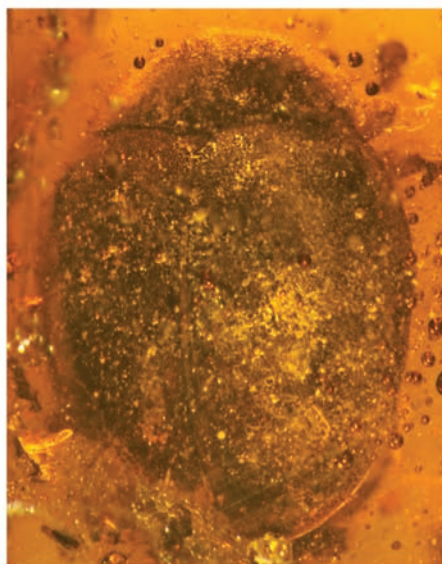
Holotype. ‘PA 1047’, male with somewhat exposed genital capsule; almost complete specimen (a part of the right half of base of the pronotum, and base of the right elytron are cut) is included in a small irregular elongate amber piece (8.0 mm in length and about 5.0 mm in width of the widest facet) with some small pieces of organic matter and small cracks diffusely spread throughout; some sclerites of the beetle is covered with “milky” cover.

The antennae, mouthparts and procoxae of the examined specimen are not clearly visible.

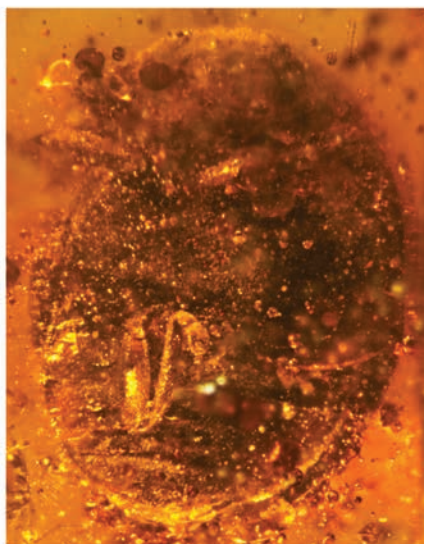
Diagnosis. The new species is rather small and, in contrast to most of the recent species, somewhat more oval; its epipleura are more gradually narrowing apically and more gradually outlined along inner edge (extending along abdominal ventrites up to ventrite 4); tarsi of the new species are somewhat narrower and its underside is less convex.

Etymology. The epithet of the new species is the complex adjective of “*sub*” (nearly) and “*circularis*” (circular).

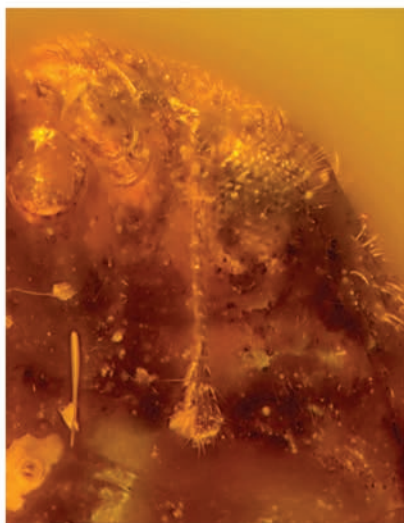
Description. *Holotype, male.* Length 1.2, width 1.0, probable height 0.4 mm. Short oval, strongly convex dorsally and moderately ventrally; unicolorous dark brown to blackish with brown appendages; dorsum with comparatively sparse and diffusely spread, not long, very thin, moderately conspicuous brownish, subrecumbent hairs



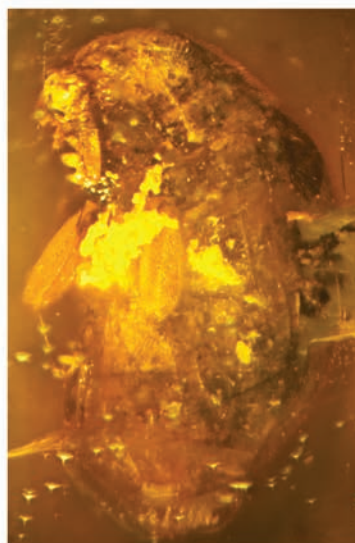
9



10



12

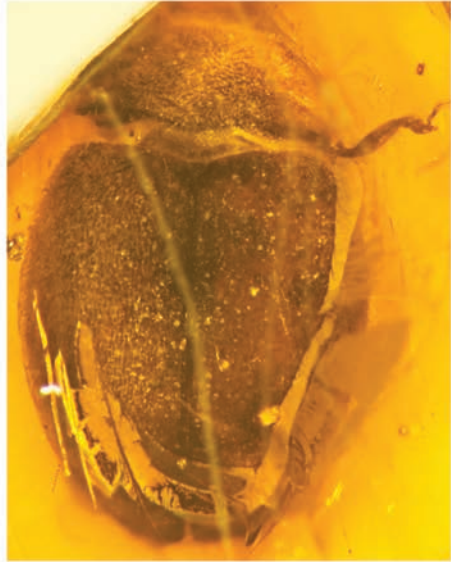


11

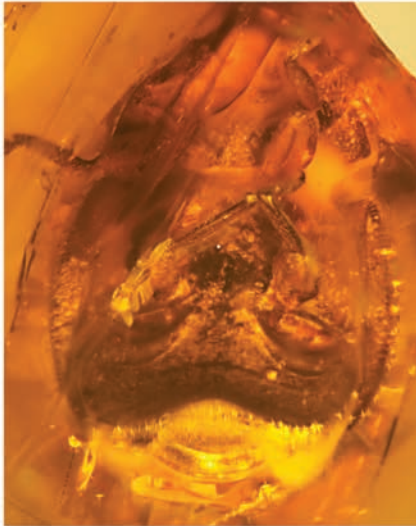
Figs 9–12. *Rhyzobius antiquus* sp. nov. **9, 10**, body of holotype ('PA 11862'), length of body – 2.8 mm; **11**, body of paratype ('PA 972'), length of body – 3.0 mm; **12**, head of paratype ('PA 972'). Dorsal (9), ventral (10) and lateroventral view (11, 12).



13



14

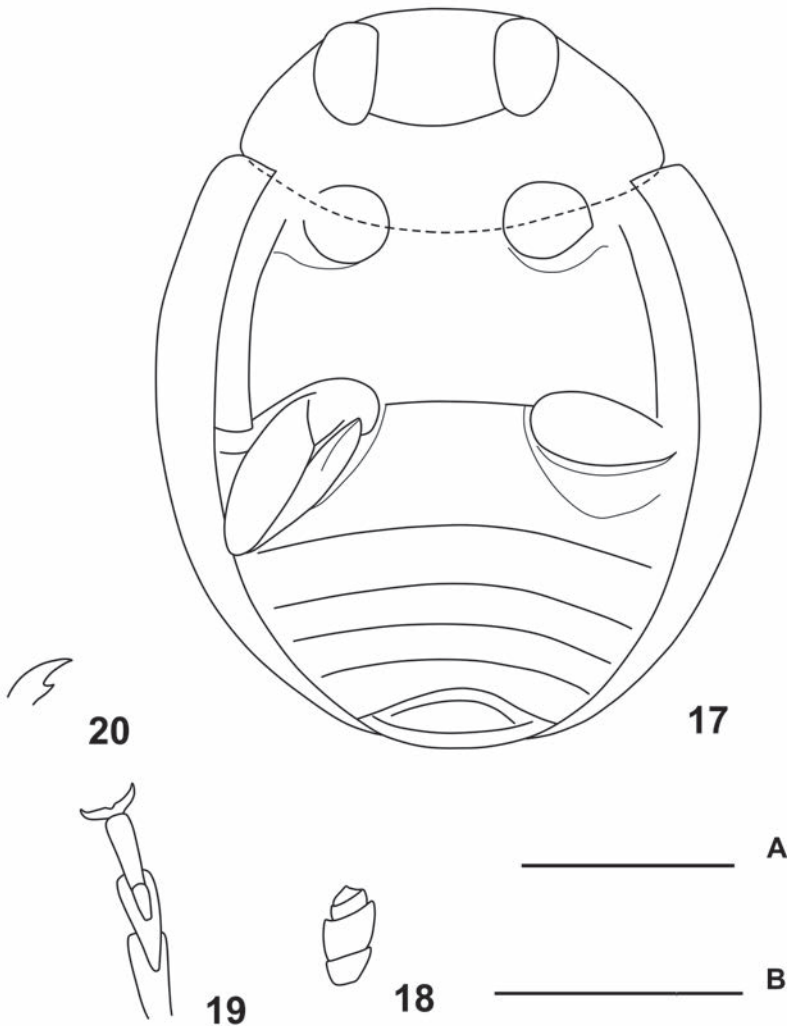


15



16

Figs 13–16. *Rhyzobius* spp. **13**, *Rhyzobius antiquus* **sp. nov.**, body of paratype ('PA 245'), length of body – 2.7 mm; **14**, **15**, *Rhyzobius gratiosus* **sp. nov.**, body of holotype ('PA 1290'), length of body – 2.6 mm; **16**, *Nephus subcircularis* **sp. nov.**, body of holotype ('PA 1047'), length of body – 1.2 mm. Dorsal (14) and ventral (13, 15, 16) view.



Figs 17–20. *Nephus subcircularis* sp. nov., holotype (‘PA 1047’). **17**, body; **18**, antennal club; **19**, protarsus; **20**, tarsal claws. Dorsal (19) and ventral (17, 18) view. Scale bars: A – to fig. 17, 0.3 mm; B – to figs 18, 19, 0.7 mm

(somewhat shorter than the distance between their roots), pronotal and elytral sides without clear cilia; underside with somewhat similar pubescence consisting of less conspicuous and somewhat shorter hairs (which are somewhat sparser on thoracic sclerites). Sculpture and puncturation of part of dorsal integument mostly not clearly visible because of very fine and dense cracks intermixed with “milky” cover,

but there are very fine and very sparse diffuse punctures and rather smoothed (alutaceous) broad interspaces between them; abdominal ventrites with somewhat denser and coarser punctures (with interspaces somewhat greater than a puncture diameter); metaventrite with yet larger punctures and interspaces about as great as a puncture diameter or very slightly greater and nearly completely smooth.

Head transverse and somewhat declined (subhypognathous) and somewhat extending anteriorly from anterior edge of pronotum, moderately narrower than pronotum, with moderately large and not coarsely faceted eyes. Mandibles very small and scarcely exposed from under frons. Antennal club three-segmented, only slightly narrower than maxillary palpomere and with largest penultimate antennomere. Pronotum markedly narrower than combined elytral base, nearly 2.5 times as wide as long, widest along posterior half and from the middle gradually narrowing anteriorly to widely rounded anterior angles, moderately and gently vaulted; its anterior edge subtruncate to subemarginate; its posterior edge moderately strongly and regularly convex; posterior angles rounded. Scutellum missing. Elytra apparently somewhat longer than wide combined, longest at suture and nearly regularly arcuate along sides, rather convex and gradually steeply sloping; lateral edges very narrowly explanate; adsutural lines not visible. Pygidium with widely rounded apex. Anal sclerite well exposed.

Considerable part of underside not clearly visible because of optical aberration in different layers of amber and partly because of "milky cover". Maxillary palpi apparently moderately short and wide, ultimate palpomere about as long as thick and obliquely truncate at apex. Prosternum somewhat medially convex, but not with longitudinal ridges along the middle and its anterior edge not projecting anteriorly. Procoxae moderately large, transverse, rather narrowly separated. Mesocoxae apparently subtransversely oval and widely separated (nearly as widely as metacoxae). Metaventrite slightly convex in the middle, posterior edge between coxae straight. Submesocoxal line more or less distinct, arcuately returning anteriorly at metepisterna. Metepisterna moderately narrow and subparallel-sided. Metacoxae transversely oval, about as wide as the distance between them. Abdominal ventrite 1 longest, submetacoxal lines not complete and becoming obsolete

while returning to the posterior edge of cavity and not joining with lateral edge of ventrite – this line reaching distal fourth of the ventrite; ventrite 2 and hypopygidium comparable in length and somewhat longer than each of ventrites 3 and 4, posterior edge of hypopygidium emarginate. Epipleura about as wide as prosternal process, gently outlined along outer and inner edges gradually narrowing apically and extending along abdominal ventrites to ventrite 4; apparently only with a slight curve visible laterally.

Legs well developed, moderately narrow and long, diffusely covered with comparatively short setae. Tibiae moderately compressed, comparable in width and shape, narrowing at apex by a comparatively wide isolated stripe reaching place of insertion of tarsus. Femora of usual shape and slightly compressed, about 2.5 times as wide as protibiae. Tibial spurs not raised. Tarsi moderately long, about 3/5 as long as tibiae, tarsomeres 1 and 2 with long and not wide lobes (narrower than tibiae); ultimate tarsomeres much longer than tarsomeres 1 and 2 combined; claws strongly dentate, about 1/4 as long as ultimate tarsomere, apex of dens reaching the middle of the claw length.

DISCUSSION

The new species described here belong to genera whose recent species have a predaceous mode of life, although it might scarcely be the initial one for the family. Different phylogenetic reconstructions (Sasaji, 1968; Yu, 1994; Kovár, 1996, etc.) assume that the tribes Coccidulini and Scymnini are not very close to the ancestor of the family. Therefore, it may be supposed that a considerable diversification of the family with probably mycetophagous archaic members took place before the time of the amber deposition in Oise.

ACKNOWLEDGEMENTS

The authors thank the company Lafarge-Granulat for help with the sampling of the fossil and the family Langlois-Meurinne for the

authorization of working in their property. They are also grateful to G. De Ploeg (MNH) and D. Azar (Lebanese University) for the careful preparation of the material. The paper was prepared in the Muséum National d'Histoire Naturelle in Paris in the framework of the Programme "Research in Paris" (programme d'accueil des chercheurs étrangers de Mairie de Paris). The work of the first author has been supported for several years by the Muséum National d'Histoire Naturelle according to the Programme of visiting professors, Programme of the Presidium of the Russian Academy of Sciences "Problems of Origin of Life and Formation of Biosphere," and his work with the collection of the Zoological Institute was supported by the Russian Ministry of Education and Science and a grant from the Russian Foundation for Basic Research (12-04-00663-a). The authors greatly appreciate the assistance of Stanislaw Adam Ślipiński (Division of Entomology, CSIRO, Canberra) and Wioletta Tomaszewska (Museum and Institute of Zoology of the Polish Academy of Sciences, Warszawa) during elaboration of the diagnoses for the new species described here. The preparation of drawings was made with assistance of the first author's daughter, Polina A. Kirejtshuk. The authors appreciate very useful comments and recommendations of anonymous reviewers.

REFERENCES

- Batelka J., Collomb F.-M., Nel A.** 2006. *Macrosiagon dewwei* n. sp. (Coleoptera: Ripiphoridae) from the French Eocene amber. *Annales de la Société Entomologique de France*, (N.S.), **42**: 75–78.
- 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.* Danzig [= Gdansk], iv + 125 p.
- Bílý S. & Kirejtshuk A. G.** 2007. *Philanthaxoides gallicus* gen. n., sp. n. from the Lowermost Eocene French amber (Coleoptera: Buprestidae). *Folia Heyrovskyana*, **14**: 181–186.
- Gersdorf E.** 1969. Käfer (Coleoptera) aus dem Jungtertiär Norddeutschlands. *Geologisches Jahrbuch*, **87**: 295–331.
- Grimaldi D.A. & Engel M.S.** 2005. *Evolution of the insects.* Cambridge University Press. xv + 755 p.
- Hieke F. & Pietrzeniuk E.** 1984. Die Bernstein-Käfer des Museums für Naturkunde, Berlin (Insecta: Coleoptera). *Mitteilungen der Zoologische Museum*, **60**(2): 297–326.
- Kirejtshuk A.G. & Nel A.** 2008. Some new fossils of the suborder Polyphaga (Insecta, Coleoptera) from Lowermost Eocene French amber. *Annales de la Société Entomologique de France*, (N.S.), **44**: 419–442.
- Kirejtshuk A.G. & Nel A.** 2009. New genera and species of Cucujiformia (Coleoptera, Polyphaga) from lowermost Eocene French amber. *Denisia*, **26**: 103–118.
- Kirejtshuk A.G., Nel A., Collomb F.-M.** 2009. New Archostemata (Insecta, Coleoptera) from the French Paleocene and Early Eocene, with a note on the composition of the suborder. *Annales de la Société Entomologique de France*, (N.S.), **45**: 216–227.
- Kirejtshuk A.G., Nabozhenko M.V. & Nel A.** 2010. New genus and species of the tribe Opatrini (Coleoptera, Tenebrionidae, Tenebrioninae) from the Lowermost Eocene amber of Paris basin. *Proceedings of the Zoological Institute RAS*, **314**(2): 191–196.
- Kirejtshuk A.G., Hava A.J. & Nel A.** 2010. New genus and species of subfamily Trinodinae (Coleoptera, Polyphaga, Dermestidae) from Lowermost Eocene French amber. *Zoosystematica Rossica*, **19**(1): 54–69.
- Klebs R.** 1910. Über Bernsteineinschlüsse in allgemeinen und die Coleopteren meiner Bernsteinsammlung. *Schriften der Physikalisch-Ökonomische Gesellschaft zu Königsberg*, **51**: 217–242.
- Kovalev A.V., Kirejtshuk A.G. & Nel A.** 2012. New species of the genus *Trixagus* Kugelann, 1794 (Coleoptera: Throscidae) from the Lowermost Eocene amber of Oise (France). *Proceedings of the Zoological Institute RAS*, **316**(1): 83–87.
- Kovár I.** 1996. Phylogeny. In: **Hodek I. & Honěk A.** (Eds.) *Ecology of Coccinellidae*: 19–31. Dordrecht: Kluwer Academic Publishers.
- Kubisz D.** 2000. Fossil beetles (Coleoptera) from Baltic amber in the collection of the Museum of Natural History of ISEA in Krakow. *Polish Journal of Entomology*, **69**(2): 225–230.
- Larsson S.G.** 1978. Baltic amber – A palaeobiological study. *Entomograph*, **1**: 1–192.
- Menge F.A.** 1856. Lebenszeichen vorweltlicher im Bernstein eingeschlossener Thiere (Heteroptera, Coleoptera, Lepidoptera, Hymeno-

- ptera). *Progressive Schüler Petrischule*. Danzig: Kafemann. 32 p.
- Montreuil O., Genier F. & Nel A.** 2010. *Lobateuchus*, un nouveau genre de "bousier" fossile du nord de la France (Coleoptera: Scarabaeidae, Scarabaeinae). *Annales de la Société Entomologique de France*, (N.S.), **46**(1–2): 164–167.
- Moseyko A.G., Kirejtshuk A.G. & Nel A.** 2010. New genera and new species of leaf beetles (Coleoptera: Polyphaga: Chrysomelidae) from Lowermost Eocene French amber. *Annales de la Société Entomologique de France*, **46**(1–2): 116–123.
- Ponomarenko A.G. & Kirejtshuk A.G.** 2012. *Taxonomic list of fossil beetles of suborder Scarabaeina (Part 3)*. St Petersburg: Zoological Institute, Russian Academy of Sciences [cited April 2012]. Available from: <<http://www.zin.ru/Animalia/Coleoptera/eng/paleosys2.htm>>.
- Sasaji H.** 1968. Phylogeny of the family Coccinellidae (Coleoptera). *Etizenia, Occasional Publications of the Biological Laboratory*, **35**: 1–37.
- Théobald N.** 1937. Note complémentaire sur les insectes fossiles oligocènes des gypses d'Aix. *Bulletin Mensuel de la Société des Sciences de Nancy*, **6**: 157–178.
- Tomaszewska W.** 2010. *Rhyzobius* (Coleoptera: Coccinellidae). A revision of the world fauna. *Fauna Mundi*, **2**: 1–475.
- Wickham H.F.** 1912. A report on some recent collections of fossil Coleoptera from the Miocene shales of Florissant. *Bulletin from the Laboratories of Natural History of the State University of Iowa*, **6** (3): 3–38.
- Zhang J.-F.** 1989. *Fossil insects from Shanwang, Shandong, China*. Jinan: Shandong Science and Technology Publishing House. 459 p. [in Chinese with abstract in English].
- Yu G.** 1994. Cladistic analyses of the Coccinellidae (Coleoptera). *Entomologica Sinica*, **1**: 17–30.

Received April 14, 2012 / Accepted June 1, 2012.