Two new species of the genus *Premicrodispus* (Acari: Microdispidae) associated with beetles (Coleoptera: Lucanidae: Tenebrionidae), with a key to Palaearctic species of the genus

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Two new species of mites of the genus *Premicrodispus* Cross, 1965 (Acari: Microdispidae) are described and illustrated from northern Iran: *Premicrodispus paramaevi* Hosseininaveh and Hajiqanbar sp. nov. recovered from *Lucanus ibericus* (Col.: Lucanidae) and *Premicrodispus spinosus* Hosseininaveh and Hajiqanbar sp. nov. from *Corticeus unicolor* (Col.: Tenebrionidae). It is the first phoretic record of the microdispid mites on beetles of the family Tenebrionidae. A key to Palaearctic species of the genus *Premicrodispus* is provided.

<http://zoobank.org/urn:lsid:zoobank.org:pub:49368637-B8D0-4697-9184-28B33B89962A>

Keywords: Heterostigmatina; mite; beetle; phoretic relationship; Iran

Introduction

Mites of the cohort Heterostigmatina (Acari: Prostigmata) usually have phoretic, parasitoid or parasitic associations with various orders of insects. Within the Heterostigmatina, phoretic relationships have been evolved mostly in the superfamily Pygmephorioidea (Kaliszewski et al. 1995; Khaustov 2008). Based on Khaustov (2008), this superfamily includes four families, one of them the family Microdispidae. The microdispid mites are inhabitants of soil, forest litter and the nests of insects, and many of them use insects for phoretic dispersal (Khaustov 2009). Fungivory appears to be the primitive feeding behaviour of this family (Kaliszewski et al. 1995). The family consists of 17 genera and more than 109 species (Zhang et al. 2011). One of the speciose microdispid genera is the genus *Premicrodispus*. Khaustov (2006) reviewed the history of the genus. This genus currently includes three subgenera, *Premicrodispus* sensu stricto with about 27 species (according to Khaustov and Maslov 2013) and two monotypic subgenera *Premicrodispululus* Khaustov and Chydyrov, 2010 and *Premicrodispoides* Khaustov and Maslov, 2013. Hitherto, the subgenus *Premicrodispus* (*Premicrodispus*) included 20 described species in the Palaearctic region (Khaustov 2006, 2009; Khaustov and Chydyrov 2010). Mites of this family have been found on beetles of the families Carabidae, Scarabaeidae and Lucanidae (Hajiqanbar et al. 2012) but this study reports, for the first time, these mites on beetles of the family Tenebrionidae.

During a preliminary study of the heterostigmatic mites associated with Coleoptera in Iran, we found two new species of the genus *Premicrodispus*. This paper describes these new species and is the first record of the phoretic association

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between mites of the family Microdispidae and beetles of the family Tenebrionidae. A key to Palaearctic species of the genus *Premicrodispus* is provided.

Material and methods

Host beetles were captured directly in their habitats from Naharkhoran forest, Golestan province, northern Iran in 2009. Mite specimens were collected from a vial containing host beetles in alcohol, cleared in lactophenol and mounted in Hoyer's medium. The morphology of the mites was studied using a light microscope with phase contrast (Olympus BX51, Tokyo, Japan). The terminology used in the description follows that of Lindquist (1986). All measurements in the descriptions are given in micrometres for the holotype and five paratypes, if available (in parentheses). Details of the geographical position were recorded using a global positioning system (GPS model: eTrex).

The holotypes of the new species are deposited in the Acarological Collection, Department of Entomology, Faculty of Agriculture, Tarbiat Modares University, Tehran, Iran. One paratype of each species is deposited in the Zoological Institute, University of Hamburg, Hamburg, Germany. The insect hosts and the rest of the paratypes are retained with the holotype.

Systematics

Family **MICRODISPIDAE** Cross, 1965

Genus *Premicrodispus* Cross, 1965

Premicrodispus (Premicrodispus) paramaevi Hosseininaveh and Hajiqanbar sp. nov.
(Figures 1–5)

Description

Female. Length of idiosoma 181 (178–184), width 95 (91–97).

Gnathosoma (Figure 3A,B). Gnathosomal capsule about twice as long as its width, dorsally with two pairs of cheliceral setae ch_1 7 (7–8) and ch_2 9 (8–10); ventrally with one pair of subcapitular setae su 7 (7–9); palps short, terminated to small tibial claw, and compressed to gnathosomal capsule, with two pairs of setae, dFe 5 (4–5) and dGe 4 (3–4); cheliceral stylets indiscernible; pharyngeal system (Figure 3C) with three pumps, pumps 1 and 3 reduced, pump 2 large and striated.

Idiosomal dorsum (Figure 1). Prodorsal shield (PrS) with elongate stigmata and distinct tracheal system; all dorsal setae smooth and pointed; prodorsal shield with one pair of capitate trichobothria and one pair of setae sc_2 19 (16–19); all tergites smooth, tergite C with two pairs of setae c_1 22 (19–22) and c_2 24 (20–24); tergite D with one pair of setae d 29 (25–29) and one pair of rounded cupuli ia ; tergite EF with two pairs of setae e 21 (18–21) and f 25 (22–26), setae f longer than setae e ; tergite H with two pairs of setae h_1 21 (18–21), h_2 20 (16–20) and one pair of rounded cupuli ih ; Distances between dorsal idiosomal setae: sc_2 – sc_2 22 (22–23), c_1 – c_1 31 (27–31), c_2 – c_2 52 (52–58), d – d 13 (13–15), e – e 55 (48–55), e – f 13 (12–14), f – f 23 (23–26), h_1 – h_1 13 (13–14), h_1 – h_2 18 (13–18), h_2 – h_2 47 (40–47).

Figure 1. *Premicrodispus paramaevi* sp. nov., female. Dorsum of the body.

50µm

Figure 2. *Premicrodispus paramaevi* sp. nov., female. Venter of the body.

Figure 3. *Premicrodispus paramaevi* sp. nov., female. (A) Gnathosoma, dorsal view; (B) gnathosoma, ventral view; (C) pharyngeal pumps.

Idiosomal venter (Figure 2). Ventral plates smooth; all ventral setae smooth and pointed; apodemes 1 and 2 reaching to presternal apodeme (appr), sejugal apodeme (apsej) joined with appr, apodemes 3 extending beyond setae 3*a* and apodemes 4 reaching to setae 3*b*, apodeme 5 short; anterior border of poststernal plate concave and posterior border of poststernal plate tripartite; coxal field I with two pairs of setae 1*a* 14 (13–14) and 1*b* 14 (13–14); coxal field II with two pairs of setae 2*a* 19 (16–19) and 2*b* 17 (14–17); coxal field III with three pairs of setae 3*a* 14 (12–14), 3*b* 14 (13–14) and 3*c* 13 (10–13), setae 3*b*, 3*a* and 3*c* subequal; coxal field IV with three pairs of setae 4*a* 11 (10–11), 4*b* 18 (16–18) and 4*c* 14 (12–14); pseudoanal segment PS with two pairs of setae *ps*₁ 12 (11–12) and *ps*₃ 11 (10–11).

Figure 4. *Premicrodispus paramaevi* sp. nov., female. (A) Leg I; (B) leg II.

Legs. All legs five-segmented except leg I (four-segmented).

Leg I (Figure 4A). Setal formula: Tr1-Fe3-Ge4-TiTa15(4) (number of solenidia in parentheses). Tibiotarsus with solenidion ω_1 8 (7–8), ω_2 4 (4–5), φ_1 6 (6–6) and φ_2 3 (3–3), solenidia ω_1 , φ_1 and φ_2 finger-shaped and striated, ω_1 longer than φ_1 and φ_2 , solenidion ω_2 uniformly thin; with five eupathidial setae (p' , ft' , ft'' , tc' , tc''), setae tc' longer than tc'' , setae pv' longer than pv'' ; setae d longer than k , setae v'' longer than v' , setae l' longer than l'' ; genu with setae l' longer than other setae of the segment, setae v' and v'' subequal; femur with setae l' and v'' subequal and both shorter than d ; trochanter with seta v' .

Leg II (Figure 4B). Setal formula: Tr1-Fe3-Ge3-Ti4(1)-Ta6(1). Tarsus with solenidion ω 6 (6–7) finger-shaped, setae pv'' , pv' and pl'' subequal, setae u' shortest on this

Figure 5. *Premicrodispus paramaevi* sp. nov., female. (A) Leg III; (B) leg IV.

segment; tibia with a finger-shaped solenidion ϕ 4 (3–4), setae v' longer than v'' , setae v'' longer than d and l' ; genu with three setae, v' longer than l' and setae l' longer than l'' ; femur with seta d longer than v'' and setae v'' longer than l' ; trochanter with seta v' .

Leg III (Figure 5A). Setal formula: Tr1-Fe2-Ge2-Ti4(1)-Ta6. Tarsus with setae pl'' , pv' , pv'' , tc' and tc'' subequal, setae pv'' weakly barbed, setae u' shortest on this segment; tibia with solenidion ϕ 2 (2–3) and setae d , l' and v'' shorter than v' ; genu with seta l' weakly barbed and shorter than v' ; femur with setae d longer than v' ; trochanter with seta v' .

Leg IV (Figure 5B). Setal formula: Tr1-Fe2-Ge1-Ti4(1)-Ta6. Tarsus with seta tc' longer than tc'' and weakly barbed, setae pv' longer than pv'' , setae u' as long as pv'' , setae pl'' shortest on the leg; tibia with small solenidion ϕ 2 (1–2), setae v'' , v' and l'

subequal and almost two times shorter than d , setae d and v' weakly barbed; genu with seta v' as long as femoral seta v' ; femur with setae d about two times longer than v' ; trochanter with seta v' .

Male and larva unknown.

Differential diagnosis

The new species is distinguished from congeners by having two pairs of cheliceral setae, rounded cupuli and reduced pump 3 of pharyngeal system. On the other hand, due to presence of setae $4a$, absence of setae ps_2 and subequal setae ps_1 and ps_3 , the new species is similar to *Premicrodispus parasilvestris* (Rack, 1974) but differs from it by setae d distinctly longer than distance between their bases (setae d distinctly shorter than distance between their bases in *P. parasilvestris*). The new species is similar to *Premicrodispus dzumaevi* (Sevastianov and Chydyrov, 1991) because of setae d distinctly longer than distance between their bases but differs from it by subequal setae ps_1 and ps_3 (setae ps_1 distinctly longer than ps_3 in *P. dzumaevi*). The new species is also similar to *Premicrodispus lambi* (Krczal, 1964) but differs from it by setae sc_2 shorter than distance between their bases (setae sc_2 longer than distance between their bases in *P. lambi*), by setae d longer than distance between their bases (setae d shorter than distance between their bases in *P. lambi*), by setae f subequal to distance between their bases (setae f as half as distance between their bases in *P. lambi*), by setae h_1 longer than distance between their bases (setae h_1 shorter than distance between their bases in *P. lambi*) and by shorter setae in coxal fields I–IV (longer setae in coxal fields I–IV in *P. lambi*).

Type material

Three females found in a vial containing the beetle *Lucanus ibericus* (Col.: Lucanidae) in 75% ethanol. The host beetle was collected in Naharkhoran forest, Golestan province, northern Iran, 36.46° N, 54.27° E, altitude 450 m., coll. V. Rahiminejad, 27 July 2010.

Etymology

The name of the new species '*Paramaevi*' is derived from combination of two species names *parasilvestris* and *dzumaevi*, two species that are most similar to the new species.

***Premicrodispus spinosus* Hosseininaveh & Hajiqanbar sp. nov.**
(Figures 6–10)

Description

Female. Length of idiosoma 152 (152–156), width 80 (74–88).

Gnathosoma (Figure 8A,B). Gnathosomal capsule about twice as long as its width, dorsally with one pair of cheliceral setae ch 3 (3–3); ventrally with one pair of

Figure 6. *Premicrodispus spinosus* sp. nov., female. Dorsum of the body.

Figure 7. *Premicrodispus spinosus* sp. nov., female. Venter of the body.

Figure 8. *Premicrodispus spinosus* sp. nov., female. (A) Gnathosoma, dorsal view; (B) gnathosoma, ventral view; (C) pharyngeal pumps.

subcapitular seta *su* 5 (4–5); palps short, terminated to small tibial claw, and compressed to gnathosomal capsule, with two pairs of setae, *dFe* 3 (3–4) and *dGe* 4 (3–4), cheliceral stylets indiscernible; pharyngeal system (Figure 8C) with three pumps, pump 1 reduced, pump 2 the largest and striated, pump 3 small and rounded.

Idiosomal dorsum (Figure 6). Stigmata oval-shaped and situated in anterior part of prodorsal shield; all dorsal setae smooth and pointed except setae *d*, *f* and *h*₁, which are blunt-ended; prodorsal shield with one pair of capitate trichobothria

Figure 9. *Premicrodispus spinosus* sp. nov., female. (A) Leg I; (B) leg II.

and one pair of setae sc_2 19 (18–19); all tergites smooth, tergite C with two pairs of setae c_1 11 (11–13) and c_2 15 (13–15), setae c_2 longer than c_1 , posterior border of tergite C with distinct median depression; tergite D with seta d 9 (9–10) and one pair of rhombic cupuli ia , posterior border of tergite D with distinct median depression; tergite EF with two pairs of setae e 10 (10–11) related to one thin apodeme and f 10 (10–11); tergite H with two pairs of setae h_1 10 (10–11), h_2 11(11–12) and one pair of rhombic cupuli ih . Distances between dorsal idiosomal setae: sc_2 – sc_2 26 (25–26), c_1 – c_1 25 (25–26), c_2 – c_2 57 (50–60), c_1 – c_2 17 (17–20), d – d 24 (24–26), e – e 41 (41–44), e – f 5 (5–6), f – f 31 (31–35), h_1 – h_1 12 (11–13), h_1 – h_2 12 (11–12), h_2 – h_2 36 (36–39).

Figure 10. *Premicrodispus spinosus* sp. nov., female. (A) Leg III; (B) leg IV.

Idiosomal venter (Figure 7). Ventral plates smooth; all ventral setae smooth and pointed; apodemes 1 and 2 reaching to *appr*, *appr* not reaching to *apsej*, apodemes 3 extending beyond bases of setae *3a*, apodemes 4 short and not reaching to bases of setae *3b*, apodemes 5 short; anterior border of poststernal plate convex and posterior border of poststernal plate tripartite; coxal field I with two pairs of setae *1a* 10 (9–10) and *1b* 10 (10–11); coxal field II with two pairs of setae *2a* 11 (11–12) and *2b* 14 (13–15), *2b* longer than *2a*; coxal field III with three pairs of setae *3a* 10 (9–10), *3b* 7 (7–8) and *3c* 7 (7–10), *3b* and *3c* subequal and shorter than *3a*; coxal field IV with two pair of setae *4b* 8 (8–9) and *4c* 7 (7–8); pseudanal segment PS with three pairs of setae *ps*₁ 11 (10–11), *ps*₂ 6 (5–6) and *ps*₃ 18 (16–18), *ps*₃ distinctly longer than *ps*₁ and *ps*₂.

Legs. Leg chaetotaxy as in previous species.

Leg I (Figure 9A). Tibiotarsus with solenidia ω_1 5 (4–5), ω_2 1 (1–2), ϕ_1 2 (1–2), and ϕ_2 4 (3–4), all finger shaped, ω_1 and ϕ_1 striated, with five eupathidial setae (p'' , ft' , ft'' , tc' , tc''), setae tc' longest on leg I, setae pl'' and pl' subequal, setae pv' longer than pv'' , setae v'' longer than v' , setae l' and l'' subequal; genu with setae l'' , l' , v' and v'' , all subequal; femur with setae d and v'' subequal and both longer than l' ; trochanter with seta v' .

Leg II (Figure 9B). Tarsus with solenidion ω 3 (2–3) finger shaped, pl'' modified and spine-like, the rest of setae of the segment subequal; tibia with a small finger-shaped solenidion ϕ 2 (1–2), setae l' modified and spine-like, setae d longer than v' and v'' ; genu with setae, l'' and v' subequal and longer than l' ; femur with setae d longer than l' and v'' ; trochanter with seta v' .

Leg III (Figure 10A). Tarsus with modified and spine-like setae pl'' and tc' , setae tc'' longest setae on the leg, setae pv'' and pv' subequal and shorter than u' ; tibia with a small solenidion ϕ 2 (1–2) and setae d modified and spine-like, seta v'' and v' subequal and longer than l' ; genu with setae l' and v' subequal; femur divided into basifemur and telofemur, setae d and l' inserted on telofemur, setae d longer than l' ; trochanter with seta v' .

Leg IV (Figure 10B). Tarsus with subequal setae pl'' , pv' and pv'' , setae u' and tc'' subequal, seta tc' longest on the segment; tibia with small solenidion ϕ 1 (1–1), seta d and v' subequal and longer than l' and v'' ; genu with seta v' as long as femoral seta v' ; femur divided into basifemur and telofemur, setae d and v' inserted on telofemur, seta d longer than v' ; trochanter with seta v' .

Male and larva unknown.

Differential diagnosis

The new species is readily distinguished from other species of the genus by some spine-like setae on tarsi and tibiae II and III. Other species of the genus *Premicrodispus* have unmodified setae on these segments. Disregarding this character, the new species is similar to *Premicrodispus tenuisetus* Khaustov, 2006 but differs from it by setae d blunt and not extending to posterior border of tergite D (seta d pointed and extending to posterior border of tergite D in *P. tenuisetus*) and setae f and h_1 blunt (setae f and h_1 pointed in *P. tenuisetus*).

Type material

Five females found in a vial containing the beetle *Corticeus unicolor* (Col: Tenebrionidae) in 75% ethanol. The host beetle was collected from oak trees in Naharkhoran forest, Golestan province, northern Iran, 36.46° N, 54.27° E, and altitude 450 m., coll. V. Rahiminejad, 30 July 2010.

Etymology

The species epithet refers to some spine-like setae on tarsi and tibiae II and III.

**Key to subgenera and Palearctic species of the genus *Premicrodispus* (females)
(modified from Khaustov 2006)**

1. Genu I with four setae, genu II with three setae 2
 - Genu I with three setae, genu II with one seta subgenus *Premicrodispulus*, *P. reductus* Khaustov and Chydyrov, 2010
2. Coxal fields I with two pairs of setae, pharyngeal pump 2 much longer than pharyngeal pump 3 subgenus *Premicrodispus* 3
 - Coxal fields I with one pair of setae, pharyngeal pump 2 distinctly shorter than pharyngeal pump 3 subgenus *Premicrodispoides*, *P. punctatus* Khaustov and Maslov, 2013
3. Setae 4a present 4
 - Setae 4a absent 8
4. Setae ps_2 present *P. stenops* (Mahunka, 1969)
 - Setae ps_2 absent 5
5. Bases of setae f associated with well-developed apodeme *P. lineatus* (Mahunka, 1986)
 - Apodemes associated with bases of setae f absent 6
6. Setae ps_1 distinctly longer than ps_3 *P. dzumaevi* (Sevastianov and Chydyrov, 1991)
 - Setae ps_1 and ps_3 subequal in length 7
7. Setae d distinctly longer than distance between their bases, bases of setae e without apodemes *P. paramaevi* sp. nov.
 - Setae d distinctly shorter than distance between their bases, bases of setae e with apodemes *P. parasilvestris* (Rack, 1974)
8. Setae ps_2 present 9
 - Setae ps_2 absent 12
9. Setae h_2 distinctly shorter than h_1 *P. akermanae* (Sevastianov and Zahida Al Douri, 1988)
 - Setae h_2 subequal or longer than h_1 10
10. Setae h_1 much shorter than h_2 , pseudanal setae distinctly shorter than setae of posterior sternal plate *P. subvarsoviensis* (Mahunka and Zyromska-Rudska, 1975)
 - Setae h_1 and h_2 subequal, pseudanal setae and setae of posterior sternal plate subequal 11
11. Setae h_1 , d and f blunt-ended, tarsi and tibiae II and III with spine-like setae..... *P. spinosus* sp. nov.
 - Setae h_1 , d and f pointed, tarsus and tibia III with setiform setae *P. tenuisetus* Khaustov, 2006

12. Setae sc_2 and d subequal 13
 - Setae sc_2 distinctly longer than d 16
13. Tergites C and D with distinct emarginations in central part
 - *P. incisus* Khaustov and Chydyrov, 2010
 - Tergites C and D without distinct emarginations in central part 14
14. Setae ps_1 and ps_3 subequal in length 15
 - Setae ps_3 distinctly longer than ps_1
 - *P. heterocaudatus* Khaustov and Chydyrov, 2010
15. Setae f short and distinctly not reaching to posterior margin of the body
 - *P. acutisetus* Khaustov, 2009
 - Setae f long and protruding the posterior margin of the body
 - *P. longisetosus* (Mahunka, 1970)
16. Setae ps_3 distinctly longer than ps_1 17
 - Setae ps_1 and ps_3 subequal in length 18
17. Tarsus III with well-developed solenidion
 - *P. paradoxus* Khaustov and Chydyrov, 2010
 - Tarsus III without well-developed solenidion *P. longicaudus* Khaustov, 2006
18. Anterior margin of posterior sternal plate distinctly convex 19
 - Anterior margin of posterior sternal plate straight
 - *P. kaliszewskii* Khaustov, 2006
19. Bases of setae e associated with well-developed apodemes 20
 - Apodemes associated with bases of setae e absent or vestigial 21
20. Setae sc_2 and c_1 subequal, setae c_2 and c_1 situated almost at the same level
 - *P. rackae* Khaustov, 2006
 - Setae sc_2 distinctly longer than c_1 , setae c_2 situated distinctly anterior to c_1
 - *P. brevisetus* Khaustov, 2006
21. Setae e shorter than setae f 22
 - Setae e longer than setae f *P. krczali* Khaustov, 2006
22. Setae c_1 and e blunt ended *P. obtusisetosus* Khaustov and Chydyrov, 2010
 - Setae c_1 and e pointed 23
23. All dorsal setae long and barbed *P. karadagensis* Khaustov, 2009
 - Dorsal setae short and usually smooth *P. montanus* Khaustov, 2006

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References

- Hajiqaanbar H, Rahiminejad V, Fathipour Y. 2012. New insect host records for mites of the family Microdispidae (Acari: Heterostigmatina), with description of a new species of the genus *Paramicrodispus*. Entomol Sci. 15: 309–313. doi:10.1111/j.1479-8298.2012.00515.x

- Kaliszewski M, Athias-Binche F, Lindquist EE. 1995. Parasitism and parasitoidism in Tarsonemina (Acari: Heterostigmata) and evolutionary considerations. *Adv Parasit.* 35:335–367. doi:[10.1016/S0065-308X\(08\)60074-3](https://doi.org/10.1016/S0065-308X(08)60074-3)
- Khaustov AA. 2006. A review of the genera *Premicrodispus* Cross, 1965 and *Dolichodispus* gen. nov. (Acari: Microdispidae) of Crimea. *Acarina.* 14:155–174.
- Khaustov AA. 2008. Mites of the family Scutacaridae of Eastern Palaearctic. Kiev: Akademperiodyka; 291 pp.
- Khaustov AA. 2009. A new genus and three new species of the family Microdispidae (Acari: Heterostigmata) from Crimea. *Acarina.* 17:65–73.
- Khaustov AA, Chydyrov P. 2010. Five new species and a new subgenus of *Premicrodispus* mites (Acari: Heterostigmata, Microdispidae) from Turkmenistan. *Zoologicheskyy Zhurnal.* 5:1–13. Russian.
- Khaustov AA, Maslov SI. 2013. A new subgenus and species of the genus *Premicrodispus* (Acari: Heterostigmata: Microdispidae) from Crimea. *Acarina.* 21:91–95.
- Krczal H. 1964. *Pygmephorus lambi*, eine neue Pyemotide aus Champignonkulturen. *Zool Anz.* 172:318–322.
- Lindquist EE. 1986. The world genera of Tarsonemidae (Acari: Heterostigmata): a morphological, phylogenetic and systematic revision with a reclassification of family-group taxa in the Heterostigmata. *Mem Entomol Soc Canada.* 118:1–517. doi:[10.4039/entm118136fv](https://doi.org/10.4039/entm118136fv)
- Mahunka S. 1969. 176. Pyemolidae and Scutacaridae IV. *Ergebnisse der zoologischen Forschungen von Dr. Z. Kaszab in der Mongolei* (Acari). *Reichenbachia.* 12:83–112.
- Mahunka S. 1970. Considerations on the systematics of the Tarsonemina and the description of new European taxa (Acari: Trombidiformes). *Acta Zool Hung.* 16:137–174.
- Mahunka S, editor. 1986. Tarsonemids of the Kiskunság National park (Acari). In: *The Fauna of the Kiskunság National park*. Budapest: Akademiai Kiado; p. 435–455.
- Mahunka S, Zyromska-Rudska H. 1975. Two new tarsonemid mites from Poland (Acari: Tarsonemida). *Folia Ent Hung.* 282:295–299.
- Rack G. 1974. Neue und bekannte Milbenarten der Überfamilie Pygmephoroida aus dem Saalkreis bei Halle (Acarina, Tarsonemida). *Ent Mitt Zool Mus Hamburg.* 4:499–521.
- Sevastianov VD, Chydyrov PR. 1991. New mite species of family Pygmephoridae (Trombidiformes) from the cotton-growing Biocenosis. *Zool Zh.* 70:134–139. Russian.
- Sevastianov VD, Zahida Al Douri ND. 1988. New species of mites of cohort Tarsonemina (Trombidiformes) from wheat plantations. *Zool Zh.* 67:1080–1083. Russian.
- Zhang ZQ, Fan QH, Pesic V, Smit H, Bochkov AV, Khaustov AA, Baker A, Wohltmann A, Wen TH, Amrine JW, et al. 2011. Order trombidiformes Reuter, 1909. In: Zhang ZQ, editor. *Animal biodiversity: an outline of higher-level classification and survey of taxonomic richness*. 3148. Auckland: Zootaxa; p. 129–138.