NEW SPECIES OF THE GENUS NEORIBATES (BERLESE, 1914) (ACARIFORMES: ORIBATIDA) FROM RUSSIA AND ADJACENT COUNTRIES

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ABSTRACT: The studies on oribatid mites deposited at the Zoological Institute, Russian Academy of Sciences, St. Petersburg, Department of Entomology of the Moscow Lomonosov State University, Moscow, and the Siberian Zoological Museum of the Institute of Systematics and Ecology of Animals, Siberian Branch of the Russian Academy of Sciences, Novosibirsk, from territory of the former Soviet Union, have revealed four new species of the genus Neoribates: N. krivolutskyi sp.n., N. borealis sp.n., N. bulanovae sp.n. and N. sibiricus sp.n.

KEY WORDS: Oribatida, Neoribates, new species, collection, oribatid mites

INTRODUCTION

The oribatid mite family Parakalummidae Grandjean, 1936 includes a small number of species. Only two genus, Neoribates (Berlese, 1914) and Parakalumma Jacot, 1912, were known to be found in the North Palaearctic region. The analysis of the material that is presently available let us correct the published data on the distribution of Neoribates in Russia (Oribatid mites... 1995). Six species are known now from various regions of Russia and adjacent countries. The distribution of Neoribates gracilis Trave, 1972 is similar to that of Neoribates aurantiacus (Oudemans, 1914) and Neoribates borealis sp.n., which is described in the present paper. Neoribates sibiricus sp.n. is common in Siberia. Neoribates krivolutskyi sp.n. and Neoribates bulanovae sp.n. are found in regions with a mild Mediterranean climate.

Family Parakalummidae Grandjean, 1936
Genus Neoribates Berlese, 1914
Neoribates krivolutskyi Grishina sp. n.
Figs. 1–5

Color. Light brown.


Prodorsum. Rostrum is oval, curved onto venter. Interlamellar (in), lamellar (le) and rostral (ro) setae differ in length, which decreases respectively. Their type and the structure of indumentum (hair covering) is the same. Interlamellar setae in intact specimen rise up the prodorsal plate creating an effect they are longer than the prodorsum itself. Lamellar setae in this case project over the anterior of prodorsum more than a half. If prodorsum is straighten when fixed on permanent microscope slide the interlamellar setae do not extend to the margins of rostrum, while lamellar ones almost reach it, and the rostral ones extend a bit over it. Lamellar lines are directed from bothridia to the anterior part of prodorsum. They are a bit inclined to each other and more than a half of prodorsum in length. The distance between the bases of lamellar setae exceeds the distance between the interlamellar ones. Sensillae (ss) arise from bothridia, slightly enlarged and finally make up a club, which is covered by small tiny spines. In the mounted slides the club may appear thin and pointed because of the spines. Exobothridial setae (ex) are relatively long and positioned away the bothridium on the distance that is larger than their length. On lateral sides of the prodorsal shield nearby lamellae there is a sublamella or sclerotized pouch, with the porous field inside. Trave (1972) has guessed that these structures were sublamellar sacculae with an opening in the deep pouch in the thick cuticle.

Notogaster. Dorsal shield is oval. Sejugal furrow is bow-like, conspicuous. It includes four pairs of small sacculae. They are dark and visible on the back of light notogaster. Sacculae Sa have a form of follicle being elongated medially and downwards. Ten pairs of notogastral setae present but only their alveoli are conspicuous. Several specimens had anomalies recorded. For example, a specimen with remained setae lp was found, and one specimen was having sacculae S2 and S3 fused at both sides. The lower angle of pteromorphs formed by the external and internal margins is about 60°.

The third pair (ad) is positioned posteriad to anal opening. All the ventral setae are thin and small.

**Legs.** Legs I and II are of the same shape and size. Genu I is a bit longer than genu II. Leg III is of the same shape as legs I and II. Trochanter and femur of leg III are similar to those of leg IV. Leg IV is distinguished by its distal part that is longer than in other legs. There is a solenidium present on a well-developed apophysis of tibia I and II and on a small tubercle of tibia III. All tarsi heterotridactylous. The central claw is stronger than the lateral ones. Setal formulae of legs:

- I: 1–5–3(1)–4(2)–20(2)–3;
- II: 1–5–3(1)–4(1)–15(2)–3;
- III: 2–3–1(1)–3(1)–15(0)–3;
- IV: 1–2–2(0)–4(0)–12(0)–3.


**Type specimens.** Holotype from Azerbaijan, reserve Lenkoransky, 1966, coll. D.A. Krivolutsky. Holotype is deposited in the collections of the Zoological Institute, Russian Academy of Sciences, St. Petersburg. Paratypes: 4 specimens from the same place; 2 specimens from Crimea, reserve Chyr-Alan, 1955, coll. E.M. Bulanova-Zakhvatkina; 7 specimens from Sochi, under cypress, 1960, coll. N.G. Bregetova; 2 specimens from Abkhasia, rotten log, 1971, coll. L.G. Grishina. Paratypes are deposited in the collections Siberian zoological museum of the Institute of Systematics and Ecol-
New species of the genus *Neoribates*

Fig. 4. *Neoribates krivolutskyi* sp.n.: a — anterior of ventral plate, b — hypostome.

Fig. 5. *Neoribates krivolutskyi* sp.n.: a — leg I, b — leg II, c — leg III, d — leg IV.
Etymology. The species is named after the late Professor Dmitry Krivoloutsky, Corresponding Member of the Russian Academy of Sciences, a distinguished acarologist.

Differential diagnosis. *Neoribates krivoloutskyi* sp.n. is larger in size than other known species. It is most similar to *N. aurantiacus* by having. Both species have the saccules of the same shape and color, the same location of *le* concerning *in*, and also similar structure of indumentum of the prodorsal setae. The species referred to as *N. aurantiacus* by Aoki (Aoki 1966) notably differs from the *N. aurantiacus* specimens, known from Russia. For example, specimens from Japan have sensilli with lanceolate heads, and their genital plates have four pairs of setae. All the specimens in our collection possess club-shaped sensilli, which are rounded, and have 5 pairs of genital setae. As we stated the distinctive characteristic that differentiates *N. aurantiacus* from previously known species is the peculiar arrangement of epimeral setae. They are located closer to 2a and along with 3a form a sort of row. All these setae are long and conspicuous.

*Neoribates borealis* Vladimirova sp. n.

Figs. 6–9

This new species is represented in all landscape zones of Russia and adjacent countries. It inhabits the forest soil litter, anthills, nests of birds and rodents. We studied material from the collections of the Zoological Institute, Russian Academy of Sciences, St. Petersburg, the Department of Entomology of the Moscow Lomonosov State University, Moscow, the Siberian zoological museum of the Institute of Systematics and Ecology of Animals, Siberian Branch of the Russian Academy of Sciences, Novosibirsk. Up to the present time this species was not correctly identified and was represented in publications as *Neoribates* cf. *roubali* (Berlese, 1910) (Grishina and Sergiyenko 1978; Byzova et al. 1986; Grishina and Machmudova 1989; Grishina et al. 1998).

Color. Light brown.


Prodorsum. Rostrum is slightly elongated and curved downwards, thus appearing to be
smoothly rounded if viewed dorsally. The bases of rostral setae (ro) are located on the ventral side of prodorsum. The lengths of interlamellar (in) and lamellar setae (le) are approximately equal. Interlamellar setae extend to the bases of rostral setae but not to the edge of the rostrum. Rostral and lamellar setae are densely barbed, whilst the interlamellar ones are not significantly barbed. The distance between lamellar setae is distinctly larger than the distance between interlamellar ones. Sensilla (ss) are equal in length to interlamellar and lamellar setae. They are enlarged distally, forming a club, pointed at the end and covered by tiny spines. Exobothridial setae (ex) are short and positioned close to bothridia. Lamellae are straight lines on the lateral sides of prodorsum. The bases of lamellae enfold bothridium. Sublamella is positioned laterally, forming a pouch that contains rounded area porosa.

**Notogaster.** Sejugal line is distinct, wide and oval, more or less trapezoid in shape. At the place of pteromorphs attachment to notogaster there is a thick sclerotized fold from which indistinct lines radiate. Their ornament has no diagnostic value. There is a small slit-like opening (ia) near this thickening. The lower angle of pteromorphs, which is formed by their inner and external edges, is about 60°. There are 10 pairs of notogaster setae present. They are minute and visible only by strong magnification; usually only their alveoli are conspicuous. Four pairs of saccules present, in form of transparent rounded follicles. Saccules Sa are larger than the others. The openings of the Sa directed towards pteromorphs, while S1 directed centrad and S3 to the lateral edges of the body, S4 directed downwards.

**Ventral plate.** Apodemas are of regular shape. Epimeral formulae: 3–1–3–3. Five pairs of genital setae, and 1 pair of aggenital setae present. Anal plates bearing 2 pairs of setae. Three pairs of adanal setae present. The lengths of ad1 and ad2 are shorter than the distance between them. Seta ad3 is located on the same line (that is parallel to the rounded line of the ventral plate) with the first pair of adanal setae, but is positioned from them at a large distance.

**Legs.** All tarsi heterotridactylous. The central claw is stronger than the lateral ones. Setal formu-

Type specimens. Holotype from the Novosibirsk Region, Sokur, birch forest, soil litter, 17.05.1992, coll. O.I. Knor. Paratypes (12 specimens) — same place. The holotype is deposited in the collections of the Zoological Institute, Russian Academy of Sciences, St. Petersburg, paratypes are deposited in the collections of the Siberian Zoological Museum of the Institute of Systematics and Ecology of Animals, Siberian Branch of the Russian Academy of Sciences, Novosibirsk.

Etymology. The name “borealis” relates to a wide distribution of the new species in the boreal climate.

Differential diagnosis. The new species is similar to Neoribates gracilis Trave, 1972 in its size, color and shape of ro, le, in. These species often could be found together in soil samples. N. borealis sp.n. has a distinct feature that easily differentiates it from other species of the genus Neoribates. The tips of lamellar lines in N. gracilis and N. rimosus Suzuki, 1978 (Suzuki 1978) are directed to the center of the prodorsum and the mutual distance of setal pair le and that of in is equal; in contrast, lamellar lines in N. borealis are located laterally on the prodorsum and the mutual distance of le is distinctly larger than that of between in. All prodorsal setae, as well as those on the ventral shield in N. gracilis are distinctly longer than those in N. borealis. The form of saccules is also a distinguishing characteristic of the new species. Saccules in N. gracilis and N. aurantiacus are slightly elongated, dark, whilst in N. borealis the saccules are rounded and light-colored. Setae ad, in N. gracilis, N. aurantiacus, and N. rimosus are placed anterior to the anal opening, whilst in N. borealis these setae are located aligning at about 2/3 the length of the anal plates. Leg I of N. gracilis has 20 setae, while that of N. borealis and N. rimosus has 19.

Neoribates bulanovae Grishinae sp.n.

Figs. 10–13

Color. Light brown.


Prodorsum. Rostrum smooth, without projection in its medial part. Prodorsal setae delicate, thin, finely barbed. Lamellar setae (le) shorter than interlamellar ones (in), and rostral setae (ro) shorter than lamellar ones. Sensillae (ss) equal to interlamellar setae and have similar indumentum. Exo-
bothridial setae (ex) thin, their length shorter than the distance between their bases and bothridia.

Lamellae are straight lines on the lateral sides of prodorsum and reach the bases of lamellar setae. Distance between lamellar setae is longer than that between interlamellar ones.

Notogaster. Rounded in shape. Sejugal furrow slightly arched and conspicuous. Four pairs of transparent sacculi present. Sacculi S1 large and elongated, positioned along pteromorphs. Sacculi $S_2$, $S_3$, and $S_4$ similar in shape, all having curved apertures. There is no any evidence of notosetae, only 10 pairs of alveoli present. Pteromorphs rounded, close to oval. Their lateral (distal) margin has no distinct incision. Posterior margin broadly rounded. Sclerotized arched strium near inner (proximal) margin distinct, but with rough outline. Marginal sclerotized stripe along the pteromorph attachment line not noticeable.

Ventral region. Epimeral formula 3–1–3–3. All setae in coxisternal region and on genital apertures have small barbs. Setae 1c, 3c, 4c are very often longer than respective setae a and b. Genital plate has 5 pairs of setae. In our material one specimen had 6 setae on one plate. Anal and adanal setae are very small, thin, without barbs. Setae $ad$, situated in the anterior part of adanal region, either close to slit organs iad or anterior to them.

Legs. All tarsi heterotridactylous. Medium claw stronger, lateral claws have distal notches. Setal formulae of legs: I: 1–5–3(1)–4(2)–20(2)–3; II: 1–5–3(1)–4(1)–15(2)–3; III: 2–3–1(1)–3(1)–15(0)–3; IV: 1–2–2(0)–4(0)–12(0)–3.

All setae have small barbs irrespective of their location on the dorsal, ventral or lateral sides. Solenidia $\omega_1$ and $\omega_2$ on tarsi have almost the same length, but $\omega_1$ thicker and with rounded tip. Solenidium $\omega_1$ has form of a regular seta. Fastigal seta $ft'$ much longer than solenidia. Setae $it$ and $tc$ have indumentum that is similar to that of ventral setae. Solenidium $\sigma$ of genu II equal in length to seta $l''$ and much shorter than setae $l'$ and $v'$. Solenidium $\sigma$ of genu III equal to the half of genu seta length. Dorsal seta $d$ on the tibia IV no longer than the other setae of this leg segment. Setae of basal trochanters I and II thin and long, not similar to setae of other leg segments.

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Fig. 12. *Neoribates bulanovae* sp.n.: a — coxisternal region and genital plates, b — posterior part of ventral shield (eggs are shown by dotted line).

Fig. 13. *Neoribates bulanovae* sp.n.: a — leg I, b — leg II, c — leg III, d — leg IV, e — tip of leg IV tarsus.
**Material examined.** Ukraine: Crimea, Alush-ta, beech-oak forest, soil litter, July 1954, coll. E.M. Bulanova-Zakhvatkina; Crimea, Kasse river, hornbeam-oak forest, soil litter, 24.06.1961, coll. N. Egorova; Crimea, the Sevastopol Region, Or-linoye village, beech-oak forest, soil litter, 8.11.2003, coll. L.G. Grishina; Russia: Daghestan, the Makhachkala Region, Tarhata mountain, shiblyak, May 1986, coll. U. Shtanchaeva.

**Type specimens.** Holotype from Ukraine, Crimea, the Sevastopol Region, Orlinoye village, beech-oak forest, soil litter, 8.11.2003, coll. L.G. Grishina. The holotype is deposited in the collections of the Zoological Institute, Russian Academy of Sciences, St. Petersburg. Three paratypes are deposited in the collections of the Siberian Zoological Museum of the Institute of Systematics and Ecology of Animals, Siberian Branch of the Russian Academy of Sciences, Novosibirsk.

**Etymology.** The species is named after one of the collectors, Elizaveta Bulanova-Zakhvatkina, a distinguished Soviet acarologist.

**Differential diagnosis.** *Neoribates bulanovae* sp.n. differs from the other known species by its larger size, rounded body, setiform sensillae and by the shape of notogastral saccules.

**Neoribates sibiricus** Vladimirova sp.n.

**Material examined.** Ukraine: Crimea, Alush-ta, beech-oak forest, soil litter, July 1954, coll. E.M. Bulanova-Zakhvatkina; Crimea, Kasse river, hornbeam-oak forest, soil litter, 24.06.1961, coll. N. Egorova; Crimea, the Sevastopol Region, Or-linoye village, beech-oak forest, soil litter, 8.11.2003, coll. L.G. Grishina; Russia: Daghestan, the Makhachkala Region, Tarhata mountain, shiblyak, May 1986, coll. U. Shtanchaeva.

**Ventral region.** Epimeral formula: 3–1–3–3. Setae 3c, 4c barbed, longer than the respective setae a, b. Five pairs of genital setae present; one studied specimen had 6 pairs of setae on one genital plate and 4 pairs on the other one. Two pairs of setae present on anal plate. Three pairs of anal female setae present. Setae ad1 positioned posterior to anal opening, like the other two pairs, but are positioned far from anal valves, so that insertions of the three pairs forms a line that is parallel to rounded margin of the ventral shield. Lengths of ad1 and ad2 are equal to distance between them. Additional “rings” can be seen through the cuticle under the bases of anal female setae, similar to those under the bases of prodorsal setae.

**Legs.** All tarsi heterotridactylous. Medium claw being much thicker than the others. Lateral claws have pronounced notches. Setal formulae of legs: I: 1–5–3(1)–4(2)–19(2)–3; II: 1–5–3(1)–4(1)–15(2)–3; III: 2–3–1(1)–3(1)–15(2)–3; IV: 1–2–0(0)–4(0)–12(0)–3.

Lateral and especially dorsal setae of leg segment have fewer hairs than ventral setae. Solenidium of tarsi ω, thick with almost parallel sides and rounded tip. Solenidium of genu ω, thin, flagelliform, very long, longer than the fastigial setae ft′. Solenidium σ of genu II of equal length to setae l′ and ν′. Solenidium σ of genu III equal to or longer than respective setae of same segment. Dorsal setae d on tibia IV very long, longer than the other setae of the segment; with no barbs, thus resembling solenidium.

**Material examined.** The species is very wide-spread. We list only examples of distribution. Russia: the Tomsk Region, Kargasokskyi District, Vanzhil-Kynak village, Siberian pine forest, soil litter, 18.07.1985, coll. L.G. Vartopetov; the Kemerovo Region, Kuzedeevo village, aspen forest, soil litter, 3.09.1972, coll. L. Lihacheva; the Novosibirsk Region, Karasukskiy District,
Fig. 14. Neoribates sibiricus sp.n., dorsal aspect.

Fig. 15. Neoribates sibiricus sp.n.: a — prodorsum, b — sensilla.

Fig. 16. Neoribates sibiricus sp.n.: a — saccules, b — pteromorph.

Fig. 17. Neoribates sibiricus sp.n.: a — anterior part of ventral side, b — posterior part of ventral side.

Troitskoye village, birchwood, anthill, 10.07.1977, coll. L.G. Grishina; the Altay Mountains, Mayma village, the northern slope of birchwood, soil litter, 17.08.1965, the Altay Mountains, the Ust-Koksinskyi Region, Kastahta village, Cherlouyh mountain hollow, subalpic meadow, 2.08.1966, coll. L.G. Grishina; the Altay Mountains, Kebezen' village, flood-plain osier-bed, pine-birch and birch-aspen forest, June 2006, coll. N.V. Vladimirova; the Altay Mountains, Obogo cordon, taiga, June 2006, August 2007, coll. N.V. Vladimirova; the Altay Mountains, Mt. Archa (Altyn-Tu Ridge), subgolets sparse growth of trees, yernik tundra, August 2007, coll. N.V. Vladimirova; Taymyr, Gydansk peninsula, Nosok village, sedge cotton-grass tundra, 12.07.1977, coll. G. Dudareva; Taymyr, Ragosinka village,

**Type specimens.** Holotype from the Altay Mountains, Turochakskiy District, Yaylyu village, bird cherry tree soil litter, 19.06.1977, coll. L.G. Grishina. The holotype is deposited in the collections of the Zoological Institute, Russian Academy of Sciences, St. Petersburg. Ten paratypes are deposited in the collections of the Siberian Zoological Museum of the Institute of Systematics and Ecology of Animals, Siberian Branch of the Russian Academy of Sciences, Novosibirsk.

**Etymology.** The species was given its name “sibiricus” according to its distribution pattern.

**Differential diagnosis.** *Neoribates sibiricus* sp.n. is similar to *N. borealis* sp.n. It has the following distinguishing features: larger body size, different shape of sensillae, sejugal fissure, form of prodorsal setae, sacculi outlines and other features.

**Key to species of the genus *Neoribates* distributed in Russia**

The identification key below was developed for the species of the genus *Neoribates* known from Russia. Several morphological characters were not used, including the lengths of leg segment setae, and correlation between the lengths of solenidia and setae, despite the fact these are different for each species. The setal formula of legs is the same for all species, except for the number of setae on tarsi: one species has 20, the others 19. Some species have quite specific pteromorphs; the differences are in the outer longitudinal margin of pteromorph, the size of posterior angle and its curving pattern. All these characters are noted in the species descriptions.

We considered it possible to add the species *N. aurantiacus* (Oudemans, 1914) to the key. It is not certain that specimens in the Zoological Museum collection were identified correctly, because the second description by Oudemans (1917) was incomplete. This species, like *N. gracilis* Trave, 1972, is widespread in Russia (Grishina 2004). The Japanese specimens redescribed as *N. aurantiacus* by Aoki (1966) have some different features, and it is necessary to study them more completely.
1(2) Sensillae setiform. Saccules $Sa$ broadly oval in shape and elongated parallel to pteromorph suture. Large (830–900 × 660–740) ................. $N. bulanovae$ Grishina sp.n. (Figs. 10–13) 2(1) Sensillae club-like or lanceolate. Saccules $Sa$ have different shape ......................... 3 3(8) Saccules dark-colored, conspicuous against lighter-colored body. Saccules $Sa$ sac-like, obliquely elongated into the body. Setae $ad_1$ close to the anterior part of anal valves .................. 4 4(5) Epimeral setae $Ia$ originate close to genital aperture and together with setae $2a$, $3a$ form a line or cluster. All these setae quite long, strong and have small barbs. Measurements: 630–760 × 314–485) ........... $N. aurantiacus$ (Oudemans, 1914) 470–570 (according to Oudemans (1917): 518–710 × 314–485) .... $N. bulanovae$ Vladimirova sp.n. (Figs. 6–9) 5(4) Arrangement of epimeral setae is different ... 6 6(7) Sensillae directed posteriorly, lanceolate, apically with long spike. Distance between bases of lamellar and interlamellar setae equal. Adanal setae $ad_1$ and $ad_2$, long, significantly exceeding the distance between their bases. Measurements: 450–550 × 320–400 (according to Trave (1972), body length 480–600) .... $N. gracilis$ Trave, 1972 7(6) Sensillae clavate with rounded tip. Distance between lamellar bases exceeds the distance between interlamellar setae. Adanal setae $ad_1$ and $ad_2$ short; their length is less than the distance between their bases. Measurements: 740–880 × 550–610 .............. $N. krivolutskyi$ Grishina sp.n. (Figs. 1–5) 8(3) Saccules light-colored, of different shape. All adanal setae posterior to anal valves, aligned parallel to curved margin of ventral shield, $ad_1$ distant from $ad_2$ and $ad_2$, ................ 9 9(10) Distance between lamellar setae exceeds the distance between interlamellar ones. Sejugal furrow is trapezoid in shape. Sensillae clavate, with conspicuous head. Only alveoli of setae present on notogaster. Length of adanal setae $ad_1$ and $ad_2$ less than distance between their bases. Measurements: 430–530 × 280–390 ..................... $N. borealis$ Vladimirova sp.n. (Figs. 6–9) 10(9) Distance between lamellar setae hardly exceeds that between interlamellar setae. Sejugal furrow broadly curved. Stalk of sensilla gets broader distally and gradually transforms into a head having a sharp tip. Microsetae present on notogaster. The lengths of adanal setae $ad_1$ and $ad_2$ equal to distance between their bases. Measurements: 570–650 × 390–490 .................... $N. sibiricus$ Vladimirova sp.n. (Figs. 14–18)

REFERENCES


