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New records of *Prozercon* SELLNICK, 1943 species from Croatia,
with description of a new species
(Acari: Mesostigmata: Zerconidae)

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ABSTRACT. Present paper contains new records of five *Prozercon* species from Croatia. One of them, *P. pilimarginatus* sp. nov. is proved to be new to science. *P. achaeanus* and *P. carpathofimbriatus* are recorded from the country for the first time. Unknown male, deutonymph and protonymph of *P. carpathofimbriatus*, male and deutonymph of *P. martae* are described and illustrated. Distinguishing characters of *P. carpathofimbriatus* and *P. fimbriatus* are discussed.

Key words: acarology, taxonomy, faunistics, new species, Zerconidae, Croatia.

INTRODUCTION

Zerconidae is one of the most abundant mesostigmatid mite groups, inhabiting woodlands and grasslands of the Northern Hemisphere, occurring in moss, lichens, litter and soil, from the subtropical forests to the boreal tundra. Currently about 390 valid species of 36 genera are known worldwide, of which *Prozercon* SELLNICK, 1943 is the second largest, with 57 species (UJVÁRI 2011). The genus is distributed in the whole Europe, West Asia and North Africa, with its largest species richness in the Eastern Mediterranean area. More than half of the species have been described in the past 20 years (e.g. BALAN & SERGIENKO 1991, URHAN & AYYILDIZ 1996a, b, c, URHAN 1998, 2002, CĂLUGĂR 2004, MORAZA 2006, UJVÁRI 2011), most of them from Turkey, Greece and Spain.

So far very little attention has been paid to the mesostigmatid mite fauna of the Balkan peninsula. However, the Hungarian Natural History Museum acquired a very

rich soil material due to the several zoological expeditions targeting many of the Balkan countries (e.g. FEHÉR et al. 2004), of which 16 new zerconid mite species and a large amount of new records have already been published (KONTSCHÁN 2006, UJVÁRI 2008, 2010a, b, c, 2011). Regarding Croatia, 23 Zerconidae species have previously been recorded from the country (UJVÁRI 2008, 2010b, c, KACZMAREK et al. 2009), of which 5 belong to the genus *Prozercon*. New records of further 3 species are presented below, one of them proved to be new to science.

MATERIAL AND METHODS

Mites were extracted using Berlese-funnels, then cleared with lactic acid and mounted in glycerine. Preparations were examined using a light microscope, drawings were made with the aid of a drawing tube. Specimens are deposited in the Collection of Soil Zoology of the Hungarian Natural History Museum, Budapest. The terminology of setae follows LINDQUIST & EVANS (1965), with modifications for the caudal region as given by LINDQUIST & MORAZA (1998). The system of notation for dermal glands and lyrifissures is based on JOHNSTON & MORAZA (1991). All measurements, including scale bars of the figures, are given in micrometres.

RESULTS

***Prozercon achaeanus* UJVÁRI, 2011**

MATERIAL EXAMINED

E-1661: Croatia, Kneževiči, Velika Paklenica, litter from beech forest, 15.05.2005, leg. Murányi, D. (1 female).

REMARKS

The species is recorded from Croatia for the first time.

***Prozercon carpathofimbriatus* MAŠÁN & FENĎA, 2004**

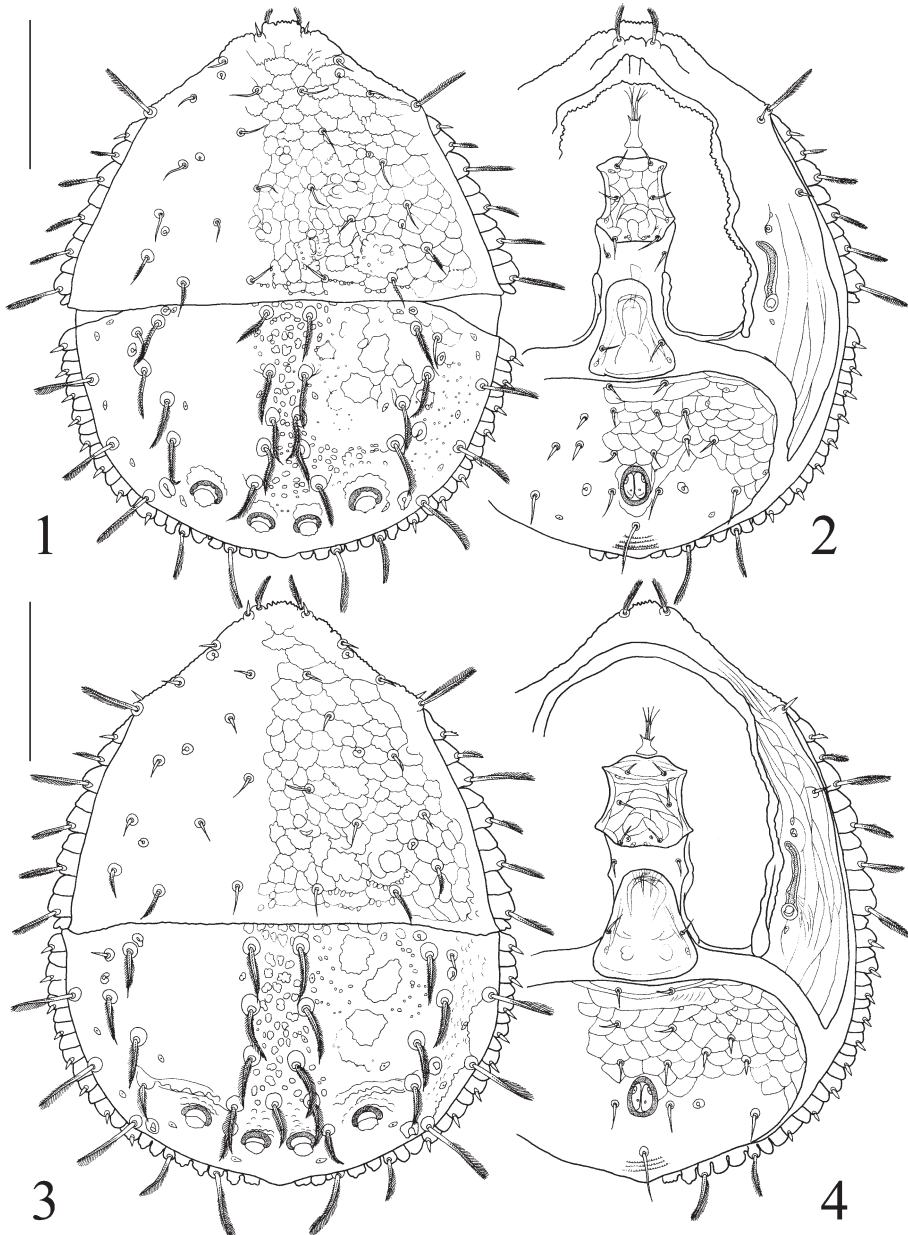
(Figs 1, 2, 5, 7 and 8)

MATERIAL EXAMINED

E-1790: Croatia, Plitvice Lakes National Park, ex. moss, 21–26.07.2005, leg. Kontschán, J. (1 female); E-2033: Croatia, Paklenica, beach forest at Velika Paklenica, from dry-rotten tree, 05.07.2006, leg. Dányi, L. (10 females, 3 males, 1 deutonymph, 2 protonymphs).

DESCRIPTION

Male. Length of idiosoma: 278–293 μm ; width: 235–242 μm (n=3). Dorsal aspect of male, regarding chaetotaxy, adenotaxy and ornamentation, similar to that of female (see: MAŠÁN & FENĎA 2004).



1–4. *Prozercon* species: 1 – *P. carpathofimbriatus* female, dorsal view, 2 – *P. carpathofimbriatus* female, ventral view, 3 – *P. fimbriatus* female, dorsal view, 4 – *P. fimbriatus* female, ventral view (scales: 100 μ m)

Ventral side (Fig. 7). Peritrematal shields posterolaterally elongate, their tips fused to the ventrianal shield at level of setae R6. Peritrematal setae R1 and R3 short, thorn-like, the shape of peritremes typical for the genus (straight). Sternigenital shield weakly sclerotized, setae st5 absent. Each ventrianal setae short, smooth, Zv2–4 stouter, similar in appearance to opisthomarginal setae. Anal valves with vestigial euanal setae. Ornamentation of the shields typical for *Prozercon*-species: sternigenital shield with reticulate pattern, peritrematal shields with longitudinal fissures, anterior surface of ventrianal shield covered by squamous ornamentation to the arcuate line of Jv4–Jv3–Jv3–Jv4.

Deutonymph (Fig. 5). Length of idiosoma: 274 μm ; width: 220 μm (n=1).

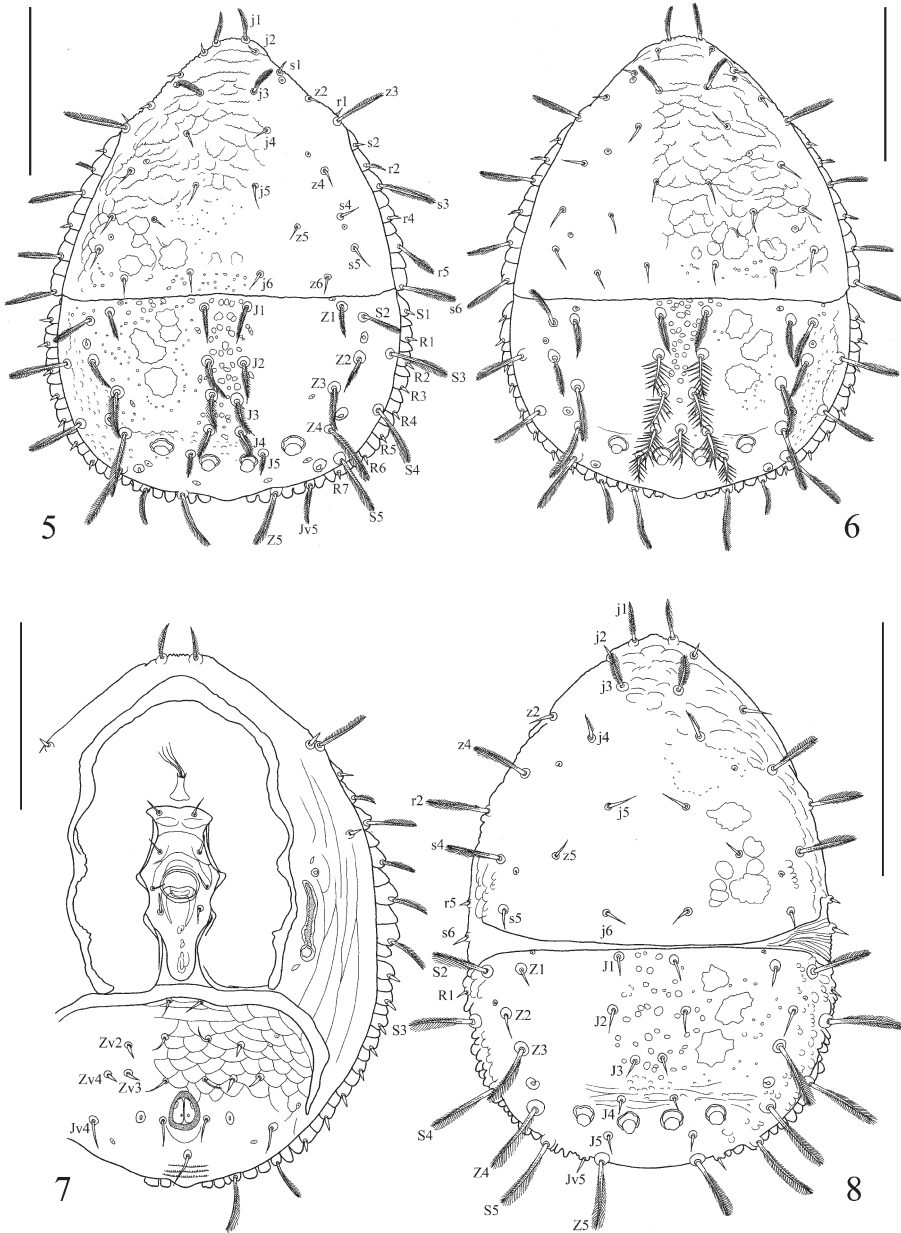
Podonotum. Setae j1, j3, z3, s3, r5 and s6 elongate, feather-like, plumose, r2 and r4 short, pilose, other j-, z-, s- and r-setae short, smooth and pointed. Podonotal adenotaxy similar to that of adults. Anterior and lateral surface of the shield covered by a reticulation of undulate lines, central surface with small, alveolar pits.

Opisthonotum. Each J-setae densely pilose, apically tapering, pointed. Setae J1 more slender in appearance, J5 shorter than other J-setae. J1 not reaching the bases of J2. J5 inserted anterolaterally to central dorsal cavities. Setae Z1–2 similar in shape to J1, Z3 similar to J3–5. Setae Z4 elongate, densely pilose, ending blunt, expanding beyond margin of idiosoma. Setae S2 longer than Z1, densely pilose, similar in shape to Z4. S3–5 similar in shape and length to Z4, expanding beyond margin of idiosoma. S1 and each R-setae short, stout, thorn-like. Posteromarginal setae Z5 and Jv5 similar in shape to Z4, however Jv5 shorter. Length of opisthonotal setae and distances between their insertions as in Table 1. Opisthonotal adenotaxy as in the adults. Dorsal cavities rotund, with slightly undulate anterior margins. The surface between J-series covered by large, irregular pits, lateral to J-series small, alveolar pits can be observed.

Protonymph (Fig. 8). Length of idiosoma: 204–215 μm ; width: 140–150 μm (n=2).

Table 1. Length of opisthonotal setae and longitudinal distances between their bases in *P. carpathofimbriatus* deutonymph and protonymph (measurements as mean, in μm).

	DN	PN		DN	PN		DN	PN
J1	22	8	Z1	18	8	S1	6	-
J1-J2	33	21	Z1-Z2	32	19	S1-S2	24	-
J2	25	10	Z2	21	11	S2	25	24
J2-J3	21	22	Z2-Z3	23	15	S2-S3	28	21
J3	23	7	Z3	27	26	S3	36	28
J3-J4	20	17	Z3-Z4	25	25	S3-S4	36	28
J4	19	6	Z4	38	31	S4	36	30
J4-J5	18	16	Z4-Z5	50	35	S4-5	37	31
J5	14	7	Z5	34	27	S5	37	30



5–6. *Prozercon* species, dorsal view of deutonymphs: 5 – *P. carpathofimbriatus*, 6 – *P. fimbriatus*; 7–8. *P. carpathofimbriatus*: 7 – ventral view of male, 8 – dorsal view of protonymph (scales: 100 µm)

Podonotum. Setae j1, j3, z4, r2 and s4 elongate, feather-like, densely pilose. Setae j4 pointed, often pilose, other podonotal setae short, smooth, pointed (r5 and s6 shorter than others). Ornamentation of the shield weakly developed, only a couple of furrows can be observed on the anterior and lateral surface as precursor of the tile-like pattern. The position of visible pores similar to that of the adults.

Opisthonotum. Each J-setae short, smooth and pointed, none of them reaching the bases of the following one in the series. Setae J5 inserted posterolaterally to central dorsal cavities. Setae Z1–2 and Jv5 similar in appearance to J-setae, R1 similar to podonotal r5 and s6. Setae Z3–5 and S2–5 elongate, feather-like, each expanding beyond margin of idiosoma. Length of opisthonotal setae and distances between their insertions as in Table 1. Opisthonotal adenotaxy as for the adults. Dorsal cavities rotund, with slightly undulate anterior margins. Area of J-series ornamented by large, alveolar pits, lateral surface of opisthonotum with protuberances.

REMARKS

The species is recorded from Croatia for the first time. *P. carpathofimbriatus* was described in the past decade, with the consideration of a character rather neglected till the end of the 20th century, namely the measure of posterolateral expansion of peritrematal shields. According to the observations of MAŠÁN & FENĎA (2004), there are two different species in Slovakia with similar dorsal aspect, one with short posterolateral peritrematal processes (which is one of the most common zerconids in Europe, *P. fimbriatus*), while these processes are elongate and reach the level of setae R6–7 in the other species (*P. carpathofimbriatus*). As an important distinctive feature, these authors draw attention to that almost each *P. fimbriatus* specimen found in Slovakia characteristically possesses a supplementary seta between setae J4 – a fact firstly remarked by SELLNICK (1958).

However, UJVÁRI (2011) found that shape of peritrematal shields and the measure of their posterolateral expansion may be a character of individual variability (e.g. in case of *P. graecus* UJVÁRI, 2011), even if it is most often characteristic for a species indeed. Therefore the author was a bit suspicious about the validity of *P. carpathofimbriatus*. Reviewing the specimens collected in Croatia it is obvious that there are basically two types of specimens, one with shorter peritrematal tips while the other with longer, but the difference in the expansion is not always as remarkable as MAŠÁN & FENĎA (2004) indicate (however the shape of shields is always distinctive), for that the figures 2 and 4 serve as a good example.

There is an early review of the genus (HALAŠKOVÁ, 1963) with key-informations regarding former species. HALAŠKOVÁ did not take into consideration such ventral characters as the shape of peritrematal shield in her review, but she found that *P. fimbriatus* has two different forms of deutonymphs. One of them possess strong, bipectinate opisthonotal setae J2–5 accompanied with a supplementary seta between setae J4 (see Fig. 6) and it was found together with 'aberrant' *P. fimbriatus* specimens (see Fig. 3) possessing the supplementary J-seta. The other form has pilose J-setae, which are similar to anterior Z-setae, and this form was found together with 'normal' specimens, with a holotrichous opisthonotal condition. Since these forms possess

overlapping distribution areas and the adults and deutonymphs of both were found together in certain samples, Halašková presumed that they belong to the same species, and she remarked that the deutonymphs with the large, bipectinate J-setae develop to the 'aberrant' *P. fimbriatus* form.

In turn, no similar dimorphism of deutonymphs is known so far among Zerconidae, therefore Halašková's description and figures suggest that there are two different species identified earlier as *P. fimbriatus*, the adults of which are very similar to each other. The additional differences found on adults by MAŠÁN & FENĎA (2004), supported by deutonymphal characters noticed by HALAŠKOVÁ (1963), serve together as a very good basis for the morphological distinction of the species mentioned.

These differences were recognized only by a couple of authors, hence many records of *P. fimbriatus* may represent occurrences of *P. carpathofimbriatus*, which is difficult to ascertain. Those papers where ventral characters of adults or dorsal characters of deutonymphs of these species are documented carefully, may be a good basis to determine which species is recorded. Unfortunately, the number of such papers is very low. There is a *P. fimbriatus* record from Turkey (URHAN & AYYILDIZ, 1996d) which could be revised due to the fine documentation, according to the former distinguishing characters. The Turkish specimens possess peritrematal shields similar to that of *P. fimbriatus*, however the morphology of deutonymph does not correspond to the former, and the authors did not observe the extra seta between setae J4. As the posterolateral extension of peritrematal shield is a character of individual variation, the Turkish specimens more likely belong to *P. carpathofimbriatus*, but the length of opisthonotal setae is shorter in general than that of the Croatian specimens. For a correct identification it would be essential to review the variations of the Turkish specimens.

***Prozercon fimbriatus* (C. L. KOCH, 1839)**

(Figs 3, 4 and 6)

MATERIAL EXAMINED

E-956: Croatia, Krk Island, Njivice, leaf litter, 30.05.1980, leg. Szabó, J. B. (1 female, 1 male); E-1380: Croatia, Rabac, litter from deciduous forest, 14.07.1992, leg. Horváth, Gy. (3 females, 6 males, 2 deutonymphs); E-1381: Croatia, Rabac, moss from deciduous forest, 14.07.1992, leg. Horváth, Gy. (7 females, 14 males); E-1382: Croatia, Rabac, above mine, 14.07.1992, leg. Horváth, Gy. (18 females, 7 males, 7 deutonymphs, 1 protonymph); E-1790: Croatia, Plitvice Lakes National Park, from moss, 21–26.07.2005, leg. Kontschán, J. (1 female).

REMARKS

Many aberrant specimens were found among those collected near Rabac, above a mine. These specimens lack a couple of J-setae, most often one of J1, both J2 and J3, but the extra seta between setae J4 is always present.

***Prozercon martae* UJVÁRI, 2010**

(Figs 9–11)

MATERIAL EXAMINED

E-954: Croatia, Krk Island, Njivice, side of ravine, 30.05.1980, leg. Szabó, J. B. (1 female); E-1050: Croatia, Rab Island, Hotel Eva, rocky grassland, litter beneath olive tree and soil from roots of *Cyclamen*, 09.05.1983, leg. Neiger, M. (3 females, 1 male, 2 deutonymphs); E-1051: Croatia, Rab Island, Hotel Eva, soil and litter beneath pine tree, 09.05.1983, leg. Neiger, M. (8 females, 1 male, 1 deutonymph); E-1052: Croatia, Rab Island, Hotel Eva, rocky grassland, soil and litter beneath olive tree, 09.05.1983, leg. Neiger, M. (1 male); E-1053: Croatia, Rab Island, Hotel Eva, soil and litter beneath olive tree, 09.05.1983, leg. Neiger, M. (1 female, 1 male); E-1380: Croatia, Rabac, litter from deciduous forest, 14.07.1992, leg. Horváth, Gy. (3 females, 1 male); E-1381: Croatia, Rabac, moss from deciduous forest, 14.07.1992, leg. Horváth, Gy. (5 females, 1 male); E-1382: Croatia, Rabac, above mine, 14.07.1992, leg. Horváth, Gy. (31 females, 6 males, 1 deutonymph).

DESCRIPTION

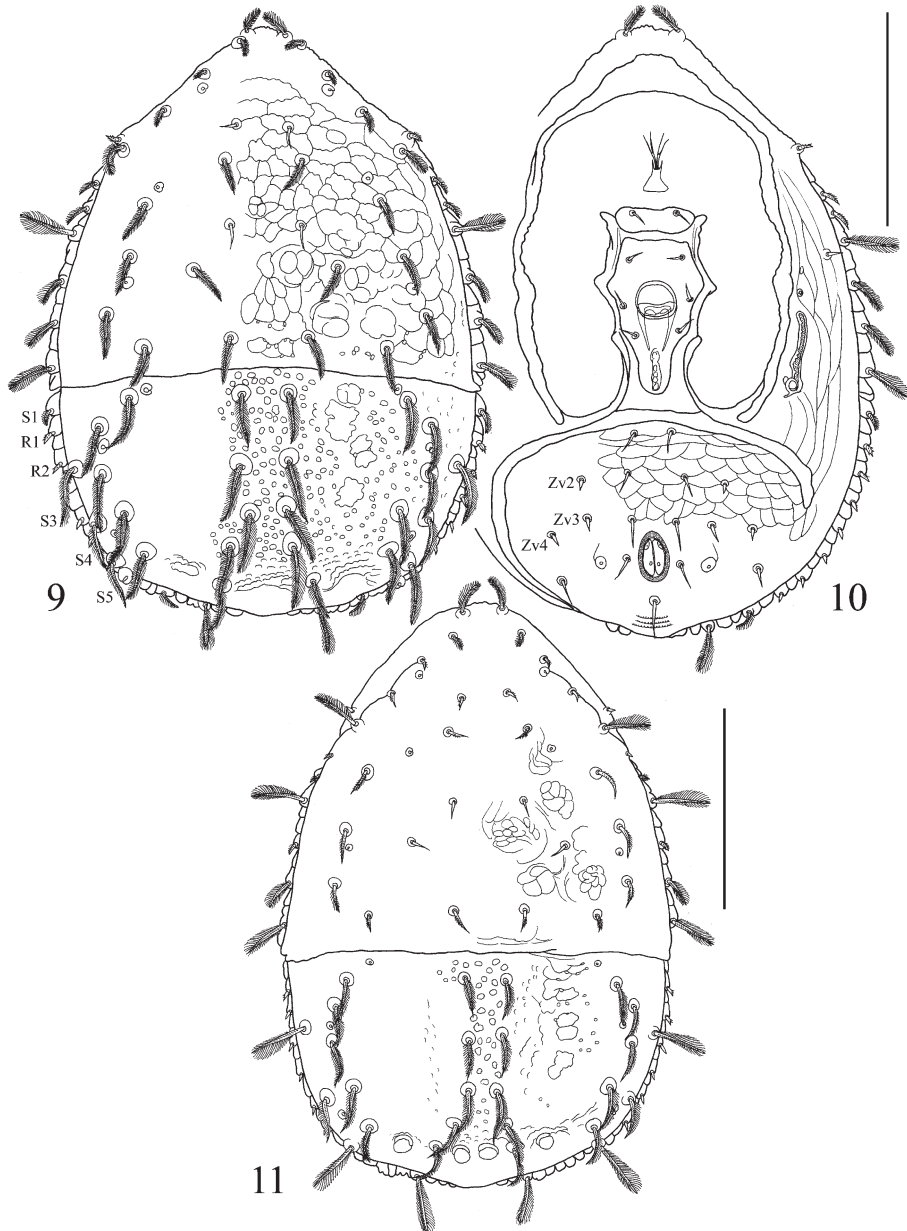
Male. Length of idiosoma: 268–280 μm ; width: 183–199 μm (n=10).

Dorsal aspect of male (Fig. 9), regarding chaetotaxy, adenotaxy and ornamentation, basically similar to that of female (see: UJVÁRI, 2010b). Each plumose setae, however, broader than in female, besides setae S3 and S5 similar in shape to S4, bent, apically tapering, unlike in female, where S3 and S5 brush-like. R-setae shorter than in female, only the first 2–3 pairs pilose, others smooth, thorn-like. Length of opisthonotal setae and distances between their insertions as in Table 2.

Ventral side (Fig. 10). Peritrematal shields posterolaterally elongate, their tips fused to the ventrianal shield at level of setae R3–7 (varying even within a specimen).

Table 2. Length of opisthonotal setae and longitudinal distances between their bases in *P. martae* male and deutonymph (measurements as mean, in μm).

	M	DN		M	DN		M	DN
J1	25	20	Z1	27	21	S1	9	5
J1-J2	33	29	Z1-Z2	37	31	S1-S2	24	22
J2	29	22	Z2	25	22	S2	25	19
J2-J3	23	27	Z2-Z3	21	24	S2-S3	22	17
J3	28	26	Z3	28	24	S3	29	28
J3-J4	17	17	Z3-Z4	20	21	S3-S4	28	36
J4	29	22	Z4	25	19	S4	23	21
J4-J5	19	14	Z4-Z5	40	37	S4-5	21	28
J5	20	21	Z5	21	26	S5	25	29



9–11. *P. martae*: 9 – dorsal view of male, 10 – ventral view of male, 11 – dorsal view of deutonymph (scales: 100 μ m)

Peritrematal setae R1 and R3 short, thorn-like, R1 pilose, R3 smooth. The shape of peritremes typical for the genus (straight). Sternigenital shield weakly sclerotized, setae st5 absent. Each ventrianal setae short, smooth, Zv2–4 stouter, similar in appearance to opisthomarginal setae. Anal valves with vestigial euanal setae. Peritrematal shields with longitudinal fissures, anterior surface of ventrianal shield covered by squamous ornamentation to the line of Zv4–Zv4. Ornamentation on sternigenital shield weakly developed.

Deutonymph (Fig. 11). Length of idiosoma: 280–296 μm ; width: 194–204 μm (n=4).

Podonotum. Setae j1, z3, s3, r5 and s6 elongate, brush-like, plumose. Setae j2 shorter (7–8 μm), but plumose. Setae s1, z2, s2, s3 and r4 short (3–6 μm), pilose. Setae j3–6 and z5–6 slightly longer than former (8–10 μm), j3–4, j6 and z6 pilose, j5 and z5 smooth, needle-like. Setae z4 and s4–5 moderately long (16–18 μm), densely pilose, apically tapering. Podonotal adenotaxy similar to that of adults. Apart from podonotal muscle-scars, the precursors of the tile-like ornamentation of adults hardly visible.

Opisthonotum. Each J-setae densely pilose, apically tapering, pointed. J1 and J2 not reaching the bases of the following setae of the series. J5 inserted laterally to central dorsal cavities, expanding beyond margin of idiosoma. Setae Z1–4, S2 and S4 similar in shape to J-setae. Setae Z5, S3 and S5 elongate, densely pilose, brush-like. S1 and each R-setae short, stout, thorn-like. S1 and R1 finely pilose, other R-setae smooth. Setae Jv5 short, plumose. Length of opisthonotal setae and distances between their insertions as in Table 2. Opisthonotal adenotaxy as for the adults. Dorsal cavities rotund, with slightly smooth anterior margins. The surface between J-series covered by large, irregular pits, lateral to J-series smaller, alveolar pits can be observed.

Prozercon pilimarginatus sp. nov.

(Figs 12–13)

TYPE MATERIAL

Holotype: female. E-1370: Croatia, Mljet Island, Mljet National Park, 02.07.1990, leg. Vörös.

ETYMOLOGY

The name of the new species refers to the pilose setae of the opisthonotal margin.

DIAGNOSIS

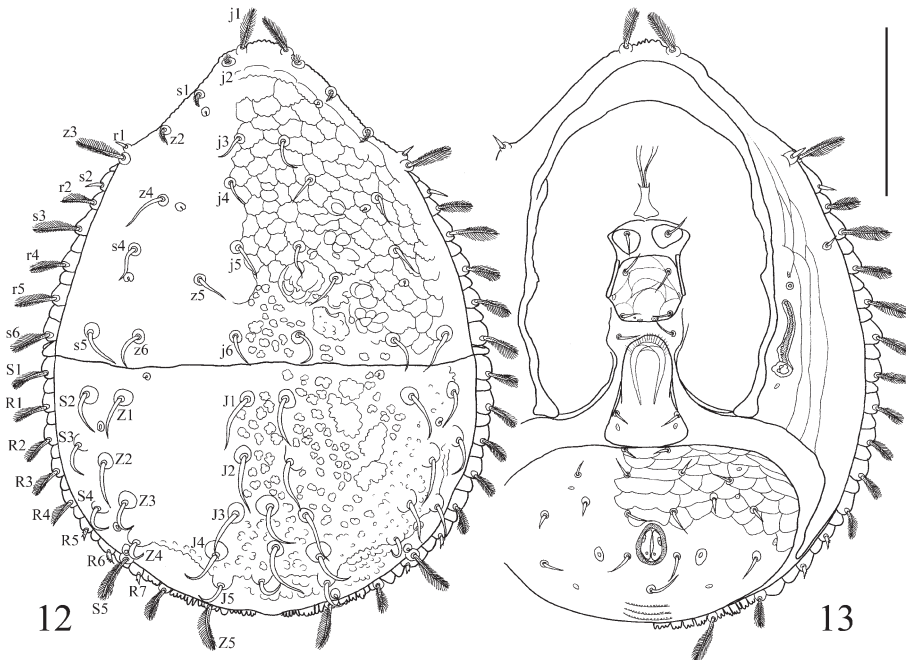
Opisthonotal setae smooth except S5 and those situated on the margin of idiosoma. Setae S3–4 not reaching beyond the margins of opisthonotum. Supplementary setae present between posterior J-setae. Anterior five pairs of opisthomarginal setae densely pilose, brush-like, posterior opisthomarginal setae thorn-like, pilose. Opisthonotum densely covered by large, irregular pits. Peritrematal shields with long, free posterolateral process expanding to level of R7.

DESCRIPTION

Female. Length of idiosoma: 340 μm ; width: 270 μm (n=1).

Dorsal side (Fig. 12). Podonotum with 22 pairs of setae, j1–6, z2–6, s1–6, r2 and r4–5 inserted dorsally, r1 and r3 inserted on peritrematal shields. Setae s2, r1 and r3 short, smooth and pointed, j2, s1 and z2 short, pilose, j1, z3, r2, s3, r4, r5 and s6 longer, brush-like, densely pilose, the rest of podonotal setae moderately long, smooth. Glands *gds1* (po1) situated posteromedially to insertions of s1; *gdj4* (po2) situated posteromedially to z4; *gds4* (po3) near line connecting s4 and s5, closer to s4. Anterior, central and lateral surface of podonotal shield covered by irregular tiles with undulate margins, posterocentral area with large, irregular pits.

Opisthonotum with 21–22 pairs of setae, J1–5, Z1–5, S1–5, marginal R-series with six to seven pairs of setae; besides three supplementary setae can be observed on the holotype, between J3–5. All J-setae, Z1–4 and S2–4 smooth, moderately long, setiform. Each of J-setae reaching approximately to the insertion of the following seta in the series. Setae Z5 elongate, brush-like, pilose, similar in shape and length to S5 which reaching beyond the margins of opisthonotum. Setae S1 brush-like, densely pilose, similar in shape and length to R1–4. Setae S2 situated approximately at level of Z1. Setae S3–4 not reaching beyond the margins of opisthonotum. Setae R5–7 short, thorn-like, pilose. Length of opisthonotal setae and distances between their insertions as in Table 3. Glands *gdZ1* (Po1) situated anteromedially to insertions of Z1; *gdS2* (Po2) laterally to line connecting insertions of Z1 and Z2; *gdZ3* (Po3) on line connecting S4



12–13. *P. pilimarginatus* sp. nov.: 12 – dorsal view of female, 13 – ventral view of female (scale: 100 μm)

and Z4; *gdS5* (Po4) anteriorly to S5. Whole opisthonotal shield densely covered by large, distinct, irregular pits. Dorsal cavities weakly developed.

Ventral side (Fig. 13). Peritrematal shields with posterolateral tips reaching level of R7, covered by fine reticulation. Peritremes slightly bent. Chaetotaxy and adenotaxy of ventral shields typical for genus *Prozercon*. Sternal shield weakly sclerotised, with straight posterior margin and reticulate ornamentation. Sternal setae st1 situated on sclerotized patches separated from each other and from the sclerotized region possessing st2–3. Ventrianal shield with short, smooth preanal and adanal setae, setae ZV1 absent. Postanal seta similar in shape and length to adanal setae, JV5 brush-like, densely pilose. Anal valves with vestigial euanal setae. Glands *gv3* situated laterally to adanal setae. Anterior surface of ventrianal shield covered by squamous pattern.

Table 3. Length of opisthonotal setae and longitudinal distances between their bases in *P. pilimarginatus* sp. nov. female (measurements as mean, in μm).

	F		F		F
J1	34	Z1	27	S1	20
J1-J2	36	Z1-Z2	40	S1-S2	24
J2	32	Z2	28	S2	24
J2-J3	34	Z2-Z3	28	S2-S3	29
J3	30	Z3	24	S3	21
J3-J4	27	Z3-Z4	23	S3-S4	40
J4	23	Z4	18	S4	20
J4-J5	17	Z4-Z5	56	S4-5	33
J5	19	Z5	27	S5	29

Gnathosoma. Shape of epistome of *Prozercon*-type. Ventral structures of gnathosoma typical for most of Zerconidae: internal malae with serrate margins, possessing short, bifurcate anteromedial processes; corniculi horn-like; capitular setae h1–2 long, smooth, setiform, h3 short, smooth, h4 long, serrate; subcapitular groove with 8 transverse lines. Chelicerae typical for *Prozercon* species.

Male and immature stages. Unknown.

DIFFERENTIAL DIAGNOSIS

Prozercon pilimarginatus sp. nov. belongs to the species possessing pilose opisthomarginal setae and it can easily be distinguished from any of these by the unique shape of setae J1–5, Z1–4 and S2–4 which are uniform, moderately long and smooth in the new species. Further unique character is the presence of three additional setae between the J-series.

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