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Rhyssemus transcaucasicus sp. nov. (Coleoptera: Scarabaeidae: Aphodiinae) from Georgia

Rhyssemus transcaucasicus sp. nov. (Coleoptera: Scarabaeidae: Aphodiinae) z Gruzie

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Scarabaeoidea, Scarabaeidae, Aphodiinae, Psammodiini, *Rhyssemus*, taxonomy, new species, Georgia, Palaearctic region

Abstract. *Rhyssemus transcaucasicus* sp. nov., from the Adjara region of Georgia is described. The new species is compared with the similar and probably closely related species *R. germanus* (Linnaeus, 1767) and *R. puncticollis* Brown, 1929. Relevant diagnostic characters are illustrated.

INTRODUCTION

Rhyssemus Mulsant, 1842 is a nearly cosmopolitan genus (absent in South America) and currently includes more than 200 species, 58 occurring in the Palaearctic region (cf. e.g., Rakovič et al. 2016a). The life history is so far only very poorly known. Adults have been sifted from sandy soils or found walking on the surface in sandy areas. Some species are also frequently collected at light.

Rhyssemus puncticollis Brown, 1929 was treated for a long period of time as a synonym of *R. germanus* (Linnaeus, 1767). In 2012 Rössner, after communication with Riccardo Pittino, confirmed the validity of the species and listed its occurrence in Germany, Austria, and the Czech Republic (Bohemia). After the release of Rössner's book, Král & Rakovič (2012) confirmed its occurrence in the Czech Republic, and reported it for the first time from Moravia. Subsequently Minkina (2013) reported this species from Bulgaria – but that information was based on the incorrect identification of an unusual, small specimen of *R. berytensis* Marseul, 1878 (Byk & Minkina 2014). In 2014, Byk & Minkina reported this species new for Poland and Latvia. During examination of Aphodiinae collected in Georgia by Cezary Nowak, we found nine specimens of *Rhyssemus*, the identification of which was not clear. After careful examination of the problematic specimens, they proved to be a new species, closely related to *R. gemanus* and *R. puncticollis*, with part of features having an indirect character.

MATERIAL AND METHODS

Material examined was observed using a Nikon SMZ-U stereoscopic microscope. Pictures were taken using a Canon EOS 5D Mark III connected to a Canon MP-E 65mm macro lens and edited in Helicon Focus software.

Specimens are deposited in the collection of Łukasz Minkina, deposited in the Institute of Systematics and Evolution of Animals in Kraków (Kraków, Poland) (ŁM), collection of David Král deposited in the National Museum

in Praha (Praha, Czech Republic) (DK), private collection of Cezary Nowak (Włoszczowa, Poland) (CN), private collection of Maciej Kaźmierczak (Koło, Poland) (MK), and private collection of Marek Bidas (Kielce, Poland) (MB). Specimens of the newly described species have one red printed label "Rhyssemus transcaucasicus sp. nov., HOLOTYPUS ♂, or PARATYPUS, Łukasz Minkina & David Král det. 2018". Exact label data are cited for the type material, individual lines of every label separated by a vertical bar ("|"), individual labels by a double vertical bar ("||"). Information in quotation marks (" ") indicates the original spelling. Our remarks and additional comments are found in brackets.

The description of the transverse structural elements of the pronotum is based on a concept proposed by Rakovič (1987), which is also explained, justified and illustrated by a schematic drawing in recent work by Rakovič et al. (2016b): five transverse ridges, five transverse furrows and an accessory swelling present in furrow 4 each side of the posterior longitudinal furrow.

RESULTS

Rhyssemus transcaucasicus sp. nov.

(Figs 1–3, 10, 13, 16, 19, 22)

Type locality. Georgia [Adjara region], Ombolo ad [= near] Batumi, Chorokhi river, N 41°35′06″N 41°37′33″E.

Type material. Holotype, ♂ (ŁM), "Georgia Ombolo ad [= near] | Batumi, Chorokhi river | 2 VII 2016 | Cezary Nowak leg.[white printed label]" . **Paratypes**: 3 spec. (MK) and 1 spec. (DK), "Georgia Ombolo ad | Batumi, Chorokhi river | 2 VII 2016 | Maciej Kaźmierczak leg. [white printed label]"; 3 spec. (MB), "2 VII 2016 | Gonio – rzeka [= river] Chorokhi | ad [= near] Kabuleti, Adżaria, Gruzja | leg. M. Bidas [white printed label]"; 6 spec. (CN), and 2 spec. (ŁM), "Georgia Ombolo ad | Batumi, Chorokhi river | 2 VII 2016 | Cezary Nowak leg. [white printed label]".

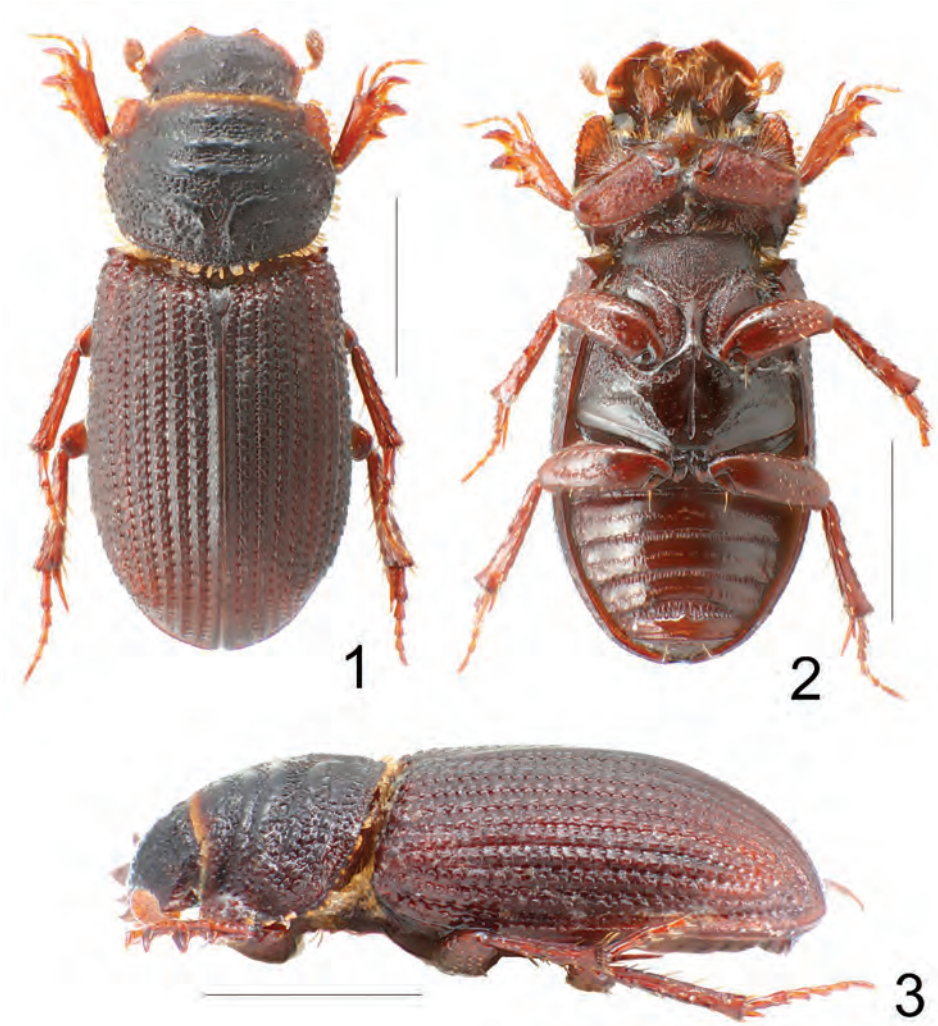
Description of holotype (♂)**.** Body (Fig. 1) oblong oval, convex, glabrous, shining, dark brown, extremities paler.

Head (Fig. 10) convex, clypeus dentate each side of anteromedian emargination, its sides moderately sinuate, then arcuate to genae, the latter protruding from the eyes and bearing few short macrosetae. Clypeus surface granulate, granules rather moderately transverse. Epistome with a central protuberance with a pair of distinct oblique ridges situated posteriorly.

Pronotum transverse, with five transverse ridges, five transverse furrows and a posterior longitudinal furrow; all ridges convex, ridges 2 and 3 highest, ridges 3 and 4 widest, all ridges granulate laterally, ridge 1 granulate on disc, but still continuous, ridge 5 frequently granulate on disc, and frequently interrupted. Furrows 1–2 and 4–5 nearly as wide as corresponding ridges; furrow 3 widest, distinctly wider than neighbouring ridges. Punctures in furrows more or less distinctly transverse, usually fused; punctures very distinctly transverse in furrow 2. Anterior angles slightly excavate, more or less distinctly flattened, sides widely rounded, gently rounded before posterior angles. Edge distinctly macrosetaceous; base regularly rounded.

Scutellum small, narrowly ogival.

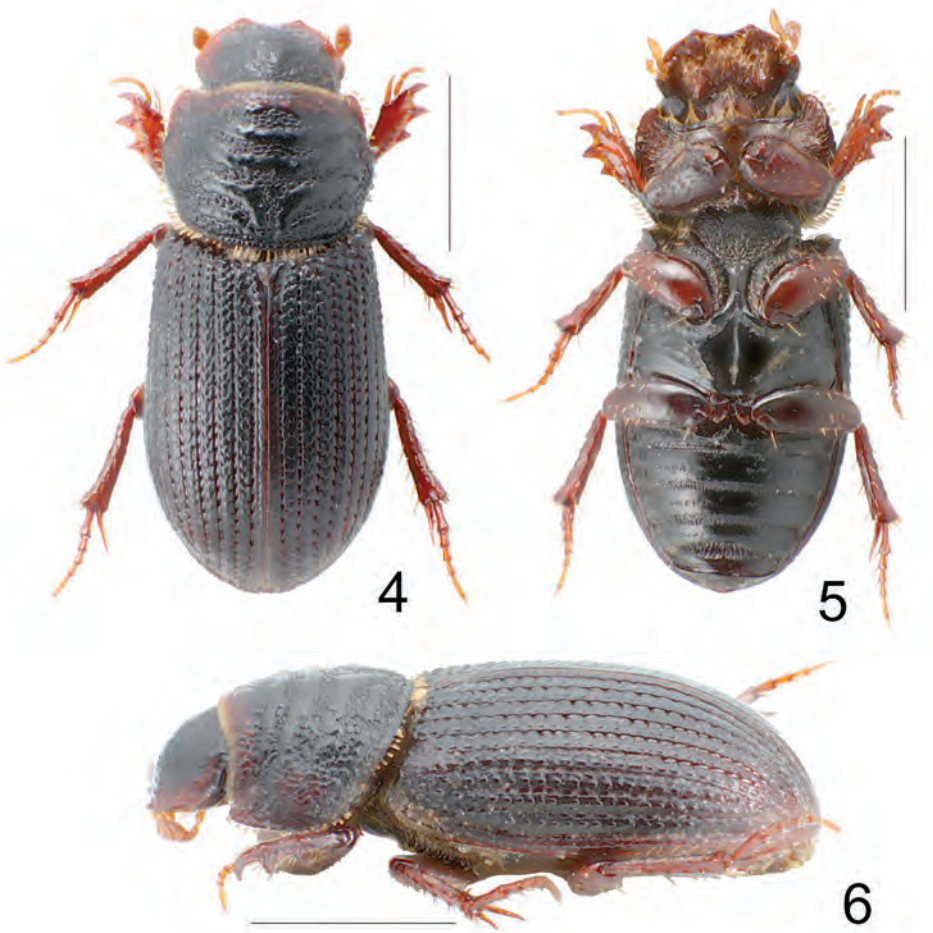
Elytra narrow, elongate, only indistinctly broader posteriad, with ten striae and ten intervals. Humeral denticles small but distinct. Each interval with two rows of granules, internal row with small, low, rounded or only slightly elongately-rounded granules; external row with rather large, usually moderately high, elongately rounded granules; sculpture of intervals with distinct microreticulation; striae shiny, without microreticulation, with small, rather dense punctures.



Figs. 1–3. *Rhyssemus transcaucasicus* sp. nov., habitus of holotype ♂. 1 – dorsal view, 2 – ventral view, 3 – lateral view. Scale – 1.0 mm.
Obr. 1–3. *Rhyssemus transcaucasicus* sp. nov., habitus, holotypus ♂. 1 – pohled svrchu, 2 – pohled zespodu, 3 – pohled ze strany. Měřítko – 1.0 mm.

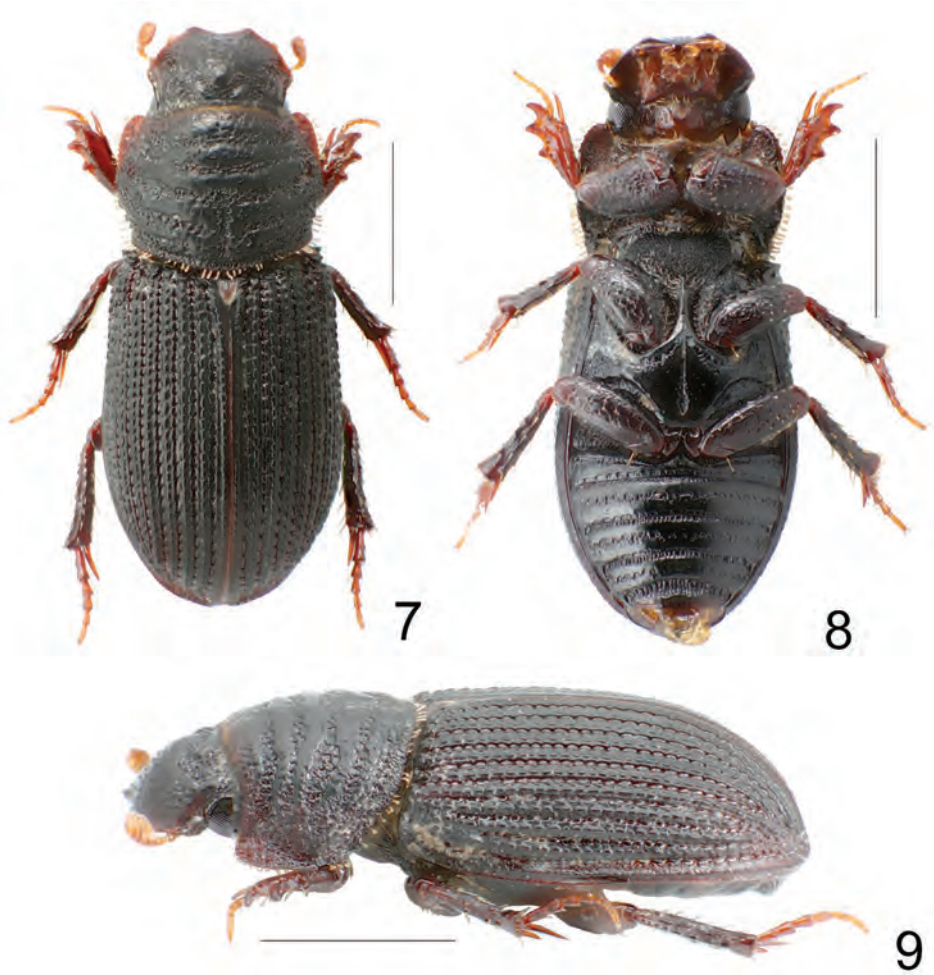
Pygidium with row of small punctures at posterior margin, slightly wrinkled surface, additionally with two very long macrosetae.

Protibiae with three distinct teeth on exterior margin in apical half, proximal part not serrulate. Apical spur elongate, distinctly bent anteriorlaterally. Meso- and metatibiae moderately widened toward apex. Superior apical spur of metatibiae distinctly longer than basal metatarsomere, latter slightly longer than next two combined.



Figs. 4–6. *Rhyssemus germanus* (Linnaeus, 1767) (Poland, Grodzonowice, ŁM), habitus of ♂. 4 – dorsal view, 5 – ventral view, 6 – lateral view. Scale – 1.0 mm.
Obr. 4–6. *Rhyssemus germanus* (Linnaeus, 1767) (Poland, Grodzonowice, ŁM), habitus, ♂. 4 – pohled svrchu, 5 – pohled zespodu, 6 – pohled ze strany. Měřítko – 1.0 mm.

Ventral surface (Fig. 2). Brownish, glabrous except a few macrosetae on femora. Profemora distinctly, densely punctate; punctures in shape of transverse wrinkles, part of punctures with macrosetae. Meso- and metafemora with quite dense punctation distally, and with only a few small punctures proximally, shape of all punctures transversely wrinkled, part of them with macrosetae, additionally on anterior border with row of punctures bearing macrosetae, and a few punctures on posterior border bearing long macrosetae. Meso-metaventral plate distinctly concave, with nearly invisible microscopic punctures and a medial longitudinal furrow. Abdominal ventrites 3–5 with a transverse row of slightly confluent punctures at anterior margin, and row of vague, frequently fused punctures at middle. Ventrite 6 with row of slightly confluent, distinctly longitudinal punctures in anterior part.



Figs. 7–9. *Rhyssemus puncticollis* Brown, 1929 (Poland, Nowy Korczyn, ŁM), habitus of ♂. 7 – dorsal view, 8 – ventral view, 9 – lateral view. Scale – 1.0 mm.
Obr. 7–9. *Rhyssemus puncticollis* Brown, 1929 (Poland, Nowy Korczyn, ŁM), habitus, ♂. 7 – pohled svrchu, 8 – pohled zespodu, 9 – pohled ze strany. Měřítko – 1.0 mm.

Aedeagus (Fig. 16). Parameres approximately as long as phallobase, at middle of length with regularly rounded ventral emargination in lateral view.
Sexual dimorphism. Longitudinal furrow at middle of meso-metaventral plate very slightly widened posteriorly in males, not widened in females. Elytra very slightly wider in females. Anterior angles of pronotum in males very slightly more excavate and flattened.
Measurements. Total body length 3.3–3.9 mm, holotype 3.5 mm.
Variability. Transversal ridges of pronotum more or less high. Granules on elytral intervals rather low to moderately high (usually moderately high), in largest specimen larger and

smaller granules slightly fused. Punctures on meso- and metafemora more or less dense. Meso-metaventral plate usually without larger punctures on sides of longitudinal furrow – except holotype which has only 2 punctures on the sides of it.

Collecting events. All specimens were sifted from roots of grass on a sandy river bank.

Distribution. Georgia [= Sakartvelo], known only from the type locality in the Adjara region.

Name derivation. Toponymic, based on the name of the origin of the new species, a geographical region in the vicinity of the southern Caucasus Mountains on the border of Eastern Europe and Asia. Transcaucasia, also Southern Caucasia, roughly corresponds to modern Georgia, Armenia, and Azerbaijan. The name was proposed by the collectors of the type material, i.e.: Cezary Nowak, Marek Kaźmierczak and Marek Bidas.

Differential diagnosis. When using the key by Baraud (1992) to the identification of *Rhyssemus* species, the newly described here species will key to *R. germanus*. *Rhyssemus transcaucasicus* sp. nov. at the first glance looks like slightly unusual, large specimens of *R. germanus*, but precise analysis confirms a large number of differences between the two species, as with *R. puncticollis* recently recognised from the Central Europe. Several of the diagnostic characters, such as size, proportions of body, shape of sides of pronotum before hind angles, punctation in transverse furrows of pronotum, punctation of meso-metaventral plate, or less distinctly visible characters like size of humeral denticles, punctation of head indicate that the new species is closely related to *R. germanus*. However, other characters, such as the shape of the anterior angles of pronotum, punctation of profemora, shape of the meso-metaventral plate, indicate a closer relationship to *R. puncticollis*. Features such as the shape of the granules on the elytral intervals, punctation on meso- and metafemora are characteristic of *R. germanus*. All these diagnostic characters show the close relationship of all three species. The shape of parameres of the new species is slightly more similar to that in *R. germanus*, however its habitat is similar that of *R. puncticollis* (see row "habitat" in Table 1; cf. also Rössner 2012 and Byk & Minkina 2014). In our opinion it is possible that the species newly described here could share a common ancestor with both of the compared species, and differentiated as a result of adaptations to environment. Their similarity also suggests a possible introduction of *R. puncticollis* from Europe into North America (and not vice versa). For differentiation of the species from each other, see Table 1.

ACKNOWLEDGEMENTS. We are obliged to the collectors of the new species for providing material for our studies. Special thanks are due to Robert Angus (Royal Holloway, University of London, United Kingdom) for editing English in the previous version of the manuscript, and Aleš Bezděk (Institute of Entomology, České Budějovice, Czech Republic) and Marco Dellacasa (Università di Pisa, Pisa, Italy) for their comments on the manuscript.

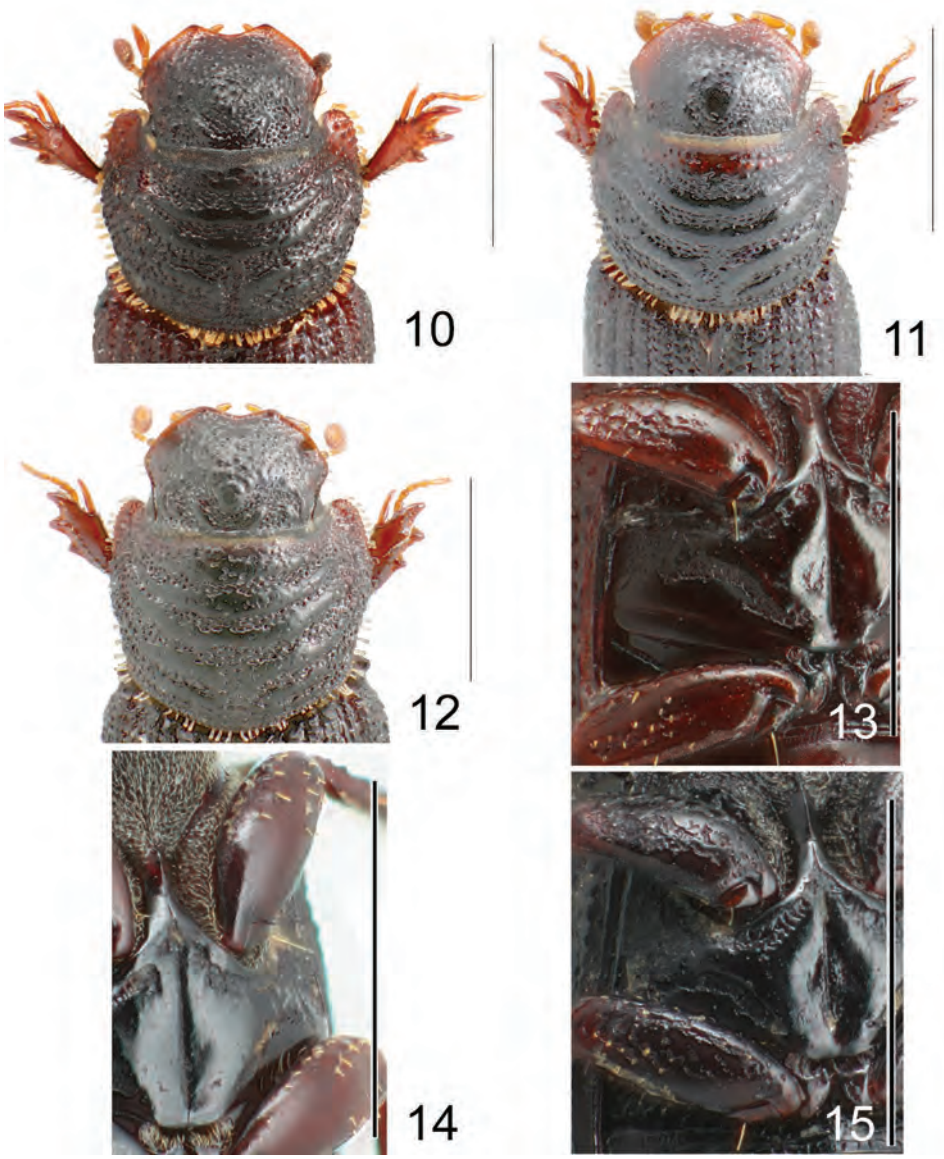
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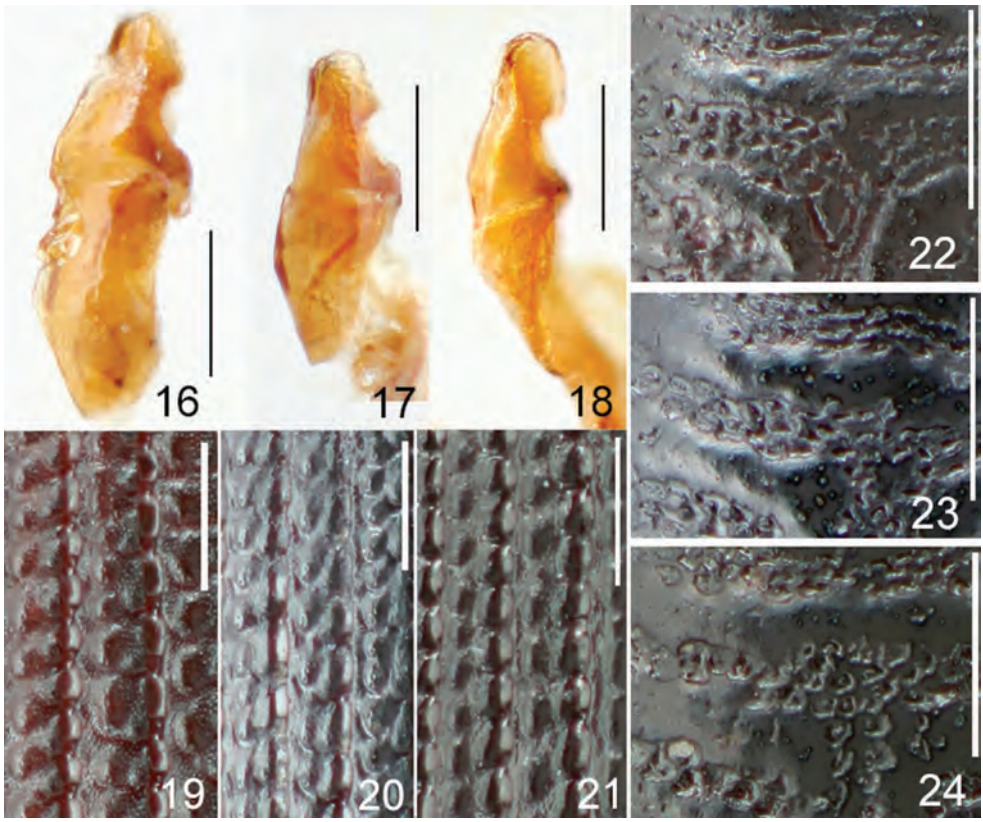
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Figs. 10–15. *Rhyssemus* Mulsant, 1842 spp., 10–12, head of ♂ in dorsal view; 13–15, meso-metaventral plate and femora of ♂, ventral view. 10, 13 – *R. transcaucasicus* sp. nov. (holotype), 11, 14 – *R. germanus* (Linnaeus, 1767) (Poland, Grodzonowice, ŁM); 12, 15 – *R. puncticollis* Brown, 1929 (Poland, Nowy Korczyn, ŁM). Scale – 1.0 mm.
Obr. 10–15. *Rhyssemus* Mulsant, 1842 spp., 10–12, hlava, ♂, pohled svrchu; 13–15 meso-metaventrální ploška a stehna, ♂, pohled zespodu;. 10, 13 – *R. transcaucasicus* sp. nov. (holotypus), 11, 14 – *R. germanus* (Linnaeus, 1767) (Poland, Grodzonowice, ŁM); 12, 15 – *R. puncticollis* Brown, 1929 (Poland, Nowy Korczyn, ŁM). Měřítko – 1.0 mm.



Figs. 16–24. *Rhyssemus* Mulsant, 1842 spp., 16–18, aedeagus in lateral view; 19–21, punctures of elytral intervals in ♂. 16, 19 – *R. transcaucasicus* sp. nov., 17, 20 – *R. germanus* (Linnaeus, 1767) (Poland, Grodzonowice, ŁM), 18, 21 – *R. puncticollis* Brown, 1929 (Poland, Nowy Korczyn, ŁM), 22–24, punctures of pronotum in ♂. 22 – *R. transcaucasicus* sp. nov. (holotype); 23 – *R. germanus* (Linnaeus, 1767) (Poland, Grodzonowice, ŁM); 24 – *R. puncticollis* Brown, 1929 (Poland, Nowy Korczyn, ŁM). Scale for Figs 16–21 – 1.0 mm, scale for Figs 22–24 – 0.2 mm.
Obr. 16–24. *Rhyssemus* Mulsant, 1842 spp., 16–18, aedeagus, pohled ze strany; 19–21, tečky krovečných mezirýží, ♂. 16, 19 – *R. transcaucasicus* sp. nov., 17, 20 – *R. germanus* (Linnaeus, 1767) (Poland, Grodzonowice, ŁM), 18, 21 – *R. puncticollis* Brown, 1929 (Poland, Nowy Korczyn, ŁM), 22–24, tečky na pronotu, ♂. 22 – *R. transcaucasicus* sp. nov. (holotypus); 23 – *R. germanus* (Linnaeus, 1767) (Poland, Grodzonowice, ŁM); 24 – *R. puncticollis* Brown, 1929 (Poland, Nowy Korczyn, ŁM). Měřítko pro obr. 16–21 – 1.0 mm, měřítko pro obr. 22–24 – 0.2 mm.

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SOUHRN

Písečnatci rodu *Rhyssemus* Mulsant, 1842 mají téměř kosmopolitní rozšíření. Zatím nebyli nalezeni jen v Jižní Americe. Rod obsahuje více než 200 druhů, z nichž 58 se vyskytuje v palearktické oblasti (viz např. Rakovič et al. 2016a). Jejich biologie je zatím jen velmi málo známa. Dospělci bývají nalézáni v písčitých půdách, zejména v dosahu břehů řek a jsou často lákáni na světlo. Druh *Rhyssemus puncticollis* Brown, 1929 byl dlouhou dobu považován za synonymum druhu *R. germanus* (Linnaeus, 1767). Až Rössner (2012) ve své monografii vyslovil názor o platnosti tohoto druhu a zaznamenal jeho výskyt v Německu, Rakousku a České republice (Čechy). Krátce na to Král & Rakovič (2012) potvrdili jeho výskyt v ČR (Čechy i Morava) a Byk & Minkina (2014) jej uvádějí z Polska a Litvy. V materiálu, který nasbíral v nedávné době kolega Cezary Nowak v Gruzii, jsme nalezli i devět kusů dosud nepopsaného druhu, který nese mozaiku morfologických znaků charakteristických pro oba výše zmíněné druhy. Všechny tři druhy jsou si navzájem morfologicky velmi podobné a tvoří pravděpodobně skupinu blízce příbuzných druhů. Naše práce obsahuje morfologický popis tohoto nového druhu. Diferenciální diagnóze je založena zejména na rozdílné struktuře povrchu hlavy, štítu a krovek a tvaru meso-metaventrální plošky a samčích vnějších genitálií.

Table 1. Character matrix for separation of *Rhyssemus germanus*, *R. puncticollis* and *R. transcaucasicus* sp. nov.
Tabulka 1. Matrice znaků pro odlišení druhů *Rhyssemus germanus*, *R. puncticollis* a *R. transcaucasicus* sp. nov.

species character	*R. germanus* (Linnaeus, 1767)	*R. puncticollis* Brown, 1929	*R. transcaucasicus* sp. nov.
total body length	2.9–3.6 mm (usually slightly larger than *R. puncticollis*)	3.1–3.5 mm (usually slightly smaller than *R. germanus*)	3.3–3.9 mm (usually slightly larger than *R. germanus*)
proportions of body length to width	elongate (ratio of length to width is largest) (Fig. 4)	elongate (ratio of length to width is smallest) (Fig. 7)	elongate (proportionally the ratio of length to width is only slightly smaller than that of *R. germanus*) (Fig. 1)
sides of pronotum anteriorly of posterior angles	truncate to gently, regularly rounded (Fig. 4)	more or less distinctly sinuate (Fig. 7)	gently, regularly rounded (Fig. 1)
anterior angles of pronotum	not excavate, rather not (or only very slightly) flattened (Fig. 4)	more or less distinctly excavate, slightly flattened (Fig. 7)	slightly excavate, more or less distinctly flattened (Fig. 1)
shape of punctures in transverse furrows of pronotum disc	transverse wrinkles, frequently fused (Fig. 23), or less frequently distinctly transverse ovals	mainly transverse ovals (Fig. 24), or less frequently more or less rounded	usually fused transverse wrinkles (Fig. 22)
shape of larger granules on elytral intervals	very low to moderately high (usually low), slightly longer than wide (Fig. 20)	moderately high, distinctly longer than wide (Fig. 21)	rather low to moderately high (usually rather moderately high), slightly longer than wide (Fig. 19)
transverse punctures on profemora	less dense then in both of other species (Fig. 5)	more dense than in *R. germanus* (Fig. 8)	more dense than in *R. germanus* (Fig. 2)
transverse punctures on meso- and metafemora	rather sparse, only at sides of distal part (Fig. 14)	remarkably dense, on whole surface (Fig. 15)	dense, mainly distally (Fig. 13)
shape of meso-metaventral plate	slightly concave (Fig. 14)	distinctly concave (Fig. 15)	distinctly concave (Fig. 13)
punctures on meso-metaventral plate nearby median longitudinal furrow	absent, or only with few fine punctures at sides (Fig. 14)	usually large amount of very small punctures, punctures fused so that the sculpture of meso-metaventral plate becomes wrinkly (Fig. 15)	usually few hardly noticeable, very small punctures at sides (Fig. 13), rarely without punctures
habitat	native xerothermic turfs, rarely river banks	areas under anthropogenic stress, frequently river banks	river banks
distribution	widespread species in Europe and the Palaearctic Asia; also know from all countries with occurrence of both other species (see e. g., Rakovič et al. 2016a)	so far recorded from Austria, Czech Republic, Germany, Latvia and Poland; probably introduced to North America (see e. g. Rakovič et al. 2016a, Rössner 2012); most probably more widely distributed in Central Europe	so far known only from the type locality in southern Georgia