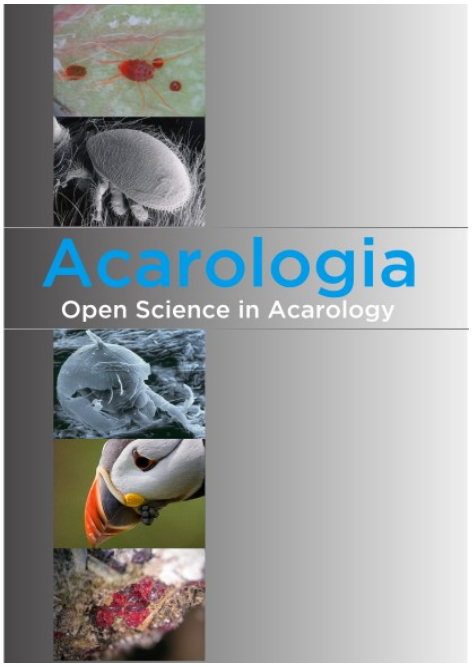

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GENUS *ORIBATULA* S. STR. BERLESE, 1896 (ORIBATIDA, ORIBATULIDAE) IN ROMANIAN FAUNA

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ABSTRACT — This study aims to review the species of *Oribatula* s. str. Berlese recorded in Romanian fauna, according to the most recent monographs and catalogues, but taking the original description and/or subsequent mentions into account, as well. Rich faunistic material was examined for this purpose, collected from various ecosystem types and from most regions of the country. Six species are analyzed from a morphological and biometrical point of view. In this context, reasons to consider *Oribatula amblyptera* Berlese, 1916 and *O. sitnikovae* Iordansky, 1991 as valid species are pointed out. A brief description and illustration of each species are given, along with data on their local distribution and ecology. An identification key is proposed.

KEYWORDS — *Oribatula*; species; diagnosis; morphology; biometry

INTRODUCTION

Oribatula Berlese, 1896 is a cosmopolitan genus, about 70 % of its species having a wide or limited distribution within the Palaearctic region (Subias 2004, 2012). More than 60 % of *Oribatula* species were described in the last three decades. In some of the earlier described species, difficulties in identification still occur. As regards the systematic status of *Oribatula* Berlese, 1896, there are three different opinions. Thus, Balogh (1972), Bulanova-Zachvatkina (1975), Balogh and Balogh (1992), Weigmann (2006), Bayartogtokh (2010) consider *Oribatula* and *Zygoribatula* Berlese, 1916 as distinct genera. According to Berlese (1916) and Subias (2004, 2012) *Zygoribatula* and *Oribatula* s. str. are subgenera of *Oribatula*, while Seniczak *et al.* (2012) motivate the fact that *Zygoribatula* should be considered junior synonym of *Oribatula*.

This paper refers to *Oribatula* s. str., a group of species differentiated within the family Oribatulidae by characters such as: true lamellae present, in the shape of ribbon or lath, missing translamella, notogastral setae simple, absence of *p3* seta, therefore 13 pairs of setae are present on notogaster, 4 pairs of genital setae (Grandjean 1954, 1958; Balogh 1972; Balogh and Balogh 1992; Weigmann 2006).

In a faunistic synopsis of the oribatid mites from Romania (Vasiliu *et al.* 1993) six species of *Oribatula* s. str. were listed, two of them being currently synonyms (Subias 2004, 2012) of other previously described species (*O. venusta* Berlese, 1908 and *Zygoribatula saxicola* Kunst, 1959, included then in the genus *Oribatula*). Afterwards two more species were recorded, namely *Oribatula amblyptera* Berlese,

1916 and *Oribatula sitnikovae* Iordansky, 1991. As in the case of many oribatid taxa, a review of these species became necessary, taking into account the new data and considerations in the literature. It is known that this genus shows a remarkable unity, as regards external morphology, so the identification of some species is problematic. Therefore in this study a comparative analysis of *Oribatula* species recorded in Romanian fauna is carried out, using biometrical characters in addition to morphological characters.

MATERIALS AND METHODS

A rich faunistic material available in the laboratory collection was used to elaborate this study. The material was collected mostly by Dr. N. A. Vasiliu and by the author, from various types of ecosystems, placed in all parts of the country. More data regarding the examined material are given for each species.

As in other studies of comparative morphology, classical methods were used in this case. The material – preserved in ethanol – was cleared in lactic acid 70 %. The observations and measurements were made using an optical microscope, and the drawings were made with the use of a camera lucida.

In the description of species the morphological terminology and chaetotaxic notation suggested by Grandjean 1954, 1958, Balogh 1972, Balogh and Balogh 1992, Mahunka and Zombori 1985 and Weigmann 2006 was followed.

RESULTS

Oribatula tibialis (Nicolet, 1855) (Figure 1) (= *O. venusta* Berlese, 1908)

Literature used for identification — Bulanova-Zachvatkina (1975), Iordansky (1991), Perez-Iñigo (1993), Weigmann (2006), Wunderle *et al.* (1990). Material examined: 20 populations (7 – 11 specimens of each population) from different ecosystem types and sampling areas.

Diagnosis (type species of the genus) — Medium sized species, but comparatively, one of the larger representatives of the genus; a considerable variability of size has been observed from one population to another (Table 1). Chestnut in colour, cuticle smooth, without obvious ornamentation. Prodorsum with broad, robust lamella, without cuspis; in some specimens a short prolamella present (Figure 1c). Prodorsal setae robust and barbed (Table 2). Sensillus fusiform elongated, often with a pointed tip (Figure 1d). Notogaster with 13 pairs of setae simple and short (p_3 missing), but well discernible. Octotaxic organ represented by 4 pairs of areae porosae, typically placed; *Aa* oval, larger than A_1, A_2 and A_3 (Figure 1a, e). Epimeral region with characteristic configuration, namely the absence of sternal furrow and the circumpedal carina well developed (Figure 1b). Epimeral setae according to the formula 3:1:3:3. Genito-anal region with the usual setal formula 4:1:2:3.

Distribution and autecology — Holarctic species; India (Subias 2004).

Oribatula tibialis is the most common species of the genus, being recorded in all zones of Romania, in various habitats, from the subalpine zone to the plains, and in the Danube Delta. It is tolerant of industrial pollution (heavy metals, cement dust). Nevertheless, it prefers the soil of deciduous forests (reaching densities of 5,300 individuals/m^2) and moist meadows (Vasiliu *et al.* 1993).

Oribatula amblyptera Berlese, 1916 (Figure 2)

Literature — Berlese (1916), Mahunka (1994), Weigmann (2006).

Material examined — 5 – 9 specimens of 2 populations, from the Danube Delta (cultivated soil) and Prut river meadow (pasture).

Diagnosis — Species of medium size (Table 1), yellowish to light chestnut in colour. Cuticle smooth, without ornamentation. Prodorsum with ribbon shaped lamella; lamellar apex concave, and its median angle prominent; a short and curved prolamella can be observed. Prodorsal setae robust, finely barbed. Sensillus relatively short, fusiform

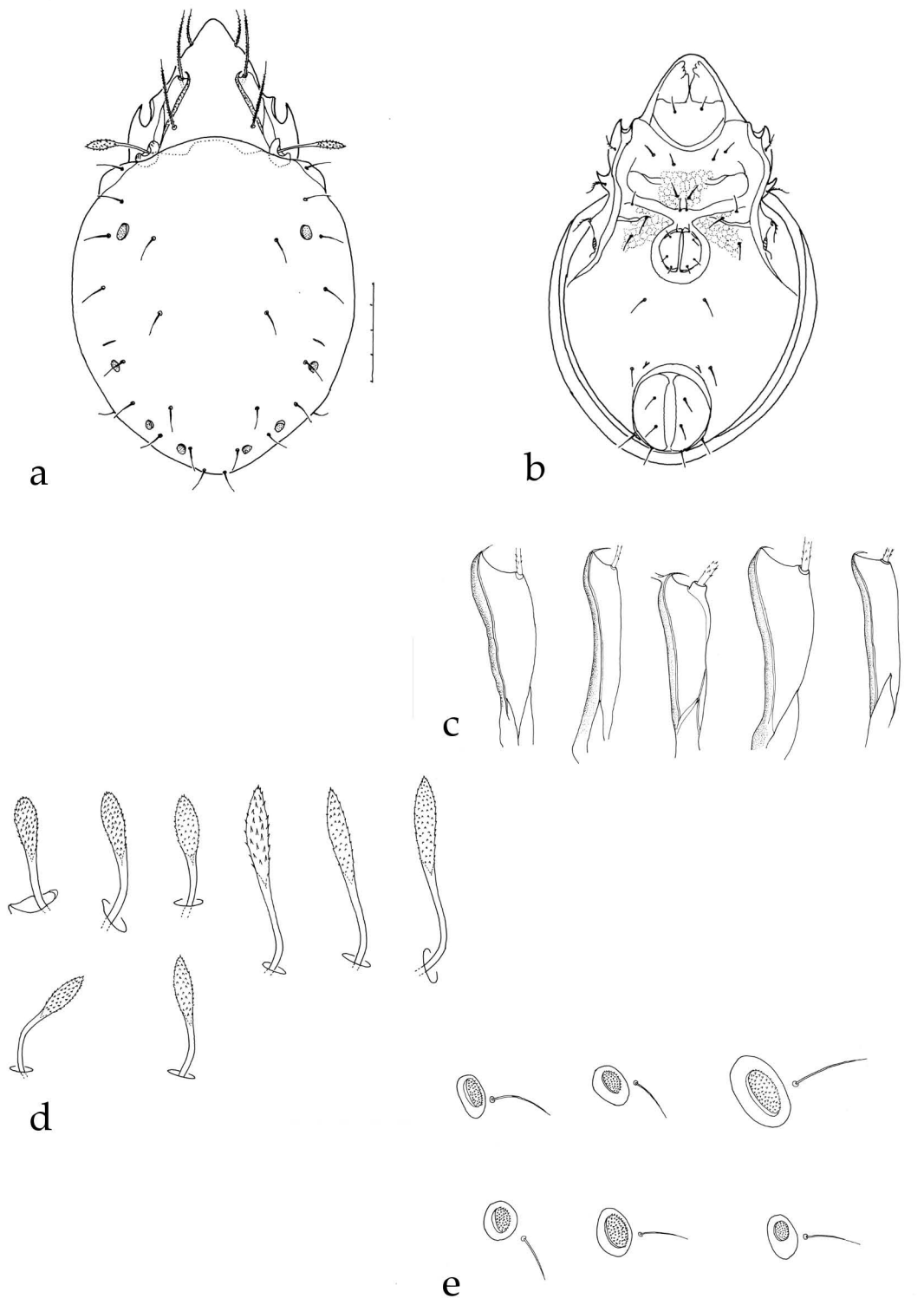

FIGURE 1: *Oribatula tibialis* (Nicolet, 1855): a – dorsal view; b – ventral view; c – variability of lamella; d – variability of sensillus; e – area porosa *Aa* and *la* seta in different specimens; scale bar (a, b): 100 μm.

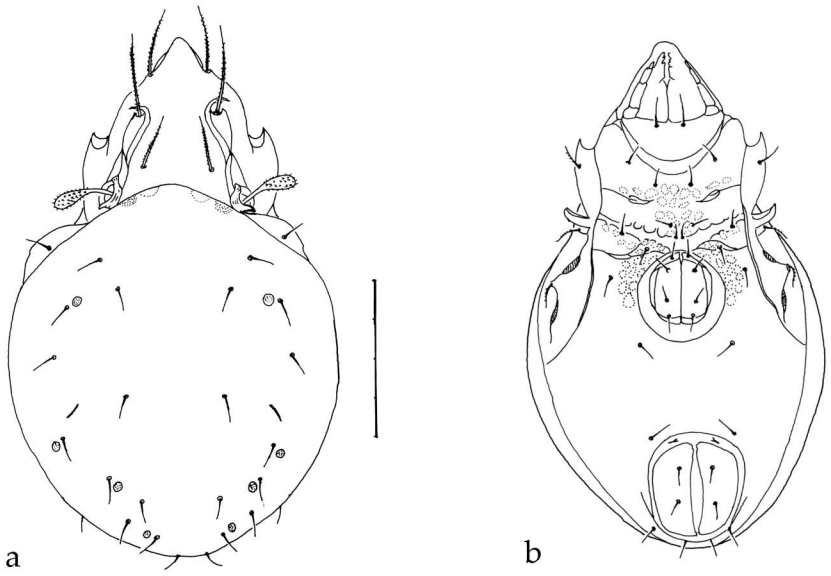

FIGURE 2: *Oribatula amblyptera* Berlese, 1916: a – dorsal view; b – ventral view; scale bar: 100 μm.

TABLE 1: Dimensions of the body and its parts in *Oribatula* species (μm; mean ± SD)

Species[1]	Idiosoma[2]				Prodorsum	Notogaster
	L min.	L max.	L	W	Lp	Ln
Oribatula tibialis (181)	407	547	467 ± 19.1	295 ± 15.9	114 ± 11.8	362 ± 13.9
Oribatula amblyptera (14)	325	367	347 ± 12.9	208 ± 13.9	94 ± 8.5	253 ± 19.2
Oribatula pannonica (25)	415	458	432 ± 17.0	253 ± 11.4	105 ± 11.3	327 ± 17.5
Oribatula longelamellata (3)	300	361	330 ± 24.9	204 ± 17.5	94 ± 5.7	236 ± 20.2
Oribatula interrupta (25)	337	391	359 ± 18.3	196 ± 16.8	96 ± 9.8	263 ± 15.7
Oribatula sitnikovae (8)	364	391	388 ± 11.5	193 ± 6.6	90 ± 1.5	298 ± 9.8

[1]Numbers in parenthesis are the number of specimens used for measurements

[2]L –length; W - width; Lp – length of prodorsum; Ln - length of notogaster

clavate, with rounded end. (Table 2). Notogaster with 13 pairs of simple and thin notogastral setae, often hardly observable; the 4 pairs of areae porosae are round and small, placed in the usual position. Ventral side has the aspect and chaetotaxy characteristic for the genus.

Remarks — Although considered as synonym of *O. tibialis* (Subias 2004, 2012), *O. amblyptera* differs from the nominate species by a number of characters, such as: body size, shape and length of sensillus, smaller areae porosae, especially *Aa*, shorter notogastral and prodorsal setae *in* and *le* (Tables 1, 2).

Distribution — Southern and Central Europe (Weigmann 2006). In Romania this species was recently recorded in the Eastern region, in wet soils, including cultivated ones, from Prut river meadow and the Danube Delta (Ivan 2009).

Oribatula pannonica Willmann, 1949 (Figure 3)

Literature — Willmann (1949), Kunst (1957), Travé (1961), Weigmann (2006), Bayartogtokh (2010).

TABLE 2: Dimensions of the idiosomal setae (μm; min/max range and mean (in bold))

Species[1]	Prodorsum[2]				Notogaster[2]		Epimeral region[2]			Genito-anal region[2]			
	in	*le*	*ro*	*ss*	Ls	Ls/Ln(%)	*a*	*b*	*c*	*g*	*ag*	*an*	*ad*
O. tibialis (181)	78-90	96-108	48-60	50-90	23-35	06-11	20-23	23-28	25-28	15-20	20-23	15-20	20-23
	84	**102**	**51**	**70**	**31**	**8.3**	**21**	**24**	**26**	**18**	**21**	**18**	**21**
O. amblyptera (14)	35-38	58-60	52-55	36-48	18-23	7.2-8.7	10-13	10-13	15-18	10-13	10-15	10-13	10-15
	36	**60**	**53**	**40**	**20**	**7.9**	**12**	**12**	**16**	**10**	**12**	**10**	**12**
O. pannonica (25)	72-84	60-66	48-60	68-80	38-42	10.5-12.7	10-15	10-15	20-23	10-13	15-18	10-13	15-18
	74	**63**	**54**	**76**	**39**	**11.9**	**12**	**12**	**21**	**10**	**16**	**10**	**16**
O. longelamellata (3)	35-38	32-47	30-35	45-48	10-15	4.8-6.2	10-13	10-13	13-15	08-10	13-15	10-13	13-15
	36	**40**	**33**	**46**	**13**	**5.5**	**12**	**12**	**14**	**9**	**14**	**11**	**14**
O. interrupta (25)	32-37	60-67	40-42	32-42	15-18	5.5-6.5	13-15	15-18	18-20	10-13	10-15	10-13	10-15
	35	**63**	**41**	**36**	**15**	**5.7**	**15**	**17**	**20**	**10**	**12**	**10**	**12**
O. sitnikovae (8)	40-43	53-58	43-48	35-38	28-30	9.3-10.2	13-15	15-18	18-20	13-15	15-18	13-15	15-18
	40	**56**	**45**	**35**	**30**	**10.1**	**15**	**15**	**20**	**15**	**15**	**15**	**15**

[1]Numbers in parenthesis are the number of specimens used for measurements

[2]*in* – interlamellar setae; *le* – lamellar setae; *ro* – rostral setae; *ss* – sensillus; Ls – length of notogastral setae; Ln – length of notogaster; *a, b, c* – epimeral setae; *g* – genital setae; *ag* – aggenital setae; *an* – anal setae; *ad* – adanal setae

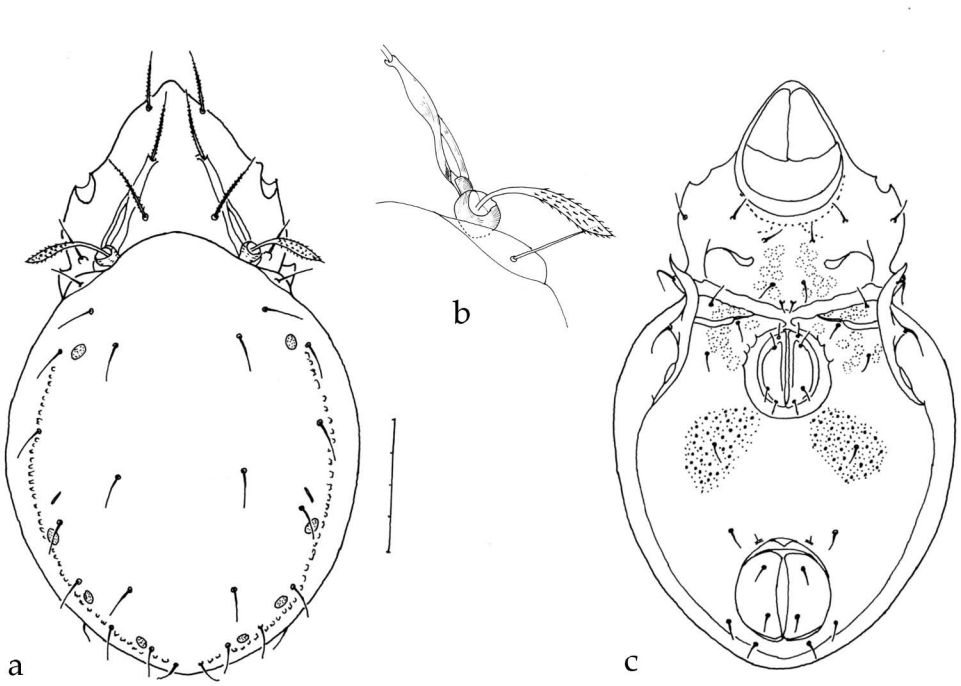

FIGURE 3: *Oribatula pannonica* Willmann, 1949: a – dorsal view; b – lamella and sensillus, detail; c – ventral view; scale bar: 100 μm.

Material examined — 7 – 11 specimens of 3 populations from the Eastern Romania (grasslands and cultivated soils).

Diagnosis — Species of medium size, chestnut to brown in colour; it is one of the larger species of this genus (Table 1). Tegument without obvious ornamentation, excepting ventral plate that can show fields with foveolae. Prodorsum conical, with convergent lamellae, their width decreasing to the apex (Fig 3a, b). Prodorsal setae robust and barbed. Sensillus fusiform elongated, with lanceolate end. Notogaster oval, with 13 pairs of notogastral se-

tae, simple and relatively long (Table 2). The areae porosae (4 pairs) are oval, *Aa* larger than A_1-A_3, being typically positioned. Epimeral region strongly sclerotized, with the setal formula 3:1:3:3. Genito-anal region with the typical chaetotaxy.

Remarks — The material collected in Romania is very close to the original description of Willmann (1949), also to redescription of Kunst (1957). Travé (1961) observed some differences between his specimens and those described by Willmann; subsequently, many authors referred to *pannonica*, sensu Travé. Comparing these descriptions and/or illustrations it seems to be two different entities. Differences can be observed in the shape of sensillus, shape of lamella (Travé 1961, Weigmann 2006), length and number of notogastral setae (Bayartogtokh 2010).

Distribution and autecology — Palaearctic species (Subias 2004). *O. pannonica* can be considered a typical meadow species; in Romania it was recorded especially in hilly pastures and hayfields (reaching abundance of 4,900 individuals/m^2), and only accidentally in forests; also, it was found in cultivated soils, proving tolerance to some degree of salinity (Vasiliu *et al.* 1993).

Oribatula longelamellata Schweizer, 1956 (Figure 4)

Literature — Schweizer (1956), Grobler and Skubala (2000), Weigmann (2006).

Material examined — 2 specimens from the Retezat Massif, 1 specimen from Turu's Gorges (Apuseni Mountains).

Diagnosis — Medium sized species, one of the smaller representatives of the genus (Table 1), light yellowish in colour. Cuticle smooth, without ornamentation. Prodorsum elongated, with long lamellae; lamellar apex with a rounded, evident cuspis. A long prolamella is present, almost reaching the origin of rostral setae (Figure 4b). Prodorsal setae finely barbed, sensillus fusiform clavate. Notogaster oval, rounded, with 13 pairs of simple and short setae (Table 2). Areae porosae are small, round, in the usual position. Epimeral and genito-anal regions with typical aspect. Chaetotaxy of these regions are also characteristic for the genus.

Distribution and autecology — Central and Western Europe (Subias 2004). *O. longelamellata* is a mountain to alpine species; in Romania was recorded in the Retezat National Park and in the Turu's Gorges (Apuseni Mountains), only on limestones, therefore can be considered a stenotopic form (Vasiliu *et al.* 1993).

Oribatula interrupta (Willmann, 1939) (Figure 5)

Literature — Willmann (1939), Weigmann (2006), Bayartogtokh (2010).

Material examined — 7-11 specimens each of 3 populations from the Eastern Carpathians (subalpine meadow and shrubs, saxicolous habitat with lichens).

Diagnosis — Species of medium size (Table 1), yellowish coloured. Tegument without apparent ornamentation. Prodorsum with a prominent rostral tectum, like a naso. Lamella wide, ribbon shaped, with the apex truncate; thickened lines, medially directed can be observed, as is an interrupted translamella. Prodorsal setae robust and barbed. Sensillus fusiform clavate, with rounded tip. Notogaster oval, with 13 pairs of notogastral setae, simple and short (Table 2). Areae porosae round, *Aa* larger than the remaining ones. Epimeral and genito-anal regions with characteristic configuration for the genus and with typical chaetotaxy.

Distribution and autecology — Holarctic species (Subias 2004). In Romania this species was recorded as *Oribatula alpina* Schweizer, 1956 in different mountain ecosystems, including subalpine and alpine ones, especially from the Eastern Carpathians (Vasiliu *et al.* 1993).

Oribatula sitnikovae Iordansky, 1991 (Figure 6)

Literature — Iordansky (1991), Weigmann (2006).

Material examined — 3 specimens from Rodna Mountains, 5 specimens from Calimani Mountains (Eastern Carpathians) (subalpine shrubs, mountain meadow respectively).

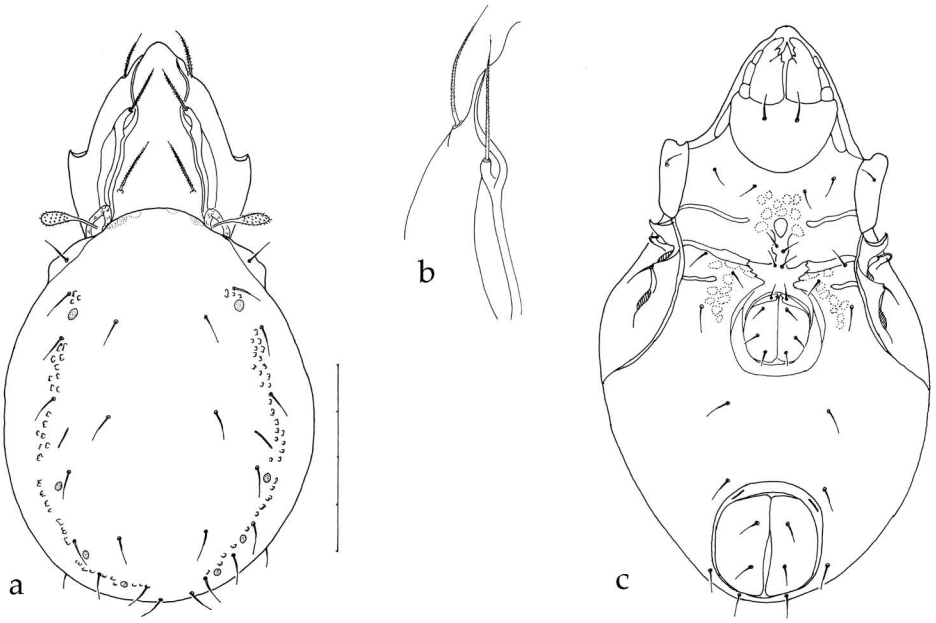

FIGURE 4: *Oribatula longelamellata* Schweizer, 1956: a – dorsal view; b – lamella with cuspis and prolamella, detail; c – ventral view; scale bar: 100 μm.

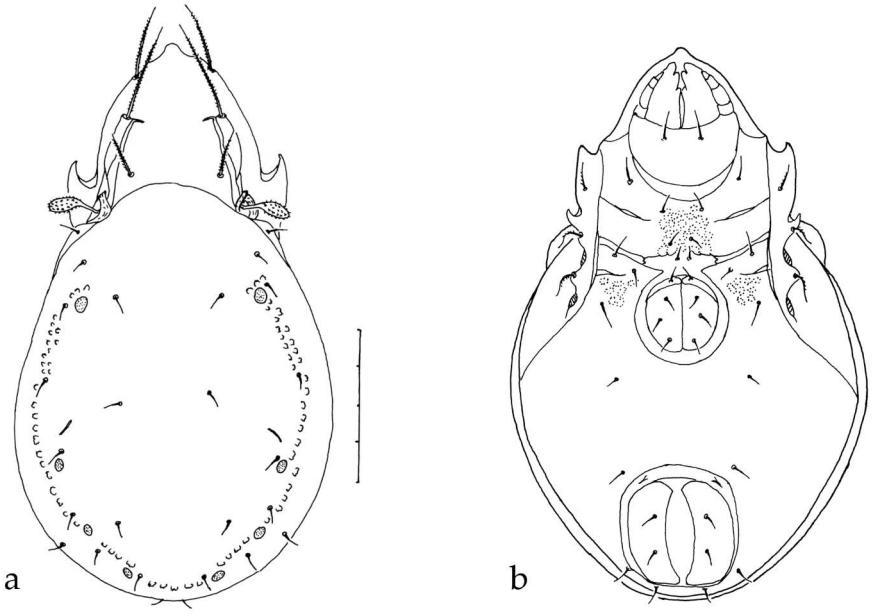

FIGURE 5: *Oribatula interrupta* (Willmann, 1939): a – dorsal view; b – ventral view; scale bar: 100 μm.

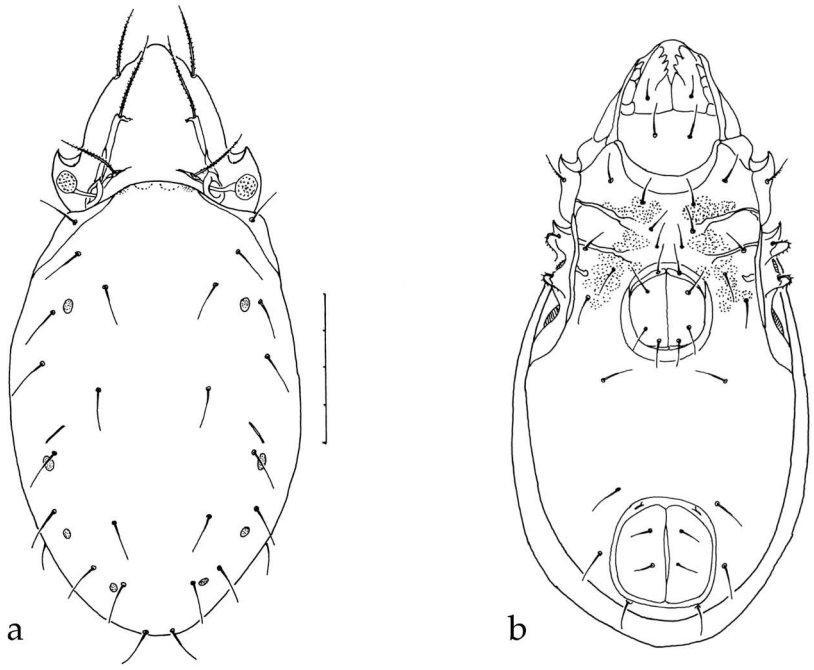

FIGURE 6: *Oribatula sitnikovae* Iordansky, 1991: a – dorsal view; b – ventral view; scale bar: 100 μm.

Diagnosis — Medium sized species (Table 1), with elongated body. Cuticle smooth, colour light yellowish. Prodorsum with narrow lamella; short thickened lines oriented medially are present at the apex of each lamella. Prodorsal setae robust and finely barbed. Sensillus short, with distal part globulous. Notogaster oval, elongated, the breadth/length ratio having a comparatively low value. The 13 pairs of notogastral setae are relatively long (Table 2). Areae porosae are small, oval, typically positioned. Ventral side has the aspect and chaetotaxy characteristic for the genus.

Remarks — At present, this species is considered synonym of *O. interrupta* (Subias 2004, 2012). However, a number of characters differentiate the two taxa, such as: shape of sensillus, width of lamella, absolute and relative length of notogastral setae (twice as long in *O. sitnikovae*) (Table 2).

Distribution — NW of the former USSR (Subias, 2004). *O. sitnikovae* has been recorded in mountain habitats, as meadows and subalpine shrubs from Calimani, and respectively Rodna Mountains (Eastern Carpathians).

Identification key

1. Lamella long, with distinct cuspis; prolamella long, reaching almost the origin of rostral setae. Lamellar cuspis rounded; sensillus fusiform clavated, with rounded tip; body length under 400 μm ..... *Oribatula longelamellata* Schweizer, 1956
— Lamellae without cuspides; prolamella absent or, if exists, it is short or hardly drawn 2

2. Lamellae narrow; notogastral setae relatively long, representing 10-12 % of the notogaster's length 3
— Lamellae wide, lath-shaped; notogastral setae relatively short, representing 6-8 % of the notogaster's length 4

3. Lamellae convergent, their width decreasing progressively to the end; sensillus fusiform, with pointed tip; body size over 400 μm ..... *O. pannonica* Willmann, 1949
— Apices of lamellae with short thickened lines medially oriented; sensillus short, with distal part

globulous . . . . . *O. sitnikovae* Iordansky, 1991

4. Sensillus long (70 μm, on average) fusiform elongated, often with pointed tip; area porosa *Aa* oval, obviously larger than the other ones; body size above 400 μm . . . . . *O. tibialis* (Nicolet, 1855) — Sensillus short, fusiform clavated, always with rounded tip; areae porosae adalares small, circular; body length less than 400 μm 5

5. Lamellar apex truncate, with a short linear thickening directed to the axis of prodorsum . . . . . *O. interrupta* (Willmann, 1939) — Lamellar apex concave, with prominent median corner; a curved, laterally directed prolamella is present . . . . . *O. amblyptera* Berlese, 1916

CONCLUSIONS

Among the species of *Oribatula* cited in Romanian fauna, there are some widely distributed and with large ecological plasticity such as *O. tibialis* or *O. pannonica*; certain other species have a limited distribution and are probably more exigent or even stenotopic forms (*O. longelamellata, O. sitnikovae*). The comparative analysis of morphological and biometrical characters permitted to clarify the status of some species, e.g. *Oribatula alpina* Schweizer, 1956 was identified as *O. interrupta* (Willmann, 1939). Also, some reasons to consider *Oribatula amblyptera* Berlese, 1916 and *O. sitnikovae* Iordansky, 1991 as valid species were pointed out. Further taxonomical studies using the molecular taxonomy tools would be useful to the knowledge of relationships within this species group.

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