

First record of *Floridotarsonemus* from Russia (Acari: Heterostigmata: Tarsonemidae) with a new species description

Kirill A. Mashkov^a, Alexander A. Khaustov^a, Anton A. Goncharov^b

^a Tyumen State University, 6 Volodarskogo Str., 625003 Tyumen, Russia.

^b A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Leninsky pr. 33, 119071 Moscow, Russia.

Original research

ABSTRACT

A new species, *Floridotarsonemus humeophilus* n. sp. (Acari: Trombidiformes: Tarsonemidae) is described based on females collected on the winter wheat field soil from European Russia (Krasnodar Krai). This is the first record of the genus *Floridotarsonemus* from Russia. A key to species of the genus *Floridotarsonemus* is also provided.

Keywords Heterostigmata; Tarsoneminae; systematics; morphology; key; soil

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Introduction

The family Tarsonemidae represents one of the largest groups in the mite cohort Heterostigmata (Acari: Trombidiformes) and currently includes 47 genera and more than 600 described species (Khaustov et al 2022; Khaustov et al 2021; Khaustov and Abramov 2017; Lofego et al 2016; Mondal and Karmakar 2021; Seeman et al 2018; Zhang *et al.* 2011). Tarsonemid mites have very broad trophic preferences, they are phytophagous, mycophagous, insect parasites, parasitoids, and egg predators of mites and insects (Lindquist 1986). Some representatives of Tarsonemidae can cause significant damage to cultivated plants, for example, *Polyphagotarsonemus latus*, *Phytonemus pallidus*, and mushroom farms can be attacked by *Tarsonemus myceliophagus* (Hussey 1963, Lindquist 1986). Representatives of the family Tarsonemidae can be found in soil, forest litter, on various plants as phytophagous mites or trees as cohabitants feeding on fungi (Suski 1972), and on insects as parasites or phoretically dispersed species (Lindquist 1986).

The genus *Floridotarsonemus* was described by Attiah (Attiah 1970). Lindquist (1986) placed *Floridotarsonemus* into the genus *Tarsonemus* as a subgenus. Later Ochoa *et al.* (1991) shifted its status to the genus level. At present the genus *Floridotarsonemus* comprises five described species:

1. *Floridotarsonemus evodiae* Ito, 1964 was discovered in Japan (Honshu Island), and found on *Tetradium ruticarpum* (A.Juss.) T.G.Hartley (syn. *Evodia rutaecarpa*) (Ito 1964). It was later found in Korea (Cho *et al.* 1995) on *Ilex serrata* Thumb. (Chungju) and on *Camellia japonica* L. (Naju).
2. *Floridotarsonemus scaber* Attiah, 1970 was found on “whitefly fungus” on citrus leaves in Florida (Attiah 1970).
3. *Floridotarsonemus edule* Ochoa *et al.*, 1991 was found on *Sechium edule* (Jacq.) Sw. in Costa Rica (Ochoa *et al.* 1991).

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Corresponding author
Kirill A. Mashkov[✉]:
m-mashkovs@yandex.ru

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4. *Floridotarsonemus kukri* Mondal and Karmakar, 2021 was found on leaves of *Rhododendron indicum* (L.) Sweet and *Cinchona officinalis* L. in West Bengal, India (Mondal and Karmakar 2021).
5. *Floridotarsonemus kanthali* Mondal and Karmakar, 2021 was found on leaves of *Artocarpus heterophyllus* Lam. in West Bengal, India (Mondal and Karmakar 2021).

This article presents the first record of the genus *Floridotarsonemus* in Russia with a description of a new species from Krasnodar Krai.

Material and methods

The mites were collected using a Tullgren funnel from the meadow-chernozem soil of the Krasnodar Krai in field of winter wheat cultivation. The terminology follows that of (Lindquist 1986), except the ventral subcapitular seta is labelled as *m* (Grandjean 1944). All measurements are given in micrometers (μm) for the holotype and five paratypes (in parentheses). Mite morphology was studied using Carl Zeiss AxioImager A2 compound microscope with phase contrast and differential-interference contrast (DIC) illumination. Photomicrographs were taken with an AxioCam 506 color digital camera. Photos were merged with Helicon Focus. Vector drawings were prepared based on layered photos in Adobe Photoshop CS2 version.

Results

Systematics

Family Tarsonemidae Canestrini and Fanzago, 1877

Subfamily Tarsoneminae Canestrini and Fanzago, 1877

Tribe Tarsonemini Canestrini and Fanzago, 1877

Genus *Floridotarsonemus* Attiah, 1970

Type species: *Floridotarsonemus scaber* Attiah, 1970, by original designation

Diagnosis — To assign the new species to the genus *Floridotarsonemus*, we followed the diagnosis of Lindquist (1986). He proposed the following features of female: femurogenu and tibia of leg III immovably connected, thin-walled pump, enlarged pharynx occupying one-third of the gnathosomal capsule, setae *sc*₂ inserted on anterior half of prodorsal shield. As can be seen (Fig. 1A), the description of the presented species does not comply with the latter feature because setae *sc*₂ are located in the middle of prodorsal shield. It should be noted that approaches to the system of allocation to the genus *Floridotarsonemus* have changed over time and at the moment there are diagnostic approaches available by Ochoa *et al.* (1991) and Mondal and Karmakar (2021). The features of the new species fit to the diagnoses provided by above mentioned authors, with the exception of the narrow gnathosomal capsule. Despite some contradictions, we thus consider this species belongs to the genus *Floridotarsonemus*.

Differential diagnosis — The female of this new species differs from all species of *Floridotarsonemus* in having an unusually narrow gnathosomal capsule about 1.5 times longer than its width. (vs. gnathosomal capsule with subequal length and width in other species). The new species is most similar to *F. scaber* in having seta *pl*'' in the distal position to solenidion ω on tarsus II. The new species differs from *F. scaber* in having extended laterally apodeme 3, shorter setae *c*₂ 14–18 (vs. 22–24 in *F. scaber*), shorter setae *e* 7–9 and *h* 5–6 (vs. setae *e* and *h* 11 in length in *F. scaber*), and setae *h* more bluntly pointed than other dorsal setae (vs. tips of setae *h* not differ from other dorsal setae in *F. scaber*).

***Floridotarsonemus humeophilus* n. sp.**

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(Figs 1–5)

Female — *Gnathosomal capsule* (Figs 2A, B, 3A) subtriangular in shape, 1.5 times longer than wide, connected with idiosoma with membranous cuticle. Length of gnathosomal capsule 28 (28–30), width 18 (15–20). Palpcoxal setae (*pp*) 9 (9–12) present laterally. Dorsal gnathosomal setae (*ch*) 13 (12–14) smooth, simple. Palpi short 10 (9–10), with tiny setae (*dGE*) and round inconspicuous process on distal extremity. Ventral gnathosomal setae (*m*) 12 (10–14) smooth and pointed. Cheliceral stylets 8 (7) and their levers short. Pharynx medium, muscular, with thin walls, width of pharynx 5 (5–6) occupies 1/3 part of gnathosomal width (Fig. 3A). *Idiosomal dorsum* (Figs 1A, 3C, D). Prodorsal shield expanded laterally. Stigmata small, round, located partially under prodorsal shield; trachea long, thin and narrow, without sclerotized sacks. Bothridia present, trichobothria (*sc*₁) clearly elongated, pilose, almost completely covered by prodorsal shield. Alveolar pits *v*₂ located at the same distance from both bases of setae *v*₁ and *sc*₂. All tergites with regular tiny puncta and delicate striation near posterior margin. Each tergite with smooth posterior margins. All dorsal setae smooth; setae *h* weakly blunt-tipped, other setae pointed. Lengths of dorsal setae: *v*₁ 15 (16–21), *sc*₂ 26 (26–28), *c*₁ 14 (12–15), *c*₂ 16 (14–18), *d* 9 (9–11), *e* 7 (7–9), *f* 12 (11–13), *h* 6 (5–6). Distances between setae: *v*₁–*v*₁ 31 (32–33), *v*₂–*v*₂ 41 (40–42), *sc*₂–*sc*₂ 51 (46–50), *c*₁–*c*₁ 78 (76–82), *c*₂–*c*₂ 104 (100–107), *c*₁–*c*₂ 31 (29–33), *d*–*d* 39 (36–41), *e*–*e* 70 (67–72), *e*–*f* 30 (25–31), *f*–*f* 17 (15–22), *h*–*h* 37 (33–38).

Idiosomal venter (Figs 1B, 3A, B). All ventral plates with tiny uniform puncta. Prosternal

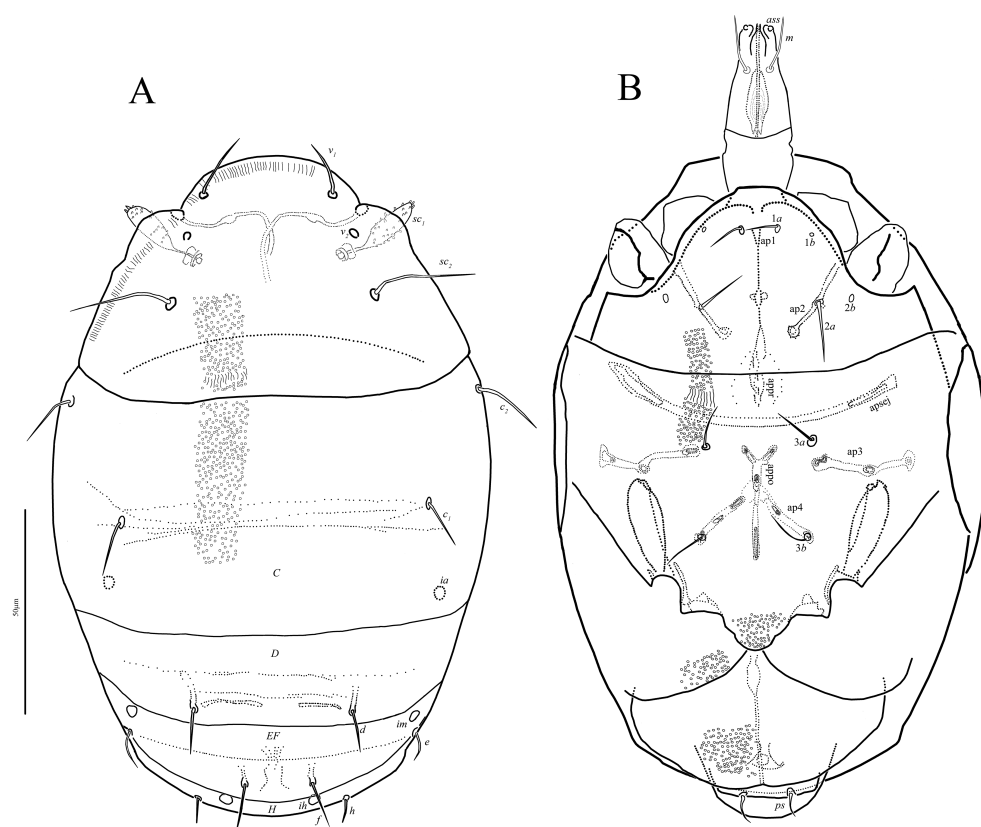


Figure 1 *Floridotarsonemus humeophilus* n. sp., female: A – dorsum of body, B – venter of body. Legs are omitted.

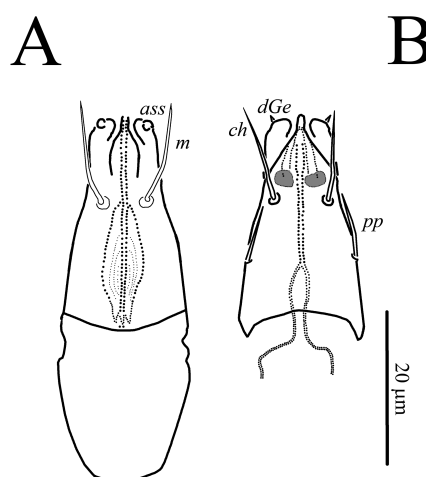


Figure 2 *Floridotaronemus humeophilus* n. sp., female: A – gnathosoma, ventral aspect, B – gnathosoma, dorsal aspect.

apodeme (appr) distally with small y-shaped bifurcation and nodule in middle part, not fused with sejugal apodeme (apsej). Apodemes 2 (ap2) not fused with prosternal apodeme (appr), with two nodules: one in the middle part, other at the end. Sejugal apodeme indistinct, continuous. All ventral setae smooth and pointed. Lateral ends of apodemes 3 (ap3) extended laterally, apodemes 3 with three nodules. Apodeme 4 (ap4) with nodules, anterior ends of apodemes not fused with poststernal apodeme (appo). Posterior ends of ap 4 reach base of setae 3b. Tegula 6 (5–7) long, 13 (13–15) wide, with slightly convave sides. Posterior sternal plate with angular sharp process between trochanter III and IV. Length of ventral setae: 1a 8 (8–9), 2a 13 (13–14), 3a 11 (11–13), 3b 12 (9–12), ps 8 (7–9). Width of tegula 13 (13–15), length of tegula 6 (5–7).

Legs (Figs 4A–E, 5A, B, 3A, B). Chaetotaxy (including unguinal setae u' , u'' on tibiotarsus I and u'' on tarsi II and III) of leg I: Fe4–Ge4–TiTa6(2 ϕ) + 10(1 ω); leg II: Fe3–Ge3–Ti4–Ta7(1 ω); leg III: FeGe1+3–Ti4–Ta6; leg IV: FeGe1+1–TiTa1+1. Length of legs: I 47 (48–53), II 48 (45–46), III 43 (41–43), IV 28 (22–24). Leg I (Figs 4A, B). Femur with flange (Fig. 4B). Solenidion ω elongated, digitiform; solenidia $\phi 1$ and $\phi 2$ clublike and elongate; seta k 3 (3–4) baculiform, slightly shorter than solenidion $\phi 1$. Lengths of solenidia: ω 5 (5–6), $\phi 1$ 5 (5), $\phi 2$ 3 (2–3). Setae: l'' , l' , and d of femur barbed and blunt-tipped; seta v'' pointed and barbed. Seta l' of genu barbed and blunt-tipped, other setae pointed and barbed. Setae d , pv'' of tibiotarsus smooth and pointed, seta s spiniform, eupathidia (p' , p'' , tc' , tc'') smooth and blunt-tipped, other setae pointed and barbed. Leg II (Figs 4C–E). Solenidion ω 6 (5–6) elongated, digitiform. Femur with distinct flange (Fig. 4E). Tibia with characteristic sharp process. (Fig. 4D). Seta d of femur smooth, stout, blunt-tipped; seta l' blunt-tipped, stout, barbed; seta v'' pointed and barbed. All setae of genu barbed and pointed. Tibia setae v'' , l' , and v' pointed and barbed; seta d smooth and pointed. Tarsus setae tc' , tc'' , pv' pointed and barbed; seta pv'' pointed and smooth; seta pl'' spiniform and located distally from solenidion ω close to base of seta tc'' ; seta u' smooth, spiniform, u'' very small, pointed and smooth. Leg III (Fig. 5A). Setae $v'Fe$ of femorogenu smooth, blunt-tipped; seta $v'Ge$ barbed and pointed; setae $l''Ge$ and $l'Ge$ smooth and pointed. All tibial setae weakly barbed and pointed. Tarsal setae tc' and pv'' barbed and pointed; setae tc'' , pv' , and u'' smooth and pointed; seta u' smooth, blunt, stout. Leg IV. (Fig. 5B). All setae smooth and pointed; measurements: $v'Fe$ 6 (6–8), $v'Ge$ 7 (8–10), $v'Ti$ 11 (11–13), tc'' 42 (43–45).

Males and juvenile stage are unknown.

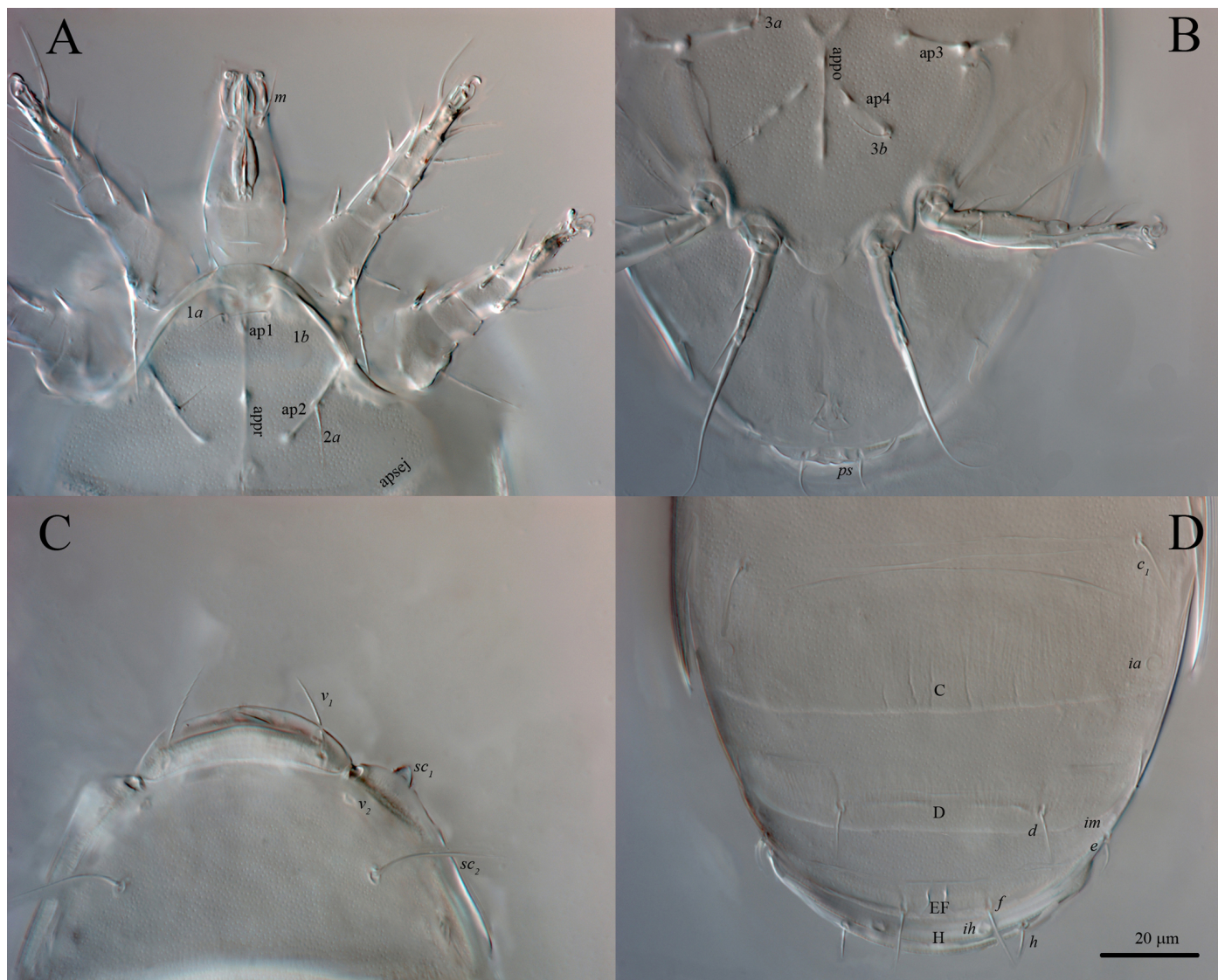


Figure 3 DIC micrographs of *Floridotarsonemus humeophilus* n. sp., female: A – gnathosome, pharynx and anterior coxisternal plate, B – posterior coxisternal plate and opisthosomal venter, C – prodorsum, D – tergites.

Type material — Female holotype, Slide ZISP T-Tar-003, Krasnodar Krai, vicinity of the city of Krasnodar, winter wheat field, extracted from soil, 6 April 2022, coll. A.A. Goncharov. Paratypes: 8 females, same data.

Type deposition — The holotype and one paratype are deposited in ZISP (Zoological Institute of Russian Academy of Science, St. Petersburg, Russia); other paratypes are deposited in the collection of the TSUMZ (Tyumen State University Museum of Zoology, Tyumen, Russia).

Etymology — The name of the species is a combination of two words, Latin *humus* meaning *soil* and Greek *φίλος* meaning *love* and refers to the soil habitat in contrast to plant habitats of other *Floridotarsonemus* species.

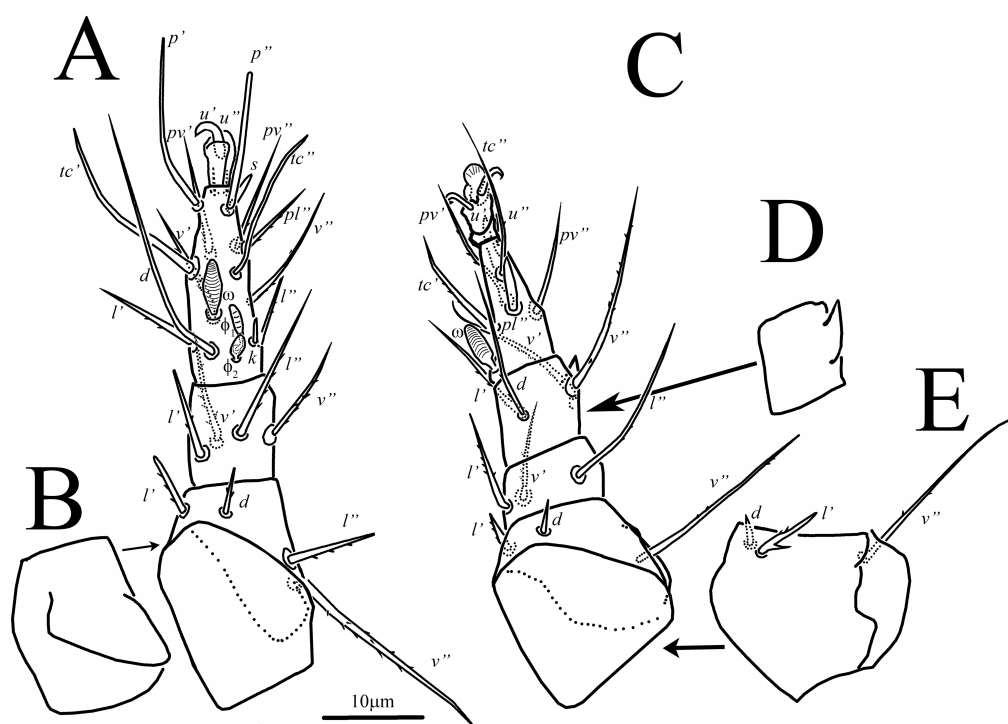


Figure 4 *Floridotaronemus humeophilus* n. sp., female: A – right leg I, dorsal aspect, B – ventral view of femur I (setae are omitted), C – right leg II, dorsal aspect, D – ventral view of genu II (setae are omitted), E – ventral view of femur II (from paratype, with all setae).

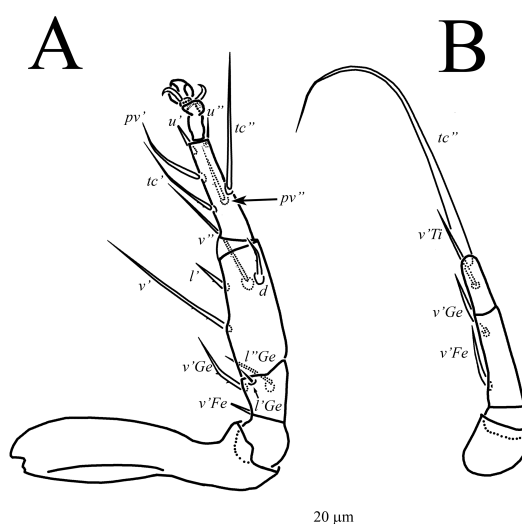


Figure 5 *Floridotaronemus humeophilus* n. sp., female: A – right leg III, dorsal aspect, B – right leg IV, dorsal aspect.

Keys to the world species of *Floridotarsonemus* (based on females)

1. Poststernal apodeme bifurcated anteriorly, tegula with posterior margin rounded and often extended beyond the margin of trochanter IV 2
 — Poststernal apodeme blunt anteriorly, tegula with posterior margin truncated confined within the margin of trochanter IV *F. evodiae*
2. Idiosomal setae *d* and *f* thin, pointed 3
 — Idiosomal setae *d* and *f* needle-like, blunt-tipped *F. kukri*
3. Gnathosomal capsule subequally as wide as long 4
 — Gnathosomal capsule narrow, ratio length/width 1.5 *F. humeophilus* **n. sp.**
4. Seta *pl*" of tarsus II located clearly anteriad base of solenidion ω 5
 — Seta *pl*" of tarsus II located at the same level as solenidion ω *F. edule*
5. Seta *pl*" of tarsus II distinctly shorter than solenidion ω and located much closer to solenidion than to seta *tc*" *F. kanthali*
 — Seta *pl*" of tarsus II subequal in length with solenidion ω and located near the base of seta *tc*" *F. scaber*

Discussion

Floridotarsonemus humeophilus **n. sp.** is the first species among the genus *Floridotarsonemus*, which was found in soil (meadow-chnozem). All previously described species of this genus were found only on various plants. A narrow gnathosomal capsule (length greater than width) is an uncharacteristic feature for the genus *Floridotarsonemus*, but is often found in the genus *Tarsonemus*.

The authors who described the species of the genus *Floridotarsonemus* did not mention possible damage to the plants caused by the mites. A study of the fauna of the tribe Tarsonemini of West Bengal, where the genus *Floridotarsonemus* was found on different plants, did not show strict specificity to the host plants and concluded that the mites probably feed on epiphytic fungi (Mondal *et al.* 2023). Unfortunately, at the moment there are no studies considering the food preferences of the genus *Floridotarsonemus*. If *Floridotarsonemus humeophilus* prefers fungi for nutrition, then probably this can explain its presence in the soil, an environment with a large abundance and variety of fungi.

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ORCID

Kirill A. Mashkov  <https://orcid.org/0009-0003-4954-1553>

Alexander A. Khaustov  <https://orcid.org/0000-0002-0306-112X>

Anton A. Goncharov  <https://orcid.org/0000-0003-3017-4557>

References

- Attiah, H.H. 1970 . New Tarsonemid Mites Associated with Citrus in Florida (Acarina: Tarsonemidae). Fla. Entomol., 53(4): 179-201. <https://doi.org/10.2307/3493188>
- Canestrini, G., Fanzago, F. 1877. Intorno agli Acari italiani. Atti - R. ist. veneto sci. lett. arti, Series 5, 4, 69-208. (Prospetto repaginaion: 1-140), 6 pl.
- Cho, M., Kwak, Y., Lee, W. 1995 . Study on the tarsonemid mites (Acari: Tarsonemidae) from Korea. II. Four unrecorded species of *Tarsonemus*. Korean J. Appl. Entomol., 34(2): 127-131.
- Grandjean, F. 1944 . Observations sur les Acariens de la famille des Stigmaeidae. Arch. Sci. phys. natur. (26): 103-131.
- Hussey, N.W. 1963. A new species of *Tarsonemus* (Acarina: Tarsonemidae) from cultivated mushrooms. Acarologia, 5: 540-544
- Ito, Y. 1964 . Descriptions of eight tarsonemid mites from Japan. Jpn. J. Appl. Entomol. Zool., (8): 34-44. <https://doi.org/10.1303/jjaez.8.34>
- Khaustov, A.A., Abramov V.V. 2017 . A new genus and species of Tarsonemidae (Acari: Heterostigmata) associated with *Aradus betulae* (Heteroptera: Aradidae) from European Russia. Acarologia, 57(4): 1079-1087. <https://doi.org/10.24349/acarologia/20174220>
- Khaustov, A.A., Fjellberg, A., Lindquist, E.E. 2022 . A new genus and species of Pseudotarsonemoidini (Acari: Heterostigmata: Tarsonemidae) associated with xylophagous gall midges in Norway. Syst. Appl. Acarol., 27(6): 1020-1034. <https://doi.org/10.11158/saa.27.6.4>
- Khaustov, A.A., Petrov, A.V., Kolesnikov, V.B. 2021 . A new genus and two new species of Tarsonemidae (Acari: Heterostigmata) associated with bark beetles (Coleoptera: Curculionidae: Scolytinae) from Peru. Zootaxa, 4966(1): 41-53. <https://doi.org/10.11646/zootaxa.4966.1.4>
- Lindquist, E.E. 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. Can., 118: 1-517. <https://doi.org/10.4039/entm118136fv>
- Lofego, A.C., Pitton, T., Rezende, J.M. 2016 . A new genus and new species of Tarsonemidae (Acari: Heterostigmata) from the Brazilian rainforests. Syst. Appl. Acarol., 21(3): 307-319. <https://doi.org/10.11158/saa.21.3.6>
- Mondal, P., Karmakar, K. 2021. Taxonomic notes on genus *Floridotarsonemus* (Acari: Tarsonemidae) with a description of two new species from West Bengal, India and keys to the world species. Syst. Appl. Acarol., 26(6): 1109-1125. <https://doi.org/10.11158/saa.26.6.8>
- Mondal, P., Karmakar, K., Ganguly M., Chatterjee D., Ghosh S.Kr. 2023 . Diversity and host specialization of Tarsonemini mites (Acari, Tarsonemidae)-Investigations in the agroclimatic zones of West Bengal, Eastern India. J. Insect Biodivers. Syst., 9(2): 265-282.
- Ochoa, R., Smiley, R.L., Saunders, J.L. 1991 . The Family Tarsonemidae in Costa Rica (Acari: Heterostigmata). Int. J. Acarol., 17(1): 41-86. <https://doi.org/10.1080/01647959108683885>
- Seeman, O.D., Lindquist, E.E., Husband R.W. 2018 . A new tribe of tarsonemid mites (Trombidiformes: Heterostigmatina) parasitic on tetrigid grasshoppers (Orthoptera). Zootaxa, 4418(1): 1-54. <https://doi.org/10.11646/zootaxa.4418.1.1>
- Suski, Z.W. 1972 . Tarsonemid mites on apple trees in Poland. X. Laboratory studies on the biology of certain mite species of the family Tarsonemidae (Acarina, Heterostigmata). Zesz. Probl. Post. Nauk Roln., (129): 111-137.
- Zhang, Z.-Q., Fan, Q.-H., Pesic, V., Smith, H., Bochkov, A.V., Khaustov, A.A., Baker, A., Wohltmann, A., Wen, T., Amrine, J.W., Beron, P., Lin, J., Gabrys, G., Husband, R. 2011 . Order Trombidiformes Reuter, 1909. In: Zhang, Z.-Q. (Ed.) Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness. Zootaxa, 3148(1): 129-138. <https://doi.org/10.11646/zootaxa.3148.1.24>