

FIRST RECORDS AND RARE SPECIES OF COLLEMBOLA IN THE ROMANIAN FAUNA – THE PIATRA CRAIULUI MASSIF (THE CARPATHIANS)

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Abstract. The author presents new data about the collembolan species collected from the Piatra Craiului Massif. Sixty-five species were identified from the material sampled from soil and mesovoid shallow substratum (M.S.S.) Three species (*Arrhopalites ornatus* Stach, 1945, *Microgastrura duodecimoculata* Stach, 1922 and *Xenylla mucronata* Axelson, 1903) are for the first time recorded in the Romanian fauna.

Key words: Mesovoid Shallow Substratum, Collembola, Piatra Craiului Massif, Romania, first records.

1. INTRODUCTION

The studies concerning Collembola from the Piatra Craiului Massif are recent (GRUIA and POPA, 2005, NAE *et al.*, 2005, POPA and GRUIA, 2006). The cavernicolous Collembola of the Piatra Craiului Ridge were recorded (GRUIA, 2003) from six caves (Peștera Ursilor, Peștera Dobreștilor, Avenul din Grind, Peștera Liliecilor, Avenul Curmătura, Peștera Dâmbovicioara; peștera = cave, aven = pothole).

Within the framework of a research program carried out in collaboration with the Administration of the Piatra Craiului National Park between 2002–2004, an intensive study of the Collembola from the subterranean profound environment (natural and artificial cavities) was made. Thirty-one species of Collembola were identified. Among them, one new species was described (*Deuteraphorura traiani* Gruia et Popa, 2005) and other 3 species (*Onychiuroides subgranulosus* (Gama, 1964), *Plutomurus carpaticus* Rusek et Weiner, 1978 and *Lepidocyrtus serbicus* Denis, 1933) revised (GRUIA and POPA, 2005).

The Collembolan fauna from the soil (edaphic) and the mesovoid shallow substratum (also named subterranean superficial environment) (MSS) from the Piatra Craiului Massif is very poorly studied. Therefore, our first purpose was to have a better evaluation of the Collembolan fauna in these habitats, taking into consideration that the studied area is included in *the Alpine scree*s “Natura 2000” habitats.

2. MATERIAL AND METHODS

Between August 2007 and October 2008, in the Piatra Craiului Massif we participated to a more complex study concerning the arthropod fauna from the soil

(edaphic) and the mesovoid shallow substratum (subterranean superficial environment). The material was collected by our colleague Augustin Nae.

The faunal samples from mesovoid shallow substratum were collected using 5 drillings of 0.50 m and 0.75 m in depth. On the bottom of each drilling, a Barber trap with olfactory attractant was placed. The traps were verified and replaced monthly, from May 2008 to October 2008 (NAE *et coll.* 2008).

The locations of the drillings are:

● **Station 1 – Cerdacul Stanciului**

Situated below Cerdacul Stanciului and having Western exposure, the habitat is characterised by nude scree in the basal part of the slope and is 70-80% covered by vegetation in the upper part.

Two drillings were placed in this sector: S I at 0.75 m in depth and 1641 m altitude and S II at 0.5 m in depth and 1610 m altitude).

● **Station 2 – Marele Grohotiș**

Limited in the basal part by spruce forest and having Western exposure, the scree is mostly nude (only in the basal zone it is about 20% covered by vegetation).

One drilling (S I) was placed at 0.5 m depth and 561 m altitude and other (S II) at 0.75 m depth and 1571 m altitude.

● **Station 3 – Valea Seacă**

The investigated habitat is a scree with eastern exposure, situated in a beech forest, under a thick layer of litter. One drill only was placed in this sector: S I, at 0.5 m in depth and 1000 m altitude.

The soil fauna was sampled in five perimeters, 5 sampling units (Barber traps with olfactory attractant and ethyl alcohol) being placed in each perimeter. The traps were verified and emptied at an interval of five days each. The locations and sampling periods were:

- Upper forest-zone, with mixed forest of maple, old beech and spruce (1343 m altitude, August 10–15, 2007);
- Sub-alpine zone, the base of Piatra Craiului Ridge (1643 m altitude, August 10–15, 2007);
- Mixed forest of spruce and beech, Valea lui Ivan (May 17–22, 2008);
- Beech forest, Valea Seacă (May 16–21, 2008);
- Spruce forest below Marele Grohotiș, (May 17–22, 2008).

In this paper we used the systematic system and taxonomy according to Bellinger *et al.* (1996–2009).

3. RESULTS AND DISCUSSIONS

65 species of Collembola belonging to 13 families were recorded. Among them, 35 species were identified from MSS and 44 from soil, 14 species being found in both habitats (Table 1).

Table 1

The list of collembolan species

Species	Mesovoid Shallow Substratum (M.S.S.)	Soil (Edaphic)
Neanuridae Borner, 1901		+
1. <i>Deutonura conjuncta</i> (Stach, 1926)		+
2. <i>Friesea mirabilis</i> (Tullberg, 1871)		+
3. <i>Morulina verrucosa</i> (Borner, 1903)		+
4. <i>Pseudachorutella asigillata</i> (Borner, 1901)		+
5. <i>Pseudachorutes dubius</i> Krausbauer, 1898	+	+
6. <i>Thaumanura carolii</i> (Stach, 1920)		+
Brachystomellidae Stach, 1949		+
7. <i>Brachystomella parvula</i> (Schaffer, 1896)		+
Odontellidae Massoud, 1967	+	+
8. <i>Superodontella empodialis</i> (Stach, 1934)		+
Hypogastruridae Borner, 1906	+	+
9. <i>Ceratophysella armata</i> (Nicolet, 1842)		+
10. <i>Ceratophysella engadinensis</i> (Gisin, 1949)		+
11. <i>Ceratophysella sigillata</i> (Uzel, 1891)	+	
12. <i>Ceratophysella silvatica</i> Rusek, 1964		+
13. <i>Choreutinula inermis</i> (Tullberg, 1871)		+
14. <i>Hypogastrura cf. monticola</i> Stach, 1946	+	
15. <i>Hypogastrura sahlbergi</i> (Reuter, 1895)	+	
16. <i>Hypogastrura tullbergi</i> (Schaffer, 1900)	+	
17. <i>Microgastrura duodecimoculata</i> Stach, 1922*		+
18. <i>Schoettela ununguiculata</i> (Tullberg, 1869)		+
19. <i>Triacanthella perfecta</i> Denis, 1926	+	
20. <i>Xenylla brevicauda</i> Tullberg, 1869		+
21. <i>Xenylla mucronata</i> Axelson, 1903*		+
Onychiuridae Lubbock, 1867	+	
22. <i>Deharvengiurus denisi</i> (Stach, 1934)		
23. <i>Deuteraphorura silvaria</i> (Gisin, 1952)	+	
24. <i>Heteraphorura variotuberculata</i> (Stach, 1934)		+
25. <i>Kalaphorura tuberculata</i> (Moniez, 1890)	+	
26. <i>Onychiuroides pseudogranulosus</i> (Gisin, 1951)		+
27. <i>Protaphorura ionescui</i> Radwanski, Fiera et Weiner, 2006		+
28. <i>Protaphorura quadriocellata</i> (Gisin, 1947)	+	+
29. <i>Tetrodontophora bielanensis</i> (Waga, 1842)	+	+

Species	Mesovoid Shallow Substratum (M.S.S.)	Soil (Edaphic)
Tomoceridae Schaffer, 1896	+	
30. <i>Plutomurus carpathicus</i> Rusek et Weiner, 1979		
31. <i>Pogonognathellus flavescens</i> (Tullberg, 1871)	+	+
32. <i>Tomocerus minor</i> (Lubbock, 1862)	+	+
33. <i>Tomocerus vulgaris</i> (Tullberg, 1871)	+	
Isotomidae Schaffer, 1896	+	+
34. <i>Desoria olivacea</i> (Tullberg, 1871)		
35. <i>Desoria violacea</i> (Tullberg, 1876)		+
36. <i>Folsomia alpina</i> Kseneman, 1936		+
37. <i>Folsomia quadrioculata</i> (Tullberg, 1871)		+
38. <i>Isotomiella minor</i> (Schaffer, 1896)	+	
39. <i>Pseudisotoma sensibilis</i> (Tullberg, 1876)		+
40. <i>Vertagopus cinereus</i> (Nicolet, 1842)		+
Entomobryidae Schaffer, 1896		+
41. <i>Entomobrya lanuginosa</i> (Nicolet, 1842)		
42. <i>Entomobrya multifasciata</i> (Tullberg, 1871)	+	
43. <i>Heteromurus major</i> (Moniez, 1889)	+	
44. <i>Heteromurus nitidus</i> (Templeton, 1835)		+
45. <i>Lepidocyrtus cyaneus</i> Tullbrg, 1871	+	+
46. <i>Lepidocyrtus lignorum</i> (Fabricius, 1775)	+	+
47. <i>Lepidocyrtus paradoxus</i> Uzel, 1891	+	
48. <i>Lepidocyrtus serbicus</i> Denis, 1933	+	
49. <i>Lepidocyrtus violaceus</i> (Fourcroy, 1785)		+
50. <i>Orchesella alticola</i> (Uzel, 1891)	+	
51. <i>Orchesella pontica</i> Ionescu, 1915	+	+
Neelidae Folsom, 1896	+	
52. <i>Neelus murinus</i> Folsom, 1896		
Katiannidae Börner, 1913		+
53. <i>Sminthurinus aureus</i> (Lubbock, 1862)		
54. <i>Sminthurinus elegans</i> (Fitch, 1863)		+
55. <i>Sminthurinus niger</i> (Lubbock, 1867)		+
Arrhopalitidae Richards, 1968	+	
56. <i>Arrhopalites bifidus</i> (Stach, 1945)		
57. <i>Arrhopalites ornatus</i> Stach, 1945*	+	
58. <i>Arrhopalites sericus</i> Gisin, 1947	+	
59. <i>Arrhopalites terricola</i> Gisin, 1958	+	
Sminthuridae Lubbock, 1862	+	+
60. <i>Allacma fusca</i> (Linnaeus, 1758)		
61. <i>Caprainea marginata</i> (Schott, 1893)	+	+
62. <i>Sminthurus viridis</i> (Linnaeus, 1758)		+
63. <i>Spatulosminthurus guthriei</i> (Stach, 1919)		+
Dicyrtomidae Börner, 1906	+	+
64. <i>Dicyrtoma fusca</i> (Lubbock, 1873)		
65. <i>Dicyrtomina minuta</i> (Fabricius, 1783)		+

*first records for the Romanian fauna

One specimen found in the Piatra Craiului Massif was identified as of *Hypogastrura cf. monticola* Stach, 1946, but we appreciate that more material is needed for a precise taxonomic and faunal analysis. According to STACH (1949), this is a cryophilic species living at high altitudes, mostly on the snow or in immediate nearness of the snow-fields. *Hypogastrura monticola* Stach, 1946 was recorded until now by F. BULIMAR (1986, 1994) only from Călimani Mountains.

Arrhopalites ornatus Stach, 1945 (2 specimens, 29.07.2008, MSS Valea Seacă, drill S I – 0.5 m; 5 specimens, 27.08.2008, MSS Valea Seacă, drill S I – 0.5 m, Piatra Craiului Massif, leg. A. Nae) was recorded up to now only from Southern Europe (Spain, France and Italy) to Hungary and former Yugoslavia. Also reported from Germany (BRETFFELD, 1999).

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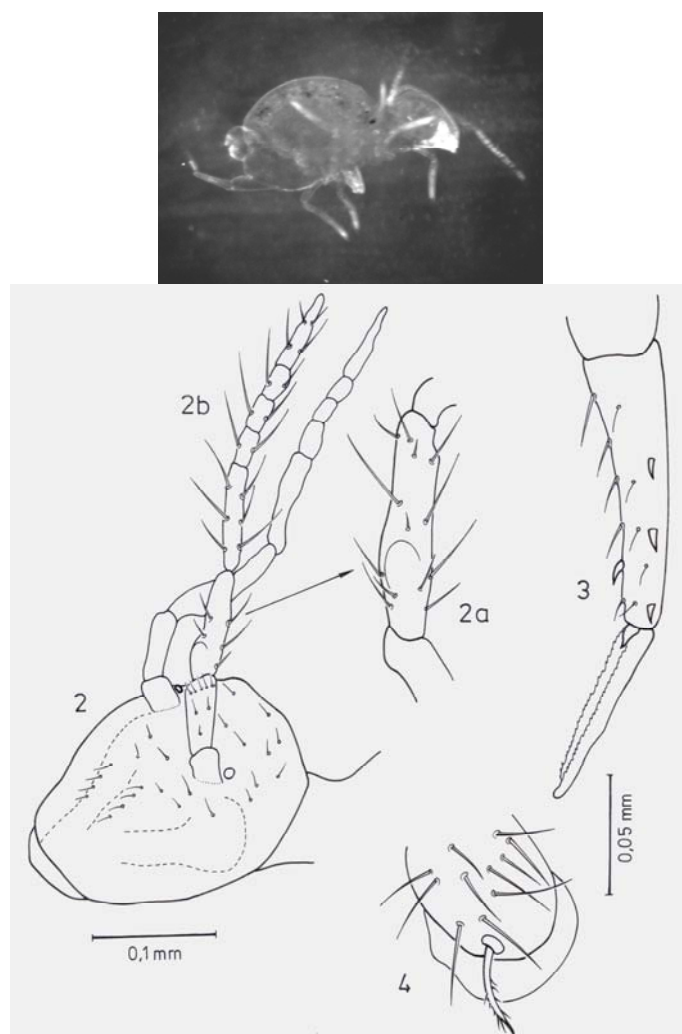


Fig. 1 – 4. – *Arrhopalites ornatus* Stach, 1945: 1 – Habitus (Photo by E. Nițu); 2 – head and antennae; 2a – antennal segment III; 2b – antennal segment IV; 3 – dens and mucro; 4 – abdominal segment VI with subanal appendage (orig.).

This species by 0.8 – 0.9 mm in length (without antennae), with white color (Fig. 1) is characterized by 1 + 1 unpigmented ommatidia; antennae about 1.8 times longer than the diameter of the head (Fig. 2); antennal segment III with prominent basal papilla (Fig. 2,a); antennal segment IV with 5 subsegments (Fig. 2,b); claws slender, with very small inner tooth (some individuals without inner tooth); empodial appendage without tooth, longer than the claw; furca well developed; dens lateral with 2 spines; on the inner side with 3 spines (Fig. 3); mucro serrated on both edges (Fig. 3); dens: mucro = 1.4; subanal appendages bandlike, slightly curved, apical with long branches like a brush (Fig. 4).

Arrhopalites ornatus is a troglophile species; it also lives in open habitats in damp soil, humus, and moss (BRETFFELD, 1999).

Microgastrura duodecimoculata Stach, 1922 (3 specimens, 21.05.2008, Valea Seacă, Barber trap, beech forest litter, Piatra Craiului Massif, leg. A. Nae) was recorded up to now only from Albania, Austria, Germany, Hungary, Portuguese mainland, Spain, Switzerland, The Netherlands, Ukraine and Near East (FAUNA EUROPAEA WEB SERVICE).

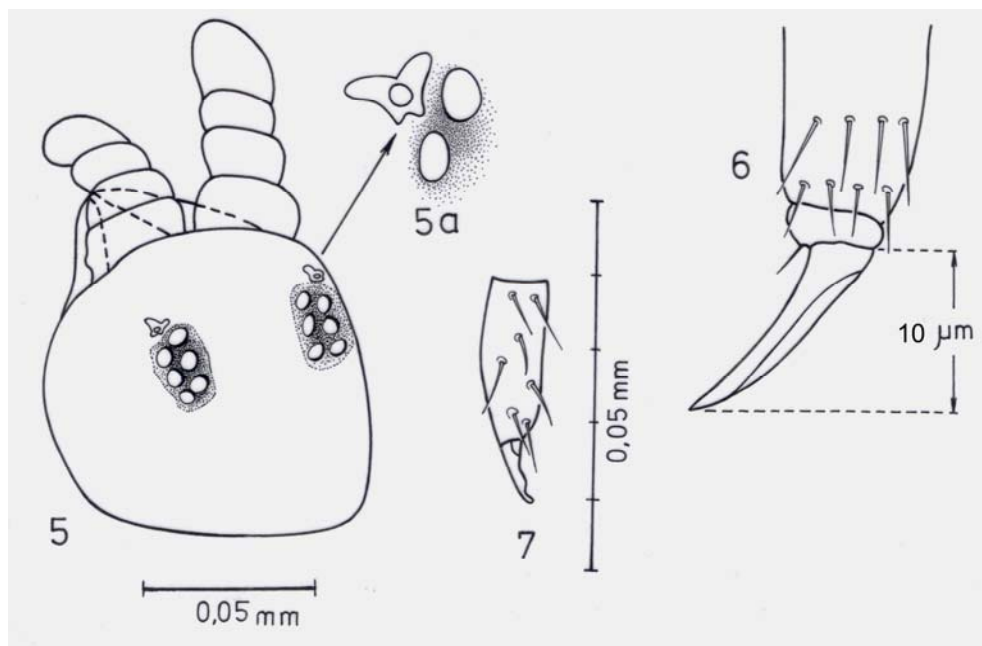


Fig. 5 – 7. – *Microgastrura duodecimoculata* Stach, 1922: 5 – head and eye patches; 5a – postantennal organ and two ommatidia; 6 – claw and tibiotarsus I; 7 – dens and mucro (orig.).

This species by 0.5 mm in length (without antennae), with bluish – brown color, mouth and furca lighter colored, is characterized by 6 + 6 ommatidia, equally large, on a dark, strong pigmented eye patch (Fig. 5); body clothed with very short

setae; postantennal organ present, a little larger than one ommatidia, consists of 4 peripheral tubercles, 2 larger and 2 smaller (Fig. 5,a); mandible present, but rudimental, without molar plate; claw slender, without inner tooth; empodial appendage reduced into a very fine short seta, without inner lamella; clavate tibiotarsal hair absent (Fig. 6); ventral tube with 4 + 4 setae; tenaculum on each ramus with 4 + 4 curved barbs and no seta on corpus; furca well developed; dens with 7 setae; mucro with broad outer lamella, about 2.5 times smaller than dens (Fig. 7); no anal spines.

This is the first report of this genus in the Romanian fauna. The reduced and seta-like empodial appendage, 6 + 6 ommatidia, the typical form of the postantennal organ and mucro are the generic characters which confirm the presence of *Microgastrura duodecimoculata* Stach, 1922 in the Romanian fauna.

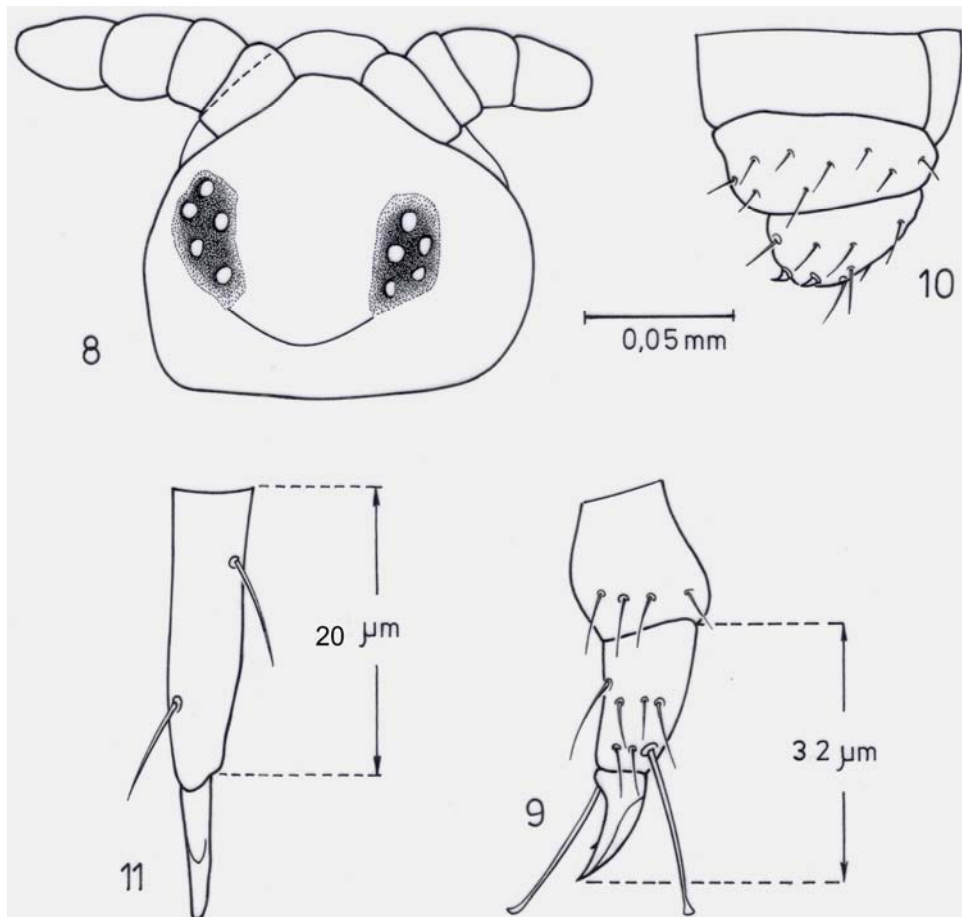


Fig. 8 – 11. – *Xenylla mucronata* Axelson, 1903: 8 – head and eye patches; 9 – claw and tibiotarsus I; 10 – abdominal segments V, VI and anal spines; 11 – dens and mucro.

Xenylla mucronata Axelson, 1903 (2 specimens, 15.08.2007, Barber trap, mixed forest litter of maple, old beech and spruce (Alt. = 1343 m), Piatra Craiului Massif, leg. A. Nae) was recorded up to now only from Austria, Finland, Germany, Russia, Sweden, Ukraine and Australia (FAUNA EUROPAEA WEB SERVICE).

This species by 0.6–0.7 mm in length (without antennae), bluish colored with unpigmented spots, is characterized by 5 + 5 ommatidia (Fig. 8); body clothed with moderately short and uniform setae; mandible with molar plate; postantennal organ and empodial appendage absent; antennal segment IV with 4 cylindrical sensilla; tibiotarsus I, II, III with 2 clavate tenent setae each; claw with small inner tooth, no empodial appendage (Fig. 9); anal spines short, conical, slightly curved (Fig. 10); furca very short; mucro distinctly separated from the dens, two times shorter than claw III, with a small outer lamella; dens with 2 dorsal setae, about 2–2.5 times longer than mucro (Fig. 11); tenaculum with 3 + 3 barbs, no seta on corpus.

Xenylla mucronata is considered as a typical species for coniferous forest litter (STACH, 1949); in the Piatra Craiului Massif it was collected with a Barber trap in mixed forest of spruce and beech.

Deharvengiurus denisi (Stach, 1934) (Fig. 12) (80 specimens, 20.05.2008, MSS Marele Grohotiș, drill S I (– 0.5 m); 7 specimens, 20.05.2008, MSS Marele Grohotiș, drill S II (– 0.75 m); 2 specimens, MSS Marele Grohotiș, drill S II (– 0.75 m); 2 specimens, 20.05.2008, MSS Cerdacul Stanciului, drill S II (– 0.5 m); 2 specimens, 30.07.2008, MSS Cerdacul Stanciului, drill S II (– 0.5 m); 94 specimens, 20.05.2008, MSS Cerdacul Stanciului, drill S I (– 0.75 m); 11 specimens, 30.07.2008, MSS Cerdacul Stanciului, drill S I (– 0.75 m), Piatra Craiului Massif, leg. A. Nae) is reported for the second time in the Romanian fauna; until now the species was recorded only from Călimani Mountains (F. BULIMAR, 1987).



Fig. 12. – *Deharvengiurus denisi* (Stach, 1934). Photo by E. Nițu.

This bisexual species, living in cold and wet places in mountains, especially in deep parts of litter, under moss, often in caves and old adits (Pomorski, 1998) was recorded up to now only from Czech Republic, Germany, Hungary, Poland, Slovakia, The Netherlands and Ukraine.

Protaphorura ionescui Radwanski, Fiera et Weiner, 2006 (2 specimens, 22.05.2008, Barber trap, spruce forest litter below Marele Grohotiș, Piatra Craiului Massif, leg. A. Nae) was recently described in Romania from Rodnei Mountains (RADWANSKI, FIERA et WEINER, 2006); it was also recorded from Romanian Plain, Călugăreni locality (SANDA *et al.* 2006b) and Rodnei Mountains (NITZU *et al.*, 2008).

Spatulosminthurus guthriei (Stach, 1919) (3 specimens, 15.08.2007, Barber trap, Subalpine zone, the base of Piatra Craiului ridge, leg. A. Nae) was recorded up to now only from Azerbaijan, Russia, Slovakia, former Yugoslavia and Ukraine.

In Romania *Spatulosminthurus guthriei* was recorded only from Râșnicova (GRUIA, 1966) and Călimani Mountains (BULIMAR, 1991). This species lives in the vegetation of meadows in low lands and mountains (ssp.*dimorphus* up to 1700 m) (BRETfeld, 1999), in forest steppe (NOSEK, 1962), and in rocky habitats (GRUIA, 1966).

4. CONCLUSIONS

As a result of the study on the soil and the mesovoid shallow substratum fauna from Piatra Craiului Massif, 65 species of Collembola were identified. Among these, 3 species (*Arrhopalites ornatus*, *Microgastrura duodecimoculata* and *Xenylla mucronata*) are for the first time recorded in the Romanian fauna. Another 2 species (*Deharvengiurus denisi* and *Spatulosminthurus guthriei*) are considered rare, *Protaphorura ionescui* recently described from Romania (RADWANSKI, FIERA ET WEINER, 2006) is for the first time recorded in the Piatra Craiului Massif. In the mesovoid shallow substratum (MSS) (also named subterranean superficial environment), unstudied up to now in the area, we identified 35 species of Collembola. From soil (edaphic) we identified 44 species, 14 species being found in both habitats.

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