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MAKA MURVANIDZE

SULTAN OBANOĐLU

CİHAN CILBIRCIOĐLU

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New record of *Oribatula (Zygoribatula) nicora* (Djaparidze, 1986) comb. nov. from Turkey with a redescription of species

Maka MURVANIDZE^{1*}, Sultan ÇOBANOĞLU², Cihan CILBIRCIOĞLU³

¹Institute of Entomology, Agricultural University of Georgia, Tbilisi, Georgia

²Department of Plant Protection, Faculty of Agriculture, Ankara University, Ankara, Turkey

³Department of Organic Agriculture, Taşköprü Vocational School, Kastamonu University, Kastamonu, Turkey

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Abstract. *Lucoppia nicora* Djaparidze, 1986 was found in garlic fields in the Kastamonu region of Turkey. This finding is a new record for Turkey and also the first finding after its description from Nikortsminda cave and a vegetable garden in Tbilisi, Georgia. Redescription of the species is accompanied by a discussion of its taxonomic status. Based on differences having generic character in the structure of the prodorsum (length of lamellae; width of translamellae; distance between *ro*, *le*, and *in* setae), *L. nicora* is regarded as belonging to the subgenus *Oribatula (Zygoribatula)*. *Oribatula (Zygoribatula) nicora* (Djaparidze, 1986) **comb. nov.** is proposed. A new diagnosis for the subgenus *Zygoribatula* is provided.

Key words: *Lucoppia nicora* Djaparidze, 1986, new record, redescription, Kastamonu region, Turkey

Oribatid mites are known as the best studied soil mites worldwide (Walter and Proctor, 2013); however, the oribatid fauna of Turkey is still understudied. The 2007 checklist of Turkish soil mites included only 70 oribatid species (Erman et al., 2007). After this checklist several additional findings were reported (Baran and Ayyıldız, 2008; Toluk and Ayyıldız, 2009a, 2009b, 2010a, 2010b, 2013; Baran, 2012; Baran and Kiliç, 2013; Sarial and Baran, 2013; Baran and Gökyeşil, 2015; Dogan et al., 2015; Bezci and Baran, 2016; Ayyıldız et al., 2017; Per et al., 2017; Toluk and Akin, 2017; Toluk et al., 2017; Akman et al., 2018; Zoroğlu et al., 2018) and a supplementary checklist of oribatid mites recorded between the years 2008 and 2016 added 96 species more to the Turkish oribatid fauna (Baran et al., 2018). However, the oribatid diversity of Turkey is still much lower than in the neighboring country of Georgia, in spite of the huge difference in the areas of these countries (Turkey: 783,562 km², Georgia: 69,700 km²), as Georgia has more than 530 species identified (Murvanidze and Mumladze, 2016).

Recent field work was conducted in garlic-growing areas of the Kastamonu region of Turkey. Together with other species, *Lucoppia nicora* Djaparidze, 1986 was identified, which was previously known from only the type locations of a Tbilisi vegetable garden and Nikortsminda cave (Djaparidze and Gomelauri, 1986).

* Correspondence: m.murvanidze@agrni.edu.ge

This finding represents the first record after the original description.

Below we provide a redescription of this species, compare it with the original description, and propose *Oribatula (Zygoribatula) nicora* (Djaparidze, 1986) **comb. nov.**

Sampling was conducted in 2015 in Kastamonu Province of Turkey, which is known as a garlic-growing area (Table 1). Specimens of *Oribatula (Zygoribatula) nicora* were collected during the vegetation period from the bulbs of garlic with attached soil. Extraction was done by Berlese funnel and individuals were stored in 70% alcohol. For identification temporary slides were made using lactic acid.

Dimensions were taken in the following manner: length – from the tip of the rostrum to the end of notogaster; width – widest part of the notogaster. Dimensions for the prodorsal setae were taken in a lateral view from the insertion to the tip of the setae. Notogastral setae were measured in dorsal view. All measures are provided in µm. Drawings were performed using an Olympus BX50 phase contrast microscope and a micrometrical scale.

Material examined: Fifty-eight individuals of *O. (Z) nicora* (Djaparidze, 1986) **comb. nov.** were found in eight locations (Table 1).

Deposition of material: The voucher specimens of the species redescribed here are deposited in the mite

Table 1. Location of sampling sites with identification of proper habitat, GPS coordinates, and number of found individuals of *O. (Z.) nicora* **comb. nov.**

Location	Habitat	GPS coordinates	Number of individuals
Halaçlı village	Garlic field	41°27'48.73"N 33°57'26.01"E	19
Taşköprü Kabalar village	Garlic field	41°28'20.20"N E 33°58'58.32"E	1
Merkez Uzunkavak village	Garlic field	41°30'21.0528"N 33°59'46.1688"E	1
Taşköprü Kızılcaören village	Garlic field	41°31'8.1984"N 34°0'50.50"E	14
Taşköprü Ağcıkışı village	Garlic field	41°31'02.65"N 34°11'19.28"E	1
Merkez Çavundur village	Garlic field	41°28'20.20"N 33°58'58.32"E	13
Hanönü Kornapa village	Garlic field	41°33'57.618"N 34°10'26.9376"E	1
Taşköprü Ağcıkışı	<i>Sinapsis arvensis</i> plantation	41°31'02.65"N 34°11'19.28"E	8

collection of the Department of Plant Protection, Ankara University, Turkey (53 specimens) and the Agricultural University of Georgia (5 females).

***Oribatula (Zygoribatula) nicora* (Djaparidze, 1986) comb. nov. (Figures 1–3)**

Diagnosis: Mites of medium size and light brown color. Cuticle with fine striation. Rostrum protruding, rounded. Lamellae wider than translamellae. Length of lamellae about half of prodorsum. Lamellar cuspis absent. Translamella binds tips of the lamellae. Prodorsal setae strong, barbed. Sensilla with thin legs, head clavate and barbed. Notogastral projections well developed. Fourteen pairs of strong, barbed notogastral setae. Areae porosae oval, reducing in size from Aa to A_3 . Ventral setae short. Legs tridactylous.

Description: Body size: 560–565 × 315–320 (n = 10). Color: Light brown. Cuticle with fine striation.

Prodorsum: Rostrum slightly protruding and rounded. Lamellae (80) strong, wide, about half the size of prodorsum (165). Translamellae (55) very thin, connecting lamellar tips, slightly curved. Lamellar cuspides are absent. Sublamellae present as thin line. Better observable at the tips of lamellae and almost absent in basis. *Ro* setae located on sides of rostrum, strong, with tiny setulae (55). Lamellar setae inserted on tips of lamellae, long, strong, with small setulae (85–88). *In* setae of same size and shape as lamellar setae. Located in the lower part of prodorsum, close to

dorsosejugal line. Bothridia cup-shaped with rounded opening. Sensilla (60–65) with clavate, barbed head; leg of sensillus long and thin. Exobothridial setae (*ex*) strong, well visible (55) (Figures 1 and 3).

Notogaster: Wide and rounded. Very fine striation can be observed under high magnification. Dorsosejugal line fine, but developed. Shoulder projections very small. Fourteen pairs of strong notogastral setae, bearing small setulae. *c1* slightly shorter (60) than centrodorsal setae (70) and directed horizontally. All areae porosae oval. Their size diminishes from Aa (25) to A_3 , A_1 (20), A_2 (15), and A_3 (13) are located in posterior part of notogaster. Lyrifissure *im* well discernible, located between *lp* and h_3 . Other lyrifissures not distinct (Figure 1).

Ventral region: Gnathosoma shows no peculiarities. Setae *a* and *m* minute (5), *h* longer (12.5), with minute setulae. Epimerae well developed. Second epimerae strongly chitinized, running over the genital plate. Epimeral formula 3–1–3–3. All epimeral setae short (12), with hardly discernable setulae.

Five pairs of genital setae. g_1 and g_2 are located in the top of genital plate, close to each other. g_3 located below g_2 , g_4 and g_5 located in the lower part of genital plate. g_1 and g_2 longest (12) and other setae shorter (5). One pair of aggenital (12), two pairs of anal (12), and three pairs of adanal setae (10) are present. All setae smooth, setiform. Adanal lyrifissures (*iad*) located close in the center at

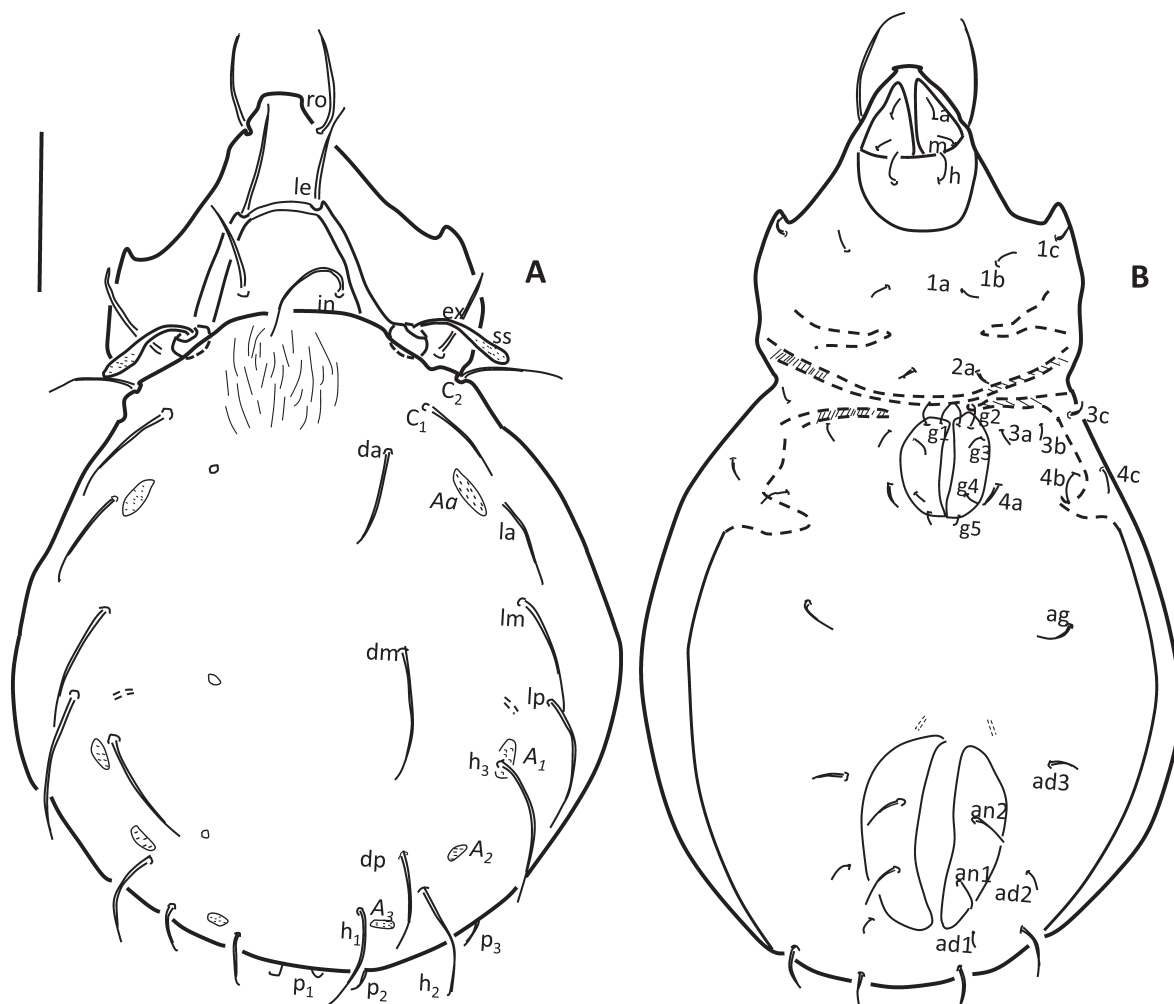


Figure 1. *Oribatula (Zygoribatula) nicora* (Djaparidze, 1986) **comb. nov.** A) Dorsal view; B) ventral view. Scale bar 100 μ m.

the anterior margin of anal plate (Figure 1). Ovipositor elongated (160–165).

Legs tridactylous. Median claw stronger than others (Figure 2). Leg setation provided in Table 2.

Comparison with original description: We had no access to the holotypes and paratypes of *L. nicora* Djaparidze, 1986, which are deposited in the Institute of Zoology in St. Petersburg. Therefore, we made a comparison based on the original description (Djaparidze and Gomelaury, 1986).

Turkish individuals belong to *O. (Z.) nicora* (Djaparidze, 1986) by body color, shape of lamellae–translamellae complex, shape of sensilla, areae porosae, notogastral setation, etc. However, there are some minor differences: 1) Djaparidze indicated the body size of *L. nicora* as 490 × 270 while Turkish individuals are larger at 560–565 × 315–320. 2) In the original description a smooth body is indicated, while under high magnification fine striation on the notogaster can be detected. This

character could have been overlooked by the author because of a low-quality microscope. 3) According to the original description, *ng* setae are smooth; however, under high magnification small setulae can be observed on these setae. 4) Djaparidze indicated *le* setae longer (85) than *in* setae (75), while in Turkish specimens these setae are of equal size (85–88). These differences can be considered as a regional peculiarity and fit within possible variation ranges.

Lucoppia Berlese 1916 is a small genus comprising only four species (www.ucm.es/info/zoo/Artropodos/Catalog.pdf): *L. burrowsi* (Michael, 1890); *L. feideri* Subias, 2009; *L. nicora* Djaparidze, 1986; and *L. ornata* Berlese, 1916.

L. nicora shows some essential differences from other *Lucoppia* species. Diagnosis of the genus *Lucoppia* indicates short and thin, strongly convergent lamellae without lamellar cuspides; *le* setae closer to the *in* than the *ro* setae; 14 pairs of strong notogastral setae; and 4 or 5 pair of genital setae (Perez-Iñigo, 1993; Weigmann, 2006).

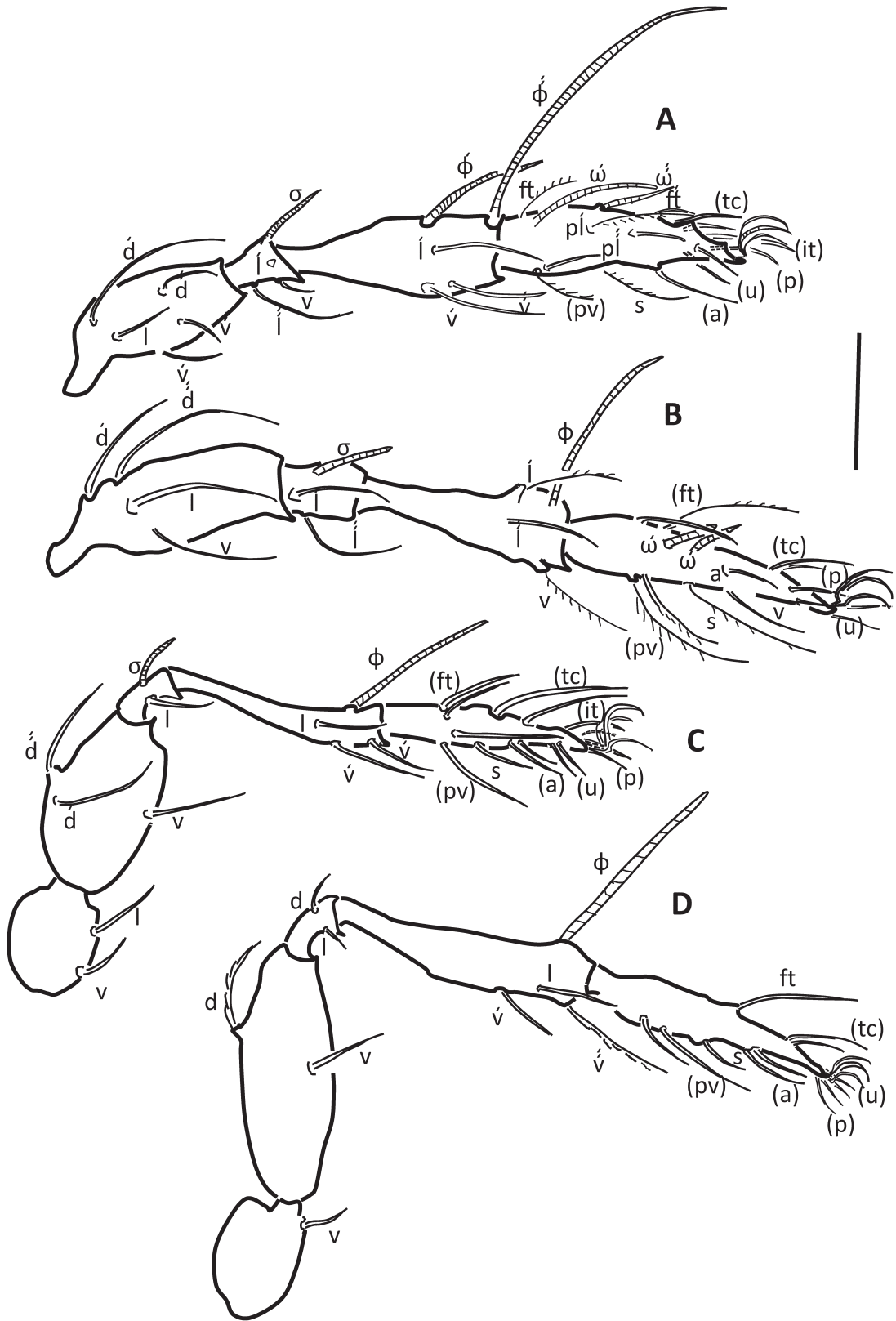


Figure 2. *Oribatula* (*Zygoribatula*) *nicora* (Djaparidze, 1986) **comb. nov.** A) Leg I; B) leg II; C) leg III; D) leg IV. Scale bar 50 μ m.

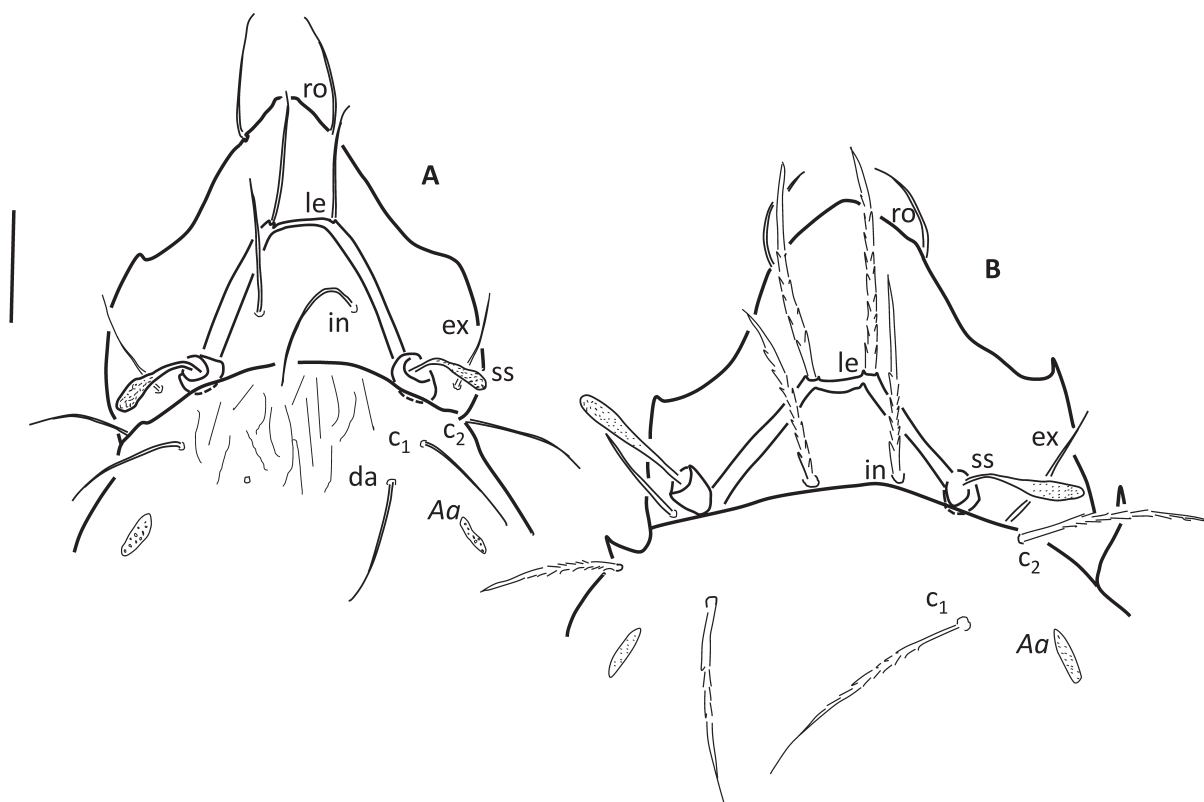


Figure 3. Prodorsum of A) *Oribatula (Zygoribatula) nicora* (Djaparidze, 1986) **comb. nov.** and B) *Lucoppia burrowsi* (Michael, 1890). Scale bar 50 μ m.

Table 2. Leg setation and solenidia for *O. (Z.) nicora comb. nov.*'

	Trochanter	Femur	Genu	Tibia	Tarsus
Leg I	v	d', d'', l, v', v''	σ , l', l'', v	$\varphi_1, \varphi_2, l, v', v''$	ω_1, ω_2 (ft), (tc), (it), (p), (u), (a), s, (pv), pl', pl''
Leg II	-	d', d'', l, v	σ , l', l''	φ, l', l'', v	ω_1, ω_2 (ft), (tc), (p), (u), (a), v, s, (pv)
Leg III	v, l	d', d'', v	σ, l	φ, l, v', v''	(ft), (tc), (it), (p), (u), (a), s, (pv)
Leg IV	v	d, v	d, l	φ, l, v', v''	ft, (tc), (p), (u), (a), s, (pv)

Roman letters refer to the normal setae, Greek letters refer to the solenidia, single prime refers to the setae on anterior side, double prime refers to the posterior side, parentheses refer to the pair of setae.

Observation of fresh individuals of *L. nicora* allowed comparison with the type species of the genus, *L. burrowsi* from the Georgian collections, and observation of all key characters that do not fit within the diagnosis (Figure 3): 1) Size of lamellae – length of lamellae of *L. nicora* is half the size of prodorsum (80 : 165). There is no size relationship provided in descriptions and redescriptions of other *Lucoppia* species (Berlese, 1916; Feider et al., 1970; Djaparidze, 1985; Mahunka, 1991; Bezci and Baran, 2016); however, all of them indicate that lamellae are short. 2) Distance between *in*, *le*, and *ro* setae – for all *Lucoppia*

species the lamellar setae are closer to interlamellar than to rostral setae, while *le* setae of *L. nicora* are the same distance from *in* (50) and *ro* setae (45). 3) Width of lamellae – lamellae of all *Lucoppia* species are reported to be thin and the same width as translamellae, while lamellae of *L. nicora* are much wider than translamellae (10–15 \times 2). 4) Number of genital setae – for *L. burrowsi* and *L. feideri* 5 pairs of genital setae are reported (Feider et al., 1970; Djaparidze, 1985; Weigmann, 2011; Bezci and Baran, 2016) and the number of genital setae of *L. ornata* is unknown (Berlese, 1916; Mahunka, 1991). *L. nicora* has

five pairs of genital setae, like other *Lucoppia* species.

Weigmann (2011) indicated that the lamellar complex of *L. nicora* was unusual for the genus and proposed its relation with *Zygoribatula*. Indeed, the size and shape of the lamellae–translamellae complex, width of lamellae, and distance between *in*, *le*, and *ro* setae fit within the diagnosis of the subgenus *Zygoribatula*, which indicates larger and wider lamellae and *le* setae closer to *ro* setae (Perez-Iñigo, 1993; Weigmann, 2006). However, all members of *Zygoribatula* are reported to have four pairs of genital setae, while *L. nicora* has five distinct pairs of genital setae.

Based on the abovementioned differences we conclude that characters of *L. nicora* do not fit within the diagnosis of *Lucoppia* and support the suggestion of Weigmann (2011) to regard *L. nicora* as a member of the subgenus *Zygoribatula*.

As for the *Oribatula* (*Zygoribatula*) species found in the Mediterranean region, *O. (Z.) nicora* shows similarity to *O. (Z.) skryabinii* (Bulanova-Zachvatkina, 1967) by body size, thin translamellae, oblong areae porosae *Aa*, and other areae porosae getting smaller in size (Bulanova-Zachvatkina, 1967; Ghilarov and Krivolutsky, 1975). However, there are also distinct differences: 1) *O. (Z.) skryabinii* shows short lamellar cuspides, while they are absent in *O. (Z.) nicora*; 2) translamella of *O. (Z.) nicora* is slightly curved, while translamella of *O. (Z.) skryabinii* is straight; 3) there are 13 pairs of *ng* setae and 4 pairs of *g*

setae in *O. (Z.) skryabinii* and 14 pairs of *ng* setae and 5 pairs of *g* setae in *O. (Z.) nicora*; 4) *ng* setae of *O. (Z.) skryabinii* are short (50–55 for specimens found in Georgia), while *ng* setae of *O. (Z.) nicora* are much longer (70) and stronger.

Based on the presence of five genital setae for *O. (Z.) nicora* **comb. nov.**, which is unusual for *Zygoribatula*, we provide a new diagnosis for this subgenus: lamellae and translamellae well developed. Lamellae with or without cuspides, slightly convergent. Translamellae of various thicknesses from linear to narrow stripe. Lamellar setae situated on the tips of lamellae. Interlamellar setae well developed, placed in interbothridial region. Distance between *ro*, *le*, and *in* setae almost equal. Shoulder projections remarkable; 13 or 14 pairs of fine, well-visible notogastral setae. Four pairs of *areae porosae*. Four or 5 pairs of genital setae. Legs tridactylous.

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