



# First record of *Prozercon plumosus* Čalugăr, 2004 (Acari, Mesostigmata, Zerconidae) from Slovakia

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**Abstract.** *Prozercon plumosus* Čalugăr, 2004, a species of mesostigmatic mite (Acari), is reported from Slovakia for the first time. Our new record, which originates from western Slovakia, extends the known distribution of *P. plumosus*. We include a key to *Prozercon* Sellnick, 1943 species that are similar to *P. plumosus*.

**Key words.** Europe, mites, new record, soil fauna

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## INTRODUCTION

Mites of the family Zerconidae, which can be found in leaf litter, moss, soil, and decomposing organic detritus, are distributed throughout the whole northern hemisphere (Mašán and Fend'a 2004; Sikora 2014).

Knowledge of zerconids in Slovakia has benefited from the work of Dr. Věra Halašková, who was one of the main acarological researchers on this family of mites in the second half of the 20th century and who described many new species in former Czechoslovakia (Halašková 1963a, 1963b, 1964, 1969a, 1969b, 1977, 1979). Other researchers later observed zerconid mites in bird nests (Fend'a et al. 1998; Krumpál et al. 1998; Fend'a and Lengyel 2007; Fend'a 2010; Fend'a and Schniererová 2010).

The most complete work on Slovak zerconids is that by Mašán and Fend'a (2004), who provided the information on the ecological requirements and morphology of zerconids, described new species, and developed a determination key to the Zerconidae of Slovakia. As stated by Mašán and Fend'a (2004), there are four known zerconid genera: *Parazercon* Trägårdh, 1931, *Mixozzercon* Błaszak, 1975, *Prozercon* Sellnick, 1943, and *Zercon* C.L. Koch, 1836. So far, 12 species of *Prozercon* are known in Slovakia, of which six are locally common: *P. carpathofimbriatus* Mašán & Fend'a, 2004, *P. carsticus* Halašková, 1963, *P. fimbriatus* C.L. Koch, 1839, *P. kochi* Sellnick, 1943, *P. sellnicki* Halašková, 1963, and *P. traegardhi* (Halbert, 1923); and six species are rare: *P. carpathicus* Balan & Sergienko, 1990, *P. kunsti* Halašková, 1963, *P. lutulentus* Halašková, 1963, *P. rafalskii* Błaszak, 1971, *P. similis* Balan, 1992 and *P. verruciger* Mašán & Fend'a, 2004.

Many *Prozercon* species are very similar, and, thus, we have included a determination key here for a few selected species that have the podonotal setae similar in shape—where most of the setal pairs are pilose—to *Prozercon plumosus* Čalugăr, 2004, which we report herein as new from Slovakia.

## METHODS

Mites were collected from samples of soil and litter from a pine stand (*Pinus* L. sp.). The samples were taken in August 2021. Soil fauna was extracted using Berlese-Tullgren funnels and stored in 70% ethanol. Mites were separated using a stereo microscope Leica S9E and mounted using chloralhydrate-based medium Liquido de Swan. Specimens were identified under the laboratory microscope Zeiss Axioscope 5 according to Mašán and Fend'a (2004) and Čalugăr (2004). Photographs and measurements were taken with Zeiss Axiocam 208 color and ZEN v. 3.4., and all measurements are in micrometers. The distribution map of the species was made with QGIS v. 3.32.1 (QGIS 2024). The localities of distribution are shown in Figure 1. The examined specimens are deposited at the Department of Zoology at Faculty of Natural Sciences of Comenius University in Bratislava, Slovakia (FNS-UK KZO, curator: M. Jandík).



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**Figure 1.** Distribution of *Prozercon plumosus* Călugăr, 2004. White dots are records from Romania and Türkiye, the red dot is the new record from Slovakia. Orange lines are borders of countries.



## RESULTS

Family Zerconidae G. Canestrini, 1891

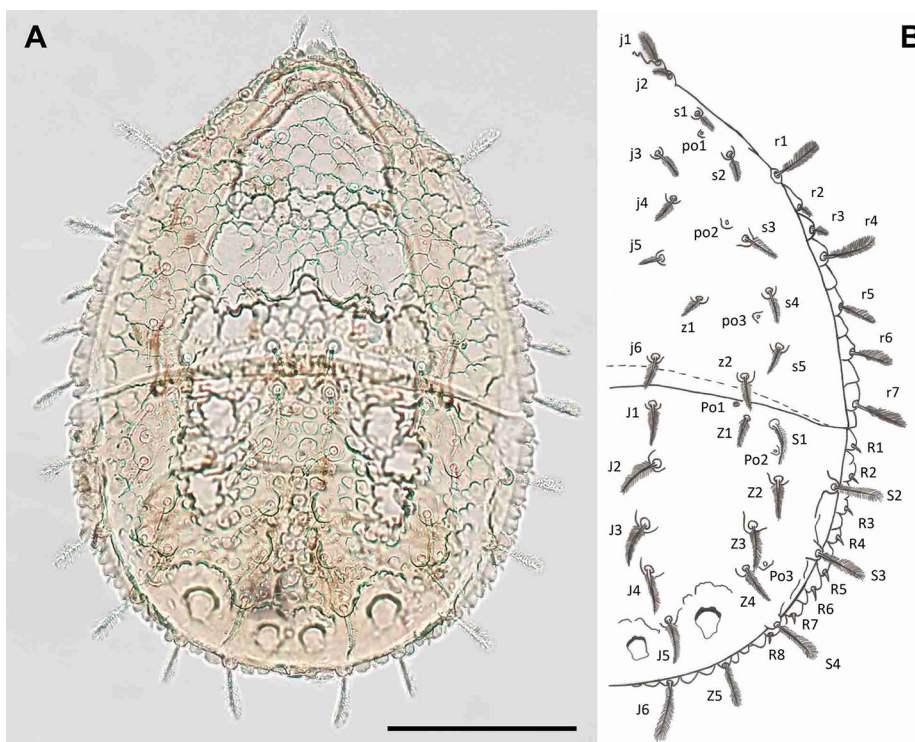
### *Prozercon plumosus* Călugăr, 2004

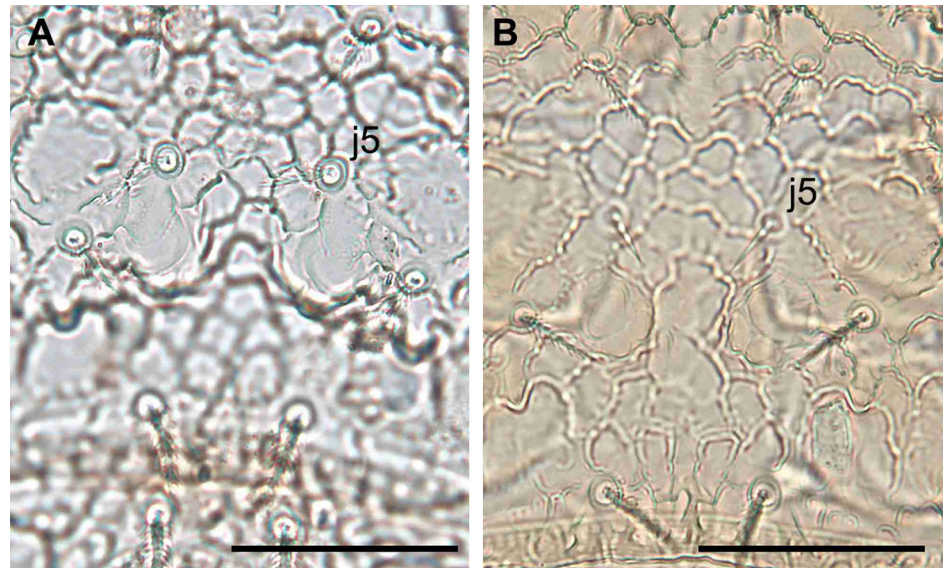
Figures 1–3A, 4

**Material examined.** SLOVAKIA – BRATISLAVA REGION • Bratislava; 48.1498°N, 017.0707°E; 170 m alt.; 18.VIII.2021; L. Švecová leg.; soil and needle litter under pine stand; inner block/atrium of the Faculty of Natural Sciences of Comenius University in Bratislava (Figure 4); 24 ♀; FNS-UK KZO 01-K-1 • Bratislava; 48.1498°N, 017.0707°E; 170 m alt.; 25.VIII.2021; L. Švecová leg.; soil sample under a rat in advanced decay; inner block/atrium of the Faculty of Natural Sciences of Comenius University in Bratislava (Figure 4); 1 ♀; FNS-UK KZO 01-V-3.

**Distribution.** This species is known from several localities in Romania: from oak-forest soil and leaf litter in Iași County (Mărzești) and from oak and hornbeam forests, as well as from ash groves and forest in Prahova

**Figure 2.** *Prozercon plumosus* Călugăr, 2004 **A.** Dorsal view. **B.** Dorsal chaetotaxy. Scale bar: 100 μm.





**Figure 3.** Detail on *j5* setae **A.** *Prozercon plumosus* Călugăr, 2004: plumose setae. **B.** *Prozercon treagardhi* (Halbert, 1923): smooth, needle-like setae. Scale bar: 50 µm.

**Figure 4.** The locality of the new record, the pine stand in atrium of Faculty of Natural Sciences of Comenius University in Bratislava.



County (Păuleşti, Dârvari, Valea Călugărească) (Călugăr 2004). In Türkiye, it was found in Kütahya Province, in soil and litter under pine trees in Güveççi (Centre) and in pine and beech forest in Safa (Domanic District) (Duran et al. 2017; Figure 1).

**Identification.** *Female.* Idiosoma. On podonotum, all setae are pilose. Setae *j2*, *r2*, and *r3* are shorter than the other setae of podonotum. Setae *r1* and *r4–r7* are densely plumose and brush-like. All opisthonotal setae, except R-rows, are pilose. Setae *J1–5*, *Z1–4*, and *S1* similar in appearance. Setae *J6*, *Z5*, and *S2–S4* densely plumose and brush-like, and only setae *S2–4* reaching beyond edge of opisthonotum. Lateral sides of opisthonotum are reticulate and the rest of opisthonotum is covered by alveolar microsculpture. Dorsal depressions are halfmoon-shaped with their axes parallel to that of the body. On ventral side, lateral ends of peritremal shields reach to *R2–3* and an adgenital shield is absent. Length of opisthonotal setae and distances between them in the same row are listed in measurements of the specimens. On the opisthonotum, pore *Po1* located in anterior position, oblique to the insertion of seta *Z1*. Pore *Po2* lies outside the line connecting setae *S1–Z2*, closer to *Z2*. Pore *Po3* lies outside the line connecting setae *Z3–Z4*, near *Z4*. Pore *Po4* located on the line connecting *S4–Z5* near *S4*.

**Measurements of the specimens** (6♀) (Figure 2). Idiosoma length 342.51 µm (331.38–350.19), width 253 µm (240.5–256.92). Setae *J1* 25.51 µm (22.32–28.33), *J2* 29.22 µm (24.89–33.19), *J3* 30.3 µm (25.83–34.01), *J4*

27.67  $\mu\text{m}$  (22.92–31.6), *J5* 24.77  $\mu\text{m}$  (20.06–29.27), *J6* 29.1  $\mu\text{m}$  (27.86–30.54), *Z1* 16.43  $\mu\text{m}$  (13.13–18.73), *Z2* 21.82  $\mu\text{m}$  (16.22–25.58), *Z3* 23.86  $\mu\text{m}$  (16.16–28.35), *Z4* 25.63  $\mu\text{m}$  (18.2–29.99), *Z5* 22.88  $\mu\text{m}$  (20.72–24.99), *S1* 19.84  $\mu\text{m}$  (13.89–23.14), *S2* 27.04  $\mu\text{m}$  (24.33–29.26), *S3* 27.74  $\mu\text{m}$  (25.45–29.16), *S4* 27.08  $\mu\text{m}$  (21.92–30.39). Distance between setae *J1–J2* 32.48  $\mu\text{m}$  (28.63–35.17), *J2–J3* 34.77  $\mu\text{m}$  (32.34–36.63), *J3–J4* 26.29  $\mu\text{m}$  (24.78–29.56), *J4–J5* 26.1  $\mu\text{m}$  (21.04–29.32), *J5–J6* 23.77  $\mu\text{m}$  (20.07–37.09), *J6–J6* 61.01  $\mu\text{m}$  (60.24–62.81), *Z1–Z2* 38.17  $\mu\text{m}$  (35.53–43.61), *Z2–Z3* 30.94  $\mu\text{m}$  (24.9–35.65), *Z3–Z4* 26.79  $\mu\text{m}$  (23.91–30.88), *Z4–Z5* 41.05  $\mu\text{m}$  (33.73–50.72), *S1–S2* 19.84  $\mu\text{m}$  (34.93–23.14), *S2–S3* 40.26  $\mu\text{m}$  (35.47–41.05), *S3–S4* 43.1  $\mu\text{m}$  (39.5–46.31).

**Similar species.** The shape of the podonotal setae is similar to that of many other *Prozercon* species. Only in *Prozercon graecus* Ujvári, 2011 and *P. plumosus* are setae *j5* pilose. *Prozercon graecus* differs in the position of pores *Po1*, which lie outside of setae *Z1*; in the weakly sclerotised band on sternal shield between setae *st1* and *st2*, and in the length of the lateral end of the peritremal shield. The closest morphologically related species in Slovakia is *P. traegardhi*, which is similar to *P. plumosus* with the exception of setae *j5*, meaning that *P. traegardhi* has a smooth *j5* and *P. plumosus* has a pilose *j5* (Figure 3).

**Determination key.** For better identification we include a key of selected *Prozercon* species with similar shape of the podonotal setae, which are mostly pilose.

1. Opisthonotal setae of *R*-row different in shape ..... 2
  - Opisthonotal setae of *R*-row similar in shape ..... 7
2. *R1* and *R2* pilose, other setae of *R*-row smooth ..... *halaskovae* Petrova, 1977
  - *R1* is pilose, other setae of *R*-row smooth ..... 3
3. Opisthonotal setae *S3* absent ..... *yavuzi* Urhan, 1998a
  - Opisthonotal setae *S3* present ..... 4
4. Sternal shield divided into two parts ..... *bisternalis* (Błaszak, 1979)
  - Sternal shield undivided ..... 5
5. Pores *Po3* outside line connecting *Z3–Z4* ..... *kunsti* Halašková, 1963
  - Pores *Po3* inside line connecting *Z3–Z4* ..... 6
6. *Z2* and *Z3* extend slightly beyond insertion of following setae; insertion of *S2* closer to body edge; *S2* and *S3* straight, distally broadening and brush-like ..... *norae* Ujvári, 2011
  - *Z2* and *Z3* do not extend beyond insertion of following setae; insertion of *S2* further from edge of body, *S2* and *S3* bent and distally pointed ..... *morazae* Ujvári, 2011
7. Opisthonotal setae of *R*-row smooth ..... 8
  - Opisthonotal setae of *R*-row pilose ..... 17
8. Dorsal depressions different in size ..... *sellnicki* Halašková, 1963
  - Dorsal depressions equal in size ..... 9
9. Peritrematal setae *p1* pilose ..... 10
  - Peritrematal setae *p1* smooth ..... 12
10. Podonotal setae *j5* smooth ..... *satapliae* Petrova, 1977
  - Podonotal setae *j5* pilose ..... 11
11. Postero-lateral tips of peritrematal shield reaching *R2*; pores *Po1* inside setae *Z1*; sternal shield well sclerotised ..... *plumosus* Călugăr, 2004
  - Postero-lateral tips of peritrematal shield reaching between *R6–R7*; pores *Po1* outside *Z1* setae; sternal shield with weakly sclerotised band between setal pairs *st1* and *st2* present ..... *graecus* Ujvári, 2011
12. Setae *S3* absent ..... *denizliensis* Urhan, 2002
  - Setae *S3* present ..... 13
13. Setae *S1* smooth ..... *tragardhisimilis* Solomon, 1984
  - Setae *S1* pilose ..... 14
14. Setae *J1* reaching insertion of *J2* ..... *tragardhi* (Halbert, 1923)
  - Setae *J1* not reaching insertion of *J2* ..... 15
15. Sternal shield divided into two parts ..... *blaszaki* (Urhan & Ayyıldız, 1996a)
  - Sternal shield undivided ..... 16
16. Postero-lateral tips of peritrematal shield reaching *R2–R3*; *J* and *Z* setae situated on enlarged setal bases ..... *bulbiferus* Ujvári, 2011
  - Postero-lateral tips of peritrematal shield reaching *R4–R5*; basis of *J* and *Z* setae of normal size ..... *sultani* Duran & Urhan, 2015
17. Peritrematal setae *p1* pilose ..... 18
  - Peritrematal setae *p1* smooth ..... 22
19. An additional unpaired seta (*Jx4*) between the setae *J4–J4'* present ..... 19
  - An additional unpaired setae between *J–J'* setal row absent ..... 20

20. Setal pairs *S2* and *S3* absent ..... *kurui* Urhan, 1998b  
 – Setal pair *S3* absent ..... *bircanae* Urhan, 1998b
21. Postero-lateral tips of peritrematal shield reaching beyond *R5* ..... *orhani* Urhan & Ayyildiz, 1996b  
 – Postero-lateral tips of peritrematal shield not reaching beyond *R5* ..... 21  
 – Postero-lateral tips of peritrematal shield reaching between *R3–R4*; *S2* not reaching beyond body edge ..... *umidicola* Urhan, 2002  
 – Postero-lateral tips of peritrematal shield reaching between *R2–R4*; *S2* reaching beyond body edge ..... *kamili* Urhan & Ayyildiz, 1996b
22. Setae *S1* smooth ..... *murati* Urhan, 2013  
 – Setae *S1* pilose ..... 23
23. Setal pair *S3* absent ..... *erdogani* Urhan, 2010  
 – Setal pair *S3* present ..... 24
24. Pores *Po3* outside *Z*-row ..... 25  
 – Pores *Po3* inside *Z*-row ..... 26
25. Setae *J1* reaching insertion of *J2, j3* smooth ..... *martae* Ujvári, 2010  
 – Setae *J1* not reaching insertion of *J2, j3* pilose ..... *ornatus* (Berlese, 1904)
26. Postero-lateral tips of peritrematal shield reaching beyond *R5* .....  
 ..... *banazensis* Urhan, Karaca & Duran, 2015  
 – Postero-lateral tips of peritrematal shield not reaching beyond *R5* ..... 27
27. Setae *J2* and *J3* reaching insertion of following setae ..... *escalai* Moraza, 1988  
 – Setae *J2* and *J3* not reaching insertion of following setae ..... *didimensis* Keçeci, Urhan & Karaca, 2021

## DISCUSSION

Members of the genus *Prozercon* are rather small predators living in soil and leaf litter (Mašán and Fendá 2004). They are non-phoretic, which means that their settlement of new territories is slow. However, *Prozercon* inhabits all four regions of the Palearctic realm.

*Prozercon plumosus* has been recorded from Romania (Iași and Prahova counties) (Călugăr 2004) and from Türkiye (Duran et al. 2017). In this paper, we present the first record from Slovakia (Bratislava), which is the most northern occurrence.

Morphologically, the species most similar to *P. plumosus* in Slovakia is *P. traegardhi*. The distinguishing characteristic is in the *j5* setal pair, which is pilose in *P. plumosus* and smooth and needle-like in *P. traegardhi*. The pilosity of setae *j5* in *P. plumosus* is very fine and can be overlooked. In addition, most determination keys focus on the opisthonotal setae. These two factors can lead to misidentification.

*Prozercon plumosus* and *P. traegardhi* were collected in the same soil samples in Slovakia, possibly sharing a similar area. In Slovakia, *P. traegardhi* is distributed from lowlands up to the montane zone. It is most abundant in heterogeneous non-woodland and woodland habitats such as littoral reed growths, alluvial stands, meadows, orchards, glades and forests, and both dry deciduous and humid coniferous (Mašán and Fendá 2004). *Prozercon plumosus* has been collected so far from soil and leaf litter in deciduous, coniferous, and mixed forests habitats (Călugăr 2004; Duran et al. 2017). Specimens from Slovakia and Türkiye (Güveççi) were collected from leaf litter and soil under pine trees. Romanian specimens were collected from leaf litter and soil in oak forest (Mârzești) and from oak and hornbeam forest (Păulești, Dârvari, Valea Călugărească). The altitudes of recorded localities of *P. plumosus* in Slovakia and Romania are both rather low in comparison with localities from Türkiye. In Romania, localities are no higher than 300 m above sea level (Călugăr 2004), and in Slovakia they are at 170 m. Localities in Türkiye are above 1130 m (Duran et al. 2017).

*Prozercon graecus* is the only other species, alongside *P. plumosus*, in which females have a pilose setal pair *j5*. These two species can be distinguished by the length of their peritrematal shield. The postero-lateral tips of the peritrematal shield in *P. plumosus* reach setae *R2*, whereas in *P. graecus*, the postero-lateral tips of the peritrematal shield reach between the *R6–R7* setae (setae originally marked as *R5–R6*) (Ujvári 2011).

The position of the opisthonotal pore *Po1* is also important. In *P. traegardi* and *P. graecus*, the *Po1* pore is near the *Z1* seta on the outer side, while in *P. plumosus* this pore is near the *Z1* seta on the inner side. Additionally, the sternal shield in *P. graecus* provides a weakly sclerotised band between setal pairs *st1* and *st2*, whereas in *P. plumosus* the sternal shield is well sclerotised.

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## ADDITIONAL INFORMATION

### Conflict of interest

The authors declare that no competing interests exist.

### Ethical statement

No ethical statement is reported.

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### Author contributions

Conceptualization: MJ. Formal analysis: LŠ. Methodology: MJ, LŠ. Visualization: MJ, LŠ. Project administration: PF. Software: MJ, LŠ, PF. Writing – original draft: MJ. Writing – review and editing: LŠ, PF.

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### Data availability

All data that support the findings of this study are available in the main text.

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