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A review of harvestmen (Arachnida: Opiliones) in Slovenia*

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**Dedicated to Prof. Jochen Martens for his contribution in revising opilionid species in Slovenia*

Abstract

The authors present a short historical faunistic, zoogeographical and ecological review of research on harvestmen (Opiliones) of the territory of presentday Slovenia, and discuss some actual ecological and nature conservational questions. Till recent, 64 species plus two subspecies of Opiliones inhabiting Slovenia are recorded, most of these are Alpine, European, Central- and Western European elements. Taxonomically, there are some open questions, especially in the genus *Trogulus*. A small number of further species can be expected in Slovenia, raising the potential final number to 69-71. Some harvestmen are locally and regionally endangered, especially by anthropogenous habitat and ecosystem changes.

Keywords: Arachnids, harvestmen, nature conservation, zoogeography

Introduction

In his famous work "Entomologia carniolica", Johannes Antonius Scopoli (1763) published the first evidence on Opiliones species within the territory of today's Slovenia. He cited *Phalangium opilio* and described a new species, *Trogulus nepaeformis* (sub *Acarus nepeformis*). In 1851, Ferdinand Schmidt described *Phalangium cancroides*, which was later renamed *Ischyropsalis hadzii* by Roewer (1950), because of its preoccupied name. Gustav Joseph's (1868) *Cyphophthalmus duricorius* was the next species described within the territory. In the 1920s, Jovan Hadži started with almost 50 years of research on Opiliones. He published several new Opiliones taxa (e.g. Hadži 1926/27, 1928, 1931, 1973a), solved a lot of taxonomical problems, especially in Ischyropsalididae (Hadži 1942, 1954), and prepared the first review of harvestmen species of the former Yugoslavia. In his catalogue, he cited (Hadži 1973b) 71 species and 8 subspecies for Slovenia. Later on, it was found that 36 of these species are valid, while 35 species and 8 subspecies have been found to be synonyms, or they do not occur in

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Slovenia (Martens 1969, 1978; Novak *et al.* 1995; Novak & Gruber 2000). Among others, Travuniidae have been excluded from the harvestmen list of Slovenia as the four species of Roewer (1935) *Peltonychia tenuis*, *P. gabria*, *Hadziana postumicola* and *Kratochviliola cavernicola* have been found to be synonyms and a case of Roewer citing localities erroneously (Martens 1978; Thaler 1996; Novak & Gruber 2000). Some further faunistic contributions have been published concerning the harvestmen of the country (Schiner 1854; Hamann 1898; Roewer 1917, 1935, 1950; Gruber & Martens 1968; Novak & Sivec 1977, Chemini 1984; Gruber 1984; Novak *et al*. 1995a, b; Komposch 2000; Novak & Slana 2003; Novak 2005). Notes and short ecological comunications, respectively, were published by Megušar (1914), Juberthie (1964), Novak & Kuštor (1982), Novak *et al.* (1984), and some others. Since 1981, the harvestman fauna of Slovenia has been systematically investigated by the authors. Ecological and supporting biochemical, histo- and cytological investigations of selected Opiliones, and on selected topics (hypogean habitats, dormancy, natural history) are recently under way (Lipovšek *et al.* 2003, 2004; Novak *et al*. 2000, 2004).

Species review and zoogeography

The revised list (Table 1) presented here is based on examined material, mostly deposited in the Slovenian Natural History Museum in Ljubljana. The taxonomical system is used according to Blick & Komposch (2004), the sironid names according to Boyer *et al.* (2005). Slovenia is a country in which the Alpine, Dinaric, Pannonian and Mediterranean biomes meet. Zoogeographically, it is subdivided into more regions (Fig. 1). The zoogeographical elements (mostly according to Martens 1978 and Komposch & Gruber 2004) are summarised in Table 2. Except for *Opilio canestrinii* which was probably introduced in Slovenia after the 1970s, and the uncertain status of *O. parietinus* and *O. saxatilis* in this sense (cf. Martens 1978), all the other species are believed to be autochthonous.

Locally, *Lacinius dentiger*, *Nelima sempronii* and some other species are dispersed by wood, brick and soil transport (Novak *et al*. 2000), and *Mitopus morio* and *Phalangium opilio* possibly also by sheep transhumance.

Taxonomical problems

Two new taxa, *Siro* sp. and *Nemastoma bidentatum* ssp., are in the course of description. Taxonomically, there are some undecided questions concerning harvestmen in Slovenia. The majority of these concern the genus *Trogulus* Latreille 1802, which has been found as the most difficult of the European harvestmen (Martens 1988). In the group of *T. tricarinatus* (Linnaeus 1767), more species have been recognized (Schönhofer 2004; Martens in lit.). Beside *T. nepaeformis* s.s., *T. closanicus* and *T. cisalpinus*, one or two further species could possibly be present within the group of *T. nepaeformis*. While *T.*

coriziformis C. L. Koch 1839 has not been confirmed in Slovenia (Novak 2005), a species of the group of *T. graecus* Dahl 1903 (own unpubl. data, Schönhofer in lit.) is present. Furthermore, the northern and the southern populations of *T. tingiformis* with respect to the Alps (cf. Martens 1978) should be revised for their taxonomical status, since there seem to be no morphological intermediate forms.

TABLE 1. The harvestmen (Opiliones) in Slovenia, their distribution (**A** Alpine, **Ad** Adriatic, **Ap** Apenninian, **At** Atlantic, **Au** Australian, **Eu** European, **C** Carpathian, **D** Dinaric, **H** Holarctic, **I** Iberian, **M** Mediterranean, **N** Nearctic, **P** Palearctic, **SAm** South America, **Sib** Siberia, **sub-M** Submediterranean, **sub-P** Subpannonian, c central), (l) locally). *probably an another species (Schönhofer in lit.) **examined by M. Řezáč, confirmed by L. Klimeš

Taxa	Distribution
CYPHOPHTHALMI	
Sironidae	
1. Cyphophthalmus duricorius duricorius Joseph 1868	SE-**A**, **D**
2. Siro sp.	sub-P? endemite(?)
LANIATORES	
Cladonychiidae	
3. Holoscotolemon unicolor Roewer 1915	E-**A**, W-**D**
Phalangodidae	
4. Scotolemon doriae Pavesi 1878	N-, c-**M**
PALPATORES	
Nemastomatidae	
5. Carinostoma carinatum (Roewer 1914)	SE-**A**, **D**
6. Histricostoma dentipalpe (Ausserer 1867)	**A**, **D**
7. Mitostoma chrysomelas (Hermann 1804)	Eu
8. Mitostoma alpinum (Hadži 1931)	E-, SE-**A**
9. Nemastoma triste (C. L. Koch 1835)	E-**A**, c-**E**
10. Nemastoma bidentatum bidentatum Roewer 1914	SE-**A**
11. Nemastoma bidentatum sparsum Gruber & Martens 1968	SE-**Eu**
12. Nemastoma bidentatum ssp.	NW-**D**(l) endemite
13. Nemastoma dentigerum Canestrini 1873	**Ap**+S-**A+**(S)c-**Eu**
14. Paranemastoma bicuspidatum (C. L. Koch 1835)	E-**A**
15. Paranemastoma quadripunctatum (Perty 1833)	c-**Eu**
Dicranolasmatidae	
16. Dicranolasma scabrum (Herbst 1799)	SE-**Eu**

....to be continued.

TABLE 1 (continued).

Taxa	Distribution
Trogulidae	
17. Anelasmocephalus hadzii Martens 1978	cS-, E-**A**, **D**
18. Trogulus cisalpinus Chemini & Martens 1988	c-, E-**A**
19. Trogulus closanicus Avram 1971*	Eu
20. Trogulus falcipenis Komposch 2000	SE-**A**, **D**
21. Trogulus sp. (*graecus* group)	D?
22. Trogulus nepaeformis (Scopoli 1763)	N-**Ad**
23. Trogulus spp. (*nepaeformis* group)	?
24. Trogulus tingiformis C. L. Koch 1847	E-**A**, **D**, **C**
25. Trogulus spp. (*tricarinatus* group)	?
Ischyropsalididae	
26. Ischyropsalis hadzii Roewer 1950	SE-**A**(l)
27. Ischyropsalis hellwigii hellwigii (Panzer 1794)	c-**Eu**
28. Ischyropsalis kollari C. L. Koch 1839	E-**A**(l)
29. Ischyropsalis muellneri Hamann 1898	SE-**A**(l)
Phalangiidae	
30. Amilenus aurantiacus (Simon 1881)	**A**, **D**
31. Dasylobus graniferus (Canestrini 1871)	**Ap**, **A**, **I**
32. Dicranopalpus gasteinensis Doleschall 1852	**A**, **C**
33. Egaenus convexus (C. L. Koch 1835)	SE-**Eu**
34. Gyas annulatus (Olivier 1791)	A
35. Gyas titanus Simon 1879	**I**, **A**, S-, c-**Eu**, **D**, **C**
36. Lacinius dentiger (C. L. Koch 1847)	SE-**E**, **sub-M**
37. Lacinius ephippiatus (C. L. Koch 1835)	Eu
38. Lacinius horridus (Panzer 1794)	SE-**Eu**, **M**
39. Lophopilio palpinalis (Herbst 1799)	c-**Eu**
40. Megabunus armatus (Kulczynski 1887)	SE-**A**
41. Metaphalangium cirtanum (C. L. Koch 1839)	M
42. Metaplatybunus carneluttii Hadži 1973	D
43. Mitopus glacialis (Heer 1845)	A
44. Mitopus morio (Fabricius 1799)	H
45. Odiellus spinosus (Bosc 1792)	**At**, N-**M**
46. Oligolophus tridens (C. L. Koch 1836)	**Eu**, W-**Sib**
47. Opilio canestrinii (Thorell 1876)	c-**M**, c**Eu**

....to be continued.

TABLE 1 (continued).

Taxa	Distribution
48. Opilio dinaricus Šilhavý 1938	SE-**Eu**
49. Opilio parietinus (De Geer, 1778)	W-**P**, **N**, **Au**
50. Opilio ruzickai Šilhavý 1938	SE-**Eu**
51. Opilio saxatilis C. L. Koch, 1839	Eu
52. Opilio transversalis Roewer 1956	E-**Eu**
53. Phalangium opilio Linnaeus, 1758	P
54. Platybunus bucephalus (C. L. Koch 1835)	**A**, c-, SE-**Eu**
55. Rilaena triangularis (Herbst 1799)	Eu
Sclerosomatidae	
56. Astrobunus helleri (Ausserer 1867)	SE-**A**, NW-**D**
57. Astrobunus laevipes (Canestrini 1872)	SE-, cS-**Eu**
58. Leiobunum limbatum L. Koch 1861	**A**, c-**Eu**
59. Leiobunum roseum C. L. Koch 1839	SE-**A**
60. Leiobunum rotundum (Latreille 1798)	c-**Eu**
61. Leiobunum rupestre (Herbst 1799)	E-**A**, c-, S-**Eu**
62. Leiobunum subalpinum Komposch 1998	E-**A**
63. Leiobunum tisciae Avram 1968**	SE-**Eu**?
64. Nelima doriae (Canestrini 1871)	N-**M**, **Au**, **SAm**
65. Nelima narcisi Novak & Slana 2003	N-**Ad**
66. Nelima sempronii Szalay 1951	**Ap**, E-**A**, E-**Eu**

TABLE 2. Zoogeographical elements of harvestman species in Slovenia. The percentage ratios were calculated upon the relative frequences of species within different regions.

Element	%
Alpine	32
European, Middle- and W-European	23
Dinaric	14
E- and SE-European and Carpathian	13
Mediterranean and Adriatic	9
widespread (palaearctic, holarctic)	5
Apennine	4
Total	100

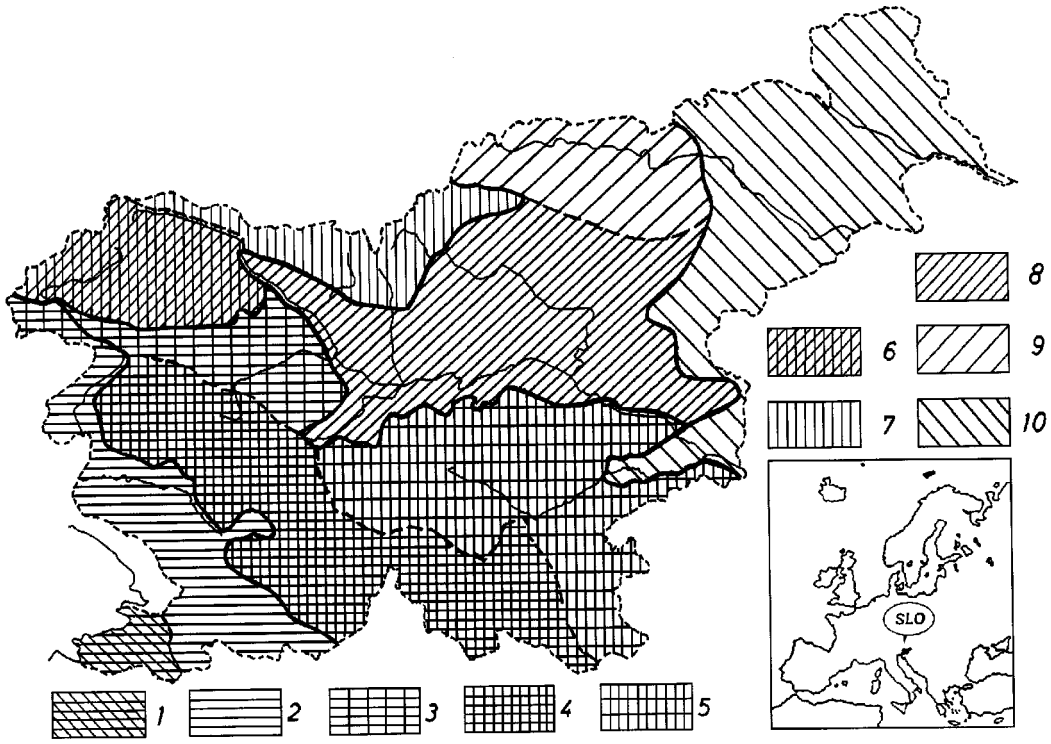

FIGURE 1. Detailed zoogeographical division of Slovenia, resulting on some groups of edaphic animals, according to Mršić (1997). Regions (Subregions): Submediterranean (1 Submediterranean s.s., 2 Submediterranean–Dinaric); Dinaric (3 Alpine–Dinaric, 4 Northern Dinaric, 5 Dinaro–Prepannonian); Alpine (6 Western Alpine, 7 Eastern Alpine); Prealpine (8 Prealpine s.s., 9 Prealpine–Prepannonian); 10 Subpannonian.

Further on, a single male has been found in Mt. Olševa in northern Slovenia, being either an aberrant *Mitostoma chrysomelas* or a representative of a new species. Perhaps, some further species could be expected in the country. In total, 64 species plus two subspecies have been recognised in Slovenia, while the real number is believed to be 69–71. In terms of harvestmen fauna, Slovenia is among the richest countries in Europe.

Nature conservation

In Slovenia, the only endemites within its political borders have been *Siro* sp. from norteastern Slovenia (Fig. 1: 10), and *Nemastoma bidentatum* ssp. living on Mt. Snežnik (Fig. 1: 4). Some further species are endemic to small territories. *Ischyropsalis muellneri* inhabits the Julian Alps/Alpi Giulie (Fig. 1: 3 and 6), *I. hadzii* the Kamnik/Steiner Alps and the Karavanke/Karawanken Mts. (Fig. 1: 7), and *Nelima narcisi* the northwestern Adriatic coast (Fig. 1: 1).

As for the species threatness, inadequate forestry and agricultural management is the

most conspicuous factor influencing the local decrease in harvestman diversity. In the late middle Ages, in many regions, beech forests were extensively exploited by the glass- and steel-trade, and afterwards reforested with pine trees. In the autochthonous deciduous and mixed forest coenoses, 7–12 harvestman species occur, while in the secondary monocultural pine, and *Robinia*-forests this number decreases to 2–5 species. Moreover, in some deciduous forests, the persistent use of forest litter for bedding cattle in the past caused the permanent disappearance of some common soil Opiliones, like *Cyphophthalmus duricorius*, *Nemastoma bidentatum bidentatum*, *N. bidentatum sparsum*, *N. dentigerum*, *Histricostoma dentipalpe* and *Carinostoma carinatum* (all unpubl. pers. obs.). Further degradation of forest soil was caused by the policy of "forest cleaning" by the removal of "waste" biomass in the recent past. For these reasons, *Nemastoma* spp. occurring in forest and shrubs are missing in such places and turned out to be indicator organisms of space providing, deep soil habitats.

In agriculture, ploughing, fertilisation and spraying of arable land directly influence the decrease in biotic, including harvestman diversity. During land cultivation, the accompanying intensive landscape tilling, soil mineralisation, desiccation by uniform drainage and the extensive use of nonspecific pesticides are the most important factors in decreasing habitat and biotic diversity (Hlad & Skoberne 2001; pers. obs.). Extensive changes in shrubs, wetlands, riverine and other habitat types adjacent to the agricultural land also threaten the opilionid fauna. As for tourism, the only one, small isolated population of *Metaplatybunus carneluttii* in Slovenia, living on the peak of Mt. Snežnik is believed to be directly endangered by massive mountaineering. Along the Adriatic coast, *Scotolemon doriae* is endangered by degradation of its preferred deep humus humid habitats. On the other hand, old heaps of discarded orchard tree branches with a more than 10 cm deep layer of humus is a case of an anthropogenous habitat, serving as a refuge for this species, and replacing the appropriate natural habitats. Branch heaps also serve as refuges in commercially managed woodland in inland Slovenia (Novak 2005). On the Pohorje Mts. ridge, a very low density of *Nemastoma triste* was recorded in the 1980s at altitudes of 1100–1500 m (pers. obs.), coinciding with SO_2 pollution, caused mostly by the Šoštanj thermal power plant (cf. Čemas & Rakovec 2003), and severe O_3 concentration in higher altitudes (Env. Agency 2005).

Synanthropic harvestmen

On the contrary to the generally threatened fauna in managed habitats, this is not the case in the urban centres of Slovenia. This is a weakly urbanised country with two small cities, Ljubljana and Maribor, having 270.000, and 100.000 citizens, respectively, four towns with 10.000–40.000 inhabitants each, and about 60 towns and villages with 1.000–10.000 inhabitants. The rest of its two million people live dispersely. So far, two thirds of the harvestmen species living in Slovenia have been found in these urban centers (Novak *et al.* 2000). *Ph. opilio*, *N. sempronii*, *Opilio saxatilis*, *O. parietinus*, *Leiobunum*

rotundum, *T. nepaeformis* and *N. b. sparsum* inhabit 20–50% of them. This can be explained by the smallness of the settlements, their close connections with neighbouring non-urban habitats, the preservation of some primary, and the appearance of appropriate secondary habitats within them (Novak *et al.* 2000).

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