





A new species of *Promicrodispus* (Acari: Microdispidae) from the Altai Republic, Russia

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ASBTRACT: A female of *Promicrodispus altaicus* Khaustov sp. nov. (Acari: Heterostigmata: Microdispidae) is described from the forest litter sample collected from vicinity of the Teletskoye Lake in Altai Republic of Russia. The new species is very similar to *P. pumilis* (Sevastianov), but it can be distinguished by the presence of setae *ps2* and lacking of seta *s* on tibiotarsus of leg I. Using of SEM microscopy revealed previously unknown structure in gnathosoma of the new species. A key to the species of *Promicrodispus* is also provided.

Keywords: Pygmephoroida, systematics, morphology, key, Western Siberia, SEM microscopy

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INTRODUCTION

The family Microdispidae Cross, 1965 is the least diverse family of pygmephoroid mites (Acari: Pygmephoroida), and comprises 28 genera and about 130 described species (Khaustov and Khaustov, 2023; Rahiminejad et al., 2023). Most microdispid mites are fungivorous, however, some species from the genera *Perperipes* Cross, 1965, *Glyphodomastax* Cross, 1965 and *Peponocara* Cross, 1965 are probably parasitoids of insects (Kaliszewski et al., 1995), and the recently described monotypic genus *Sidorchukdispus* Khaustov et al., 2019 most likely includes external parasites of termites (Khaustov et al., 2019). Khaustov (2018) provided the latest key to the genera of Microdispidae. Microdispid mites of Asian Russia are poorly studied. At present 11 species of 6 genera have been recorded in Western Siberia, namely: *Caesarodispus samsinaki* (Mahunka, 1967), *C. brevipes* Mahunka, 1981, *C. minutus* (Sevastianov, 1981), *Pseudomicrodispus setosus* (Evans, 1952), *Promicrodispus pumilis* (Sevastianov, 1975), *Unguidispus contematosus* Sevastianov, 1981, *U. japonicas* Kurosa, 1979, *U. lasii* Kurosa, 1979, *U. polycctenus* (Sevastianov, 1969), *Neomicrodispus sibiricus* Khaustov, 2018, and *Premicrodispus (Premicrodispus) kurganiensis* Khaustov and Khaustov, 2023 (Khaustov, 2014, 2016a, b, 2017; Khaustov and Khaustov, 2023). Nothing is known about Microdispidae of Altai.

The genus *Promicrodispus* Khaustov, 2017 comprises four described species: *P. pumilis*, *P. fageus* (Rack, 1965), *P. salinus* Khaustov and Trach, 2022 from the Palaearctic, and *P. bisetus* Khaustov and Minor, 2020 from New Zealand (Rack, 1965; Sosnina and Sevastianov, 1975; Khaustov, 2017; Khaustov and Minor, 2020; Khaustov and Trach, 2022)). Here we describe a female of *Promicrodispus altaicus* sp. nov. collected from the forest litter sample in Altai Republic of Russia.

MATERIALS AND METHODS

Mites were extracted from the forest litter samples using Tullgren-Berlese funnels. Most of specimens were cleared

in lactic acid and mounted on slides in Hoyer's medium. The terminology of the idiosoma and legs follows that of Lindquist (1986); the nomenclature of subcapitular setae and the designation of cheliceral setae follow those of Grandjean (1944, 1947), respectively. The systematics of Pygmephoroida follows that of Khaustov (2004, 2008). All measurements are given in micrometers (μm) for the holotype and paratypes (in parentheses). For leg chaetotaxy, the number of solenidia is given in parentheses. Mite morphology was studied using a Carl Zeiss AxioImager A2 compound microscope with phase contrast and differential-interference contrast (DIC) optics. Photomicrographs were taken with an AxioCam ICc5 (Carl Zeiss, Germany) digital camera. For SEM microscopy several alcohol-preserved mites were dried in a JFD 320 freeze drying device (JEOL, Japan), dusted with gold and scanned with a TESCAN Mira3 LMU SEM microscope.

Abbreviations: Ap1-5 – apodemes 1-5; appr – prosternal apodeme; apsej – sejugal apodeme; appo – poststernal apodeme; ags, pgs – anterior and posterior genital sclerites; php 1-3 – pharyngeal pumps; cl – palptibial claw; ζ – eupathid-like seta on palptarsus; ZINRAN—Zoological Institute of Russian Academy of Sciences, St. Petersburg, Russia, TSUMZ—Tyumen State University, Museum of Zoology, Tyumen, Russia.

RESULTS

Systematics

Family Microdispidae Cross, 1965

Genus *Promicrodispus* Khaustov, 2017

Type species: *Brennandania pumilis* Sevastianov, 1975, by original designation

***Promicrodispus altaicus* Khaustov sp. nov.** (Figures 1-9)

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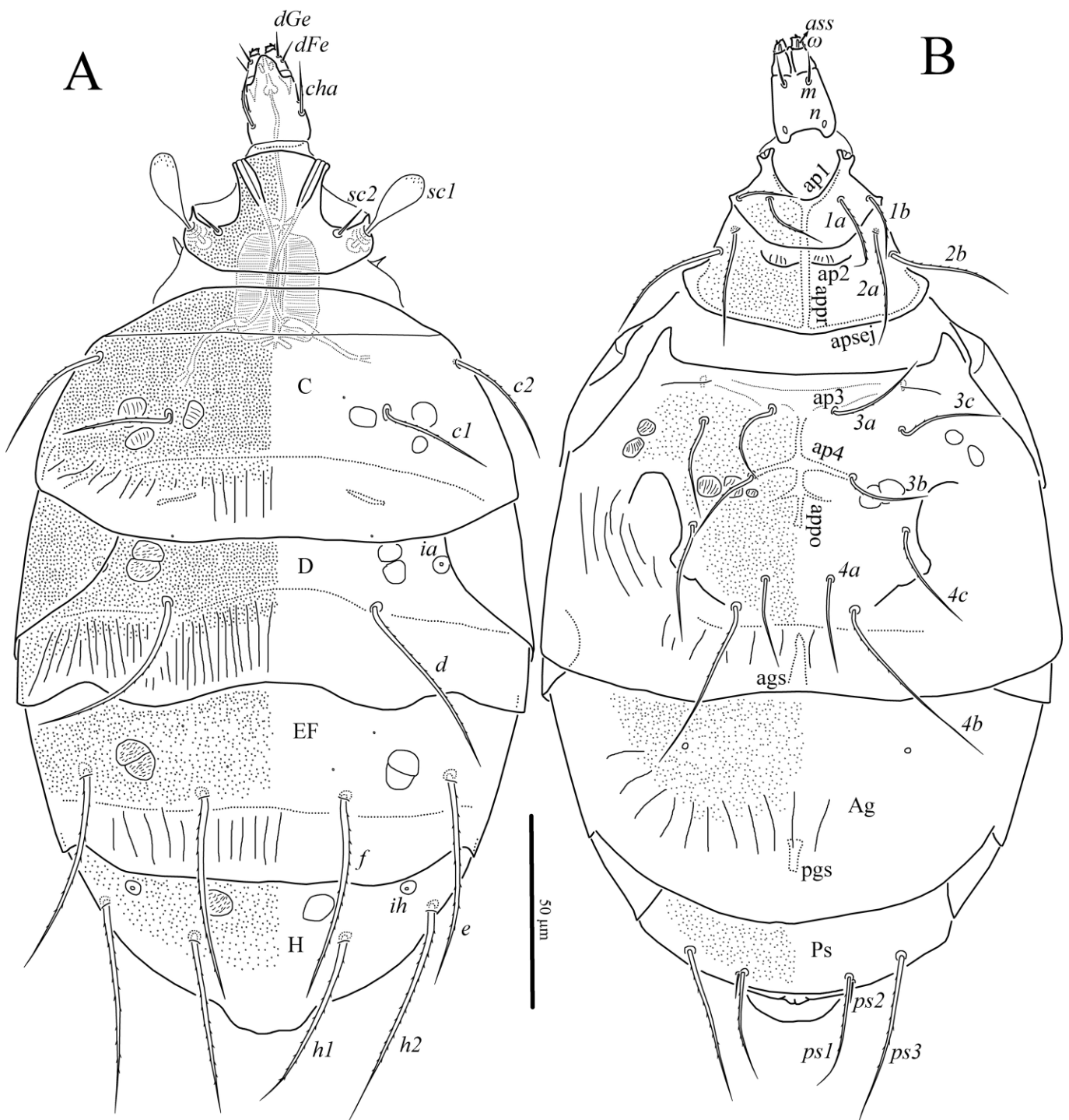


Figure 1. *Promicrodispus altaicus* Khaustov sp. nov., female: **A.** Dorsum of body; **B.** Venter of body. Legs omitted.

Description

Female (n=13). Length of idiosoma 225 (200–235), width of tergite C 135 (120–135).

Gnathosoma (Figs 7, 8). Length of gnathosoma 24 (22–24), width 16 (14–16). Dorsal median apodeme absent. Cheliceral setae *cha* 14 (13–15) weakly barbed, pointed. Postpalpal setae flattened and blunt-tipped (Fig. 8C), situated anterolaterally to setae *cha*. Setae *dFe* 6 (4–6) slightly shorter than *dGe* 7 (6–7), both smooth and pointed. Subcapitular

setae *m* 12 (11–13) smooth and pointed. Palpal tibiotarsus ventrally with sausage-like accessory setigenous structure (*ass*) and tiny (about 0.5) solenidion ω (Fig. 7F); tibial claw well-developed; palpal tibiotarsus with short spiniform seta (probably *l'*) laterad tibial claw, short eupathid-like seta (ζ) mesad tibial claw, and tiny projection probably of setal origin (?) posterolaterad ζ (Fig. 7B). Pharyngeal pumps grouped together; pumps 1 and 3 small, bow-shaped; pump 2 large, subrectangular and transversely striated (Fig. 5D).

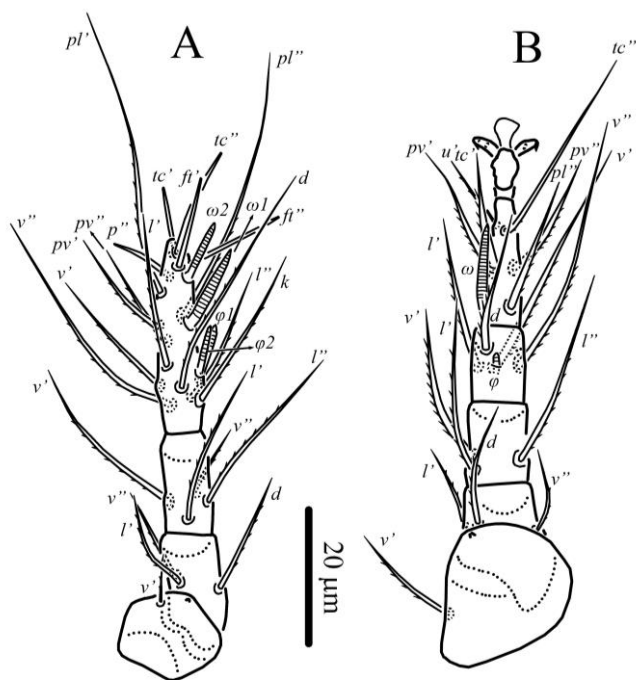


Figure 2. *Promicrodispus altaicus* Khaustov sp. nov., female: **A.** Right leg I, dorsal aspect; **B.** Right leg II, dorsal aspect.

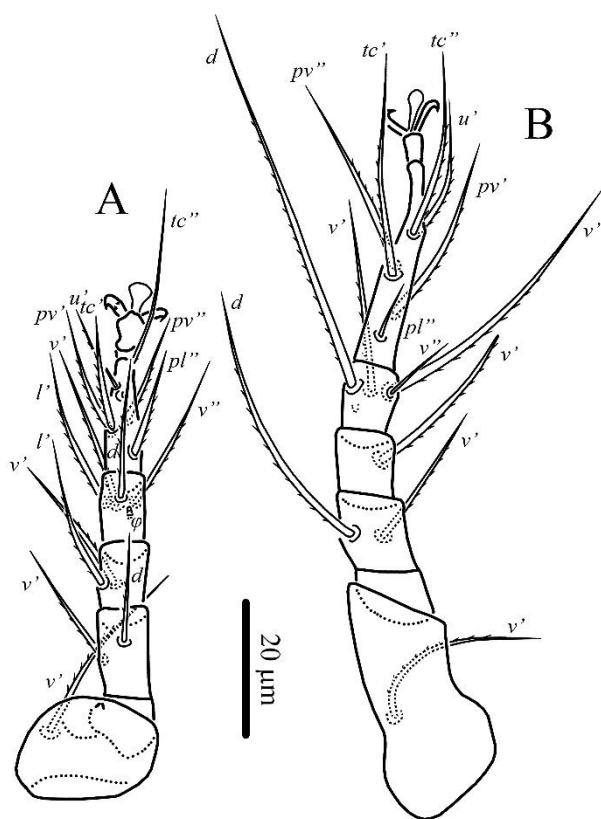


Figure 3. *Promicrodispus altaicus* Khaustov sp. nov., female: **A.** Right leg III, dorsal aspect; **B.** Right leg IV, dorsal aspect.

Idiosomal dorsum (Figs 1A, 4A, 5A-C, 6A, B). Prodorsum separated from tergite C in slide-mounted specimens (Fig. 5A) and covered by tergite C in alive mites (Fig. 6A).

Prodorsum with one pair of elongate stigmata with longitudinal slit-like openings leading from dorsal side to ventral (Figs 5A, 7D) and one pair of lateral spines (Fig. 5A). Posterior margin of tergite H with short and wide lobe. All dorsal shields with numerous very small round puncta (Figs 5A-C). Setae *sc*₂ short, smooth, needle-like, other dorsal setae sparsely barbed and pointed. Trichobothria with short stem, clavate, sparsely barbed, with rounded apex (Fig. 6E). Cupules *ia* on tergite D and *ih* on tergite H large, round; *ia* situated anterolaterally to bases of setae *d*; *ih* situated anteromedially to bases of setae *h*₂. Tergite C with two pairs of porous areas situated laterally to bases of *c*₁ and with one pair posteromedially to *c*₁; tergite D with one pair of porous areas situated anterolaterally to setae *d*; tergite EF with oval porous areas situated medially to bases of setae *e*; tergite H with oval porous areas situated anteriorly to setae *h*₁. Tergites C, D and EF with weak longitudinal striae posteriorly. Lengths of dorsal setae: *sc*₂ 9 (7–9), *c*₁ 29 (27–29), *c*₂ 37 (33–37), *d* 50 (48–52), *e* 57 (54–60), *f* 53 (47–54), *h*₁ 47 (45–47), *h*₂ 62 (58–64). Distances between setae: *sc*₂–*sc*₂ 31 (29–31), *c*₁–*c*₁ 56 (53–56), *c*₁–*c*₂ 21 (18–21), *d*–*d* 53 (50–53), *e*–*f* 30 (28–30), *f*–*f* 37 (33–37), *h*₁–*h*₁ 38 (32–38), *h*₁–*h*₂ 25 (24–26).

Idiosomal venter (Figs 1B, 4B, 5E, F, 6D, F, 7A-C). Ventral plates with numerous very small puncta (Figs 5E, F). All ventral setae pointed; setae *ps*₂ smooth; other ventral setae barbed; in some specimens setae *4a* smooth; setae *ps*₁ and *ps*₂ contiguous (Figs 5F, 6D). Lateral plates with several oblique sclerotized lines laterally to legs III–IV (Fig. 6C). Ap₁, appr and apsej well sclerotized and fused together; ap₂ very thin and fused with appr; appo and ap₄ well sclerotized and fused; ap₃ very weakly sclerotized and poorly visible (Fig. 5E); ap₅ absent. Posterior sternal plate with two pairs of porous areas just laterad ap₄ and with two pairs of porous areas anteriorad legs III. Posterior margin of posterior sternal plate weakly concave. Posterior margin of aggenital plate evenly rounded. Lengths of ventral setae: *1a* 24 (24–25), *1b* 19 (16–19), *2a* 32 (28–32), *2b* 37 (32–38), *3a* 26 (26–30), *3b* 22 (20–24), *3c* 27 (23–28), *4a* 24 (24–26), *4b* 47 (46–48), *4c* 30 (28–31), *ps*₁ 29 (26–29), *ps*₂ 6 (5–6), *ps*₃ 44 (38–44).

Legs (Figs 2, 3, 9). Setation of legs as in generic diagnosis (Khaustov 2017) except absence of seta *s* on tibiotarsus. Leg I (Figs 2A, 9A-D). Lengths of solenidia ω ₁ 13 (13), ω ₂ 10 (9–10), ϕ ₁ 8 (8–9), ϕ ₂ 7 (6–7); ϕ ₁ weakly clavate, ω ₁ digitiform with attenuate tip, ω ₂ and ϕ ₂ baculiform. All setae of leg I (except eupathidia (*tc*), (*ft*) and *p*'') sparsely barbed and pointed. Leg II (Fig. 2B). Solenidion ω ₁₄ (12–1) digitiform with attenuate tip, solenidion ϕ ₄ (3–4) rod-like, situated in shallow depression. All setae on leg segments pointed and sparsely barbed; seta *tc*'' usually with only several weak barbs in basal part. Leg III (Fig. 3A). Solenidion ϕ ₂ (2) very short, situated in depression and hardly visible. All setae on leg segments pointed and sparsely barbed; seta *tc*'' usually with only several weak barbs in basal part. Leg IV (Fig. 3B). Solenidion ϕ absent, but tibia with small pore-like depression instead of solenidion. Setae *v*'' of tibia and *pl*'' of tarsus smooth, other setae on leg segments sparsely barbed; seta *v*'' of genu blunt-tipped, other leg setae pointed.

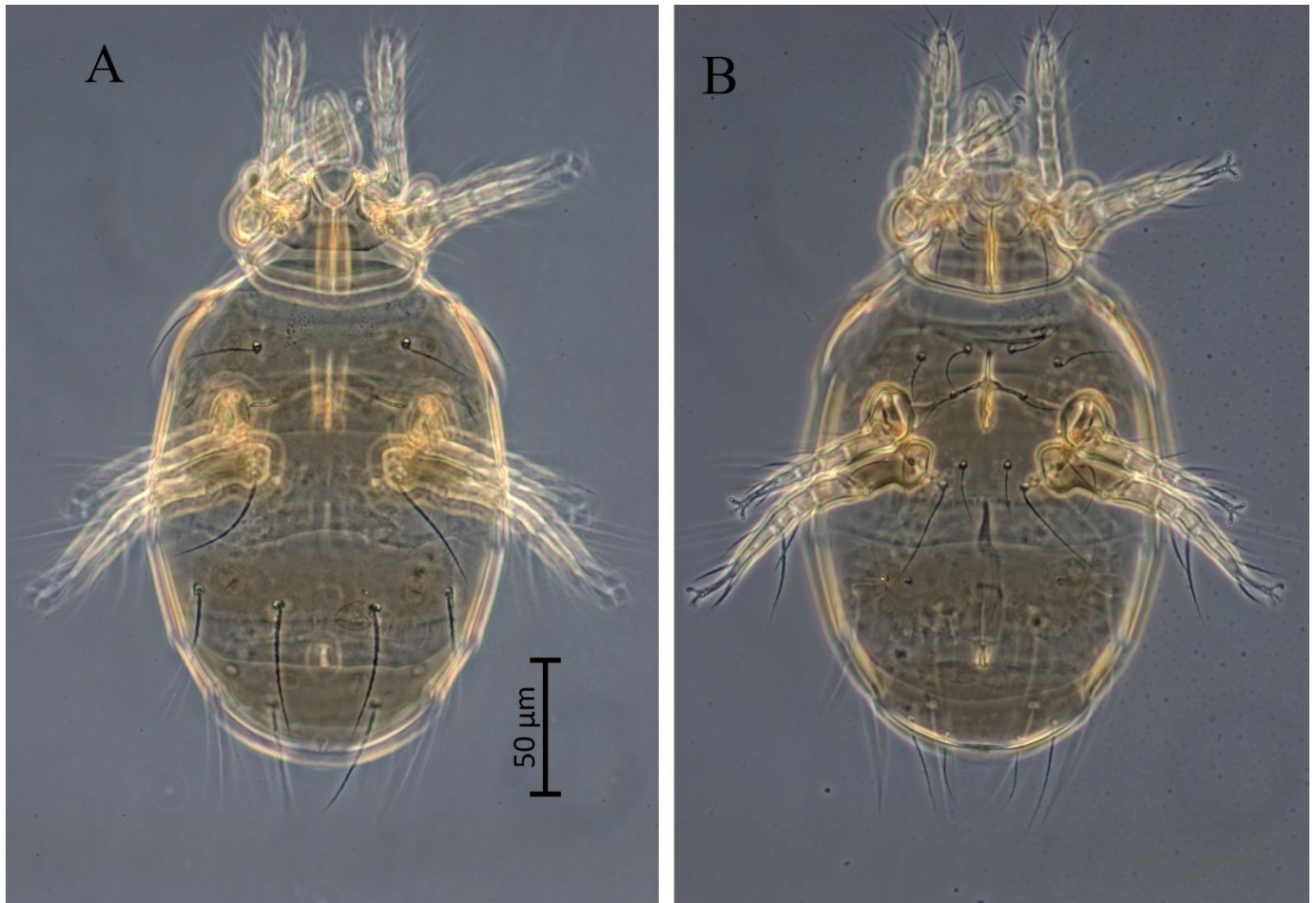


Figure 4. Phase-contrast micrographs of *Promicrodispus altaicus* Khaustov sp. nov., female (holotype): **A.** General view dorsally; **B.** General view ventrally.

Male and larva unknown.

Type material. Holotype female, slide ZISP T-Mcd-4, Russia, Altai Republic, Turochaksky District, vicinity of Teletskoye Lake, bank of Tebenek River, 453 m a.s.l., 01 October 2023, in forest litter, 51°47'28.914" N 87°19'15.132" E, coll. A. O. Svinin; paratypes: 12 females, same data.

Type deposition. The holotype and one paratype female are deposited in the collection of ZINRAN; other paratypes are deposited in the collection of the TSUMZ.

Differential diagnosis. The new species is closely resembles to *P. pumilis* in having very similar relative lengths of idiosomal setae and presence of one pair of cheliceral setae. The new species differs from *P. pumilis* in having setae *ps2* (vs. setae *ps2* absent in *P. pumilis*) and in absence of seta *s* on tibiotarsus of leg I (vs. present in *P. pumilis*).

Etymology. The name of the new species *altaicus* refers to its geographical distribution in Altai Mountains.

Key to species of the genus *Promicrodispus* (females)

- 1a. Gnathosoma dorsally with one pair of setae (*cha*) 3
- 1b. Gnathosoma dorsally with two pairs of setae (*cha*, *chb*) 2

- 2a. Setae *ps2* absent; three solenidia on tibiotarsus I *P. bisetus*
- 2b. Setae *ps2* present; four solenidia on tibiotarsus I *P. salinus*
- 3a. Setae *ps2* absent; seta *s* of tibiotarsus I present 4
- 3b. Setae *ps2* present; seta *s* of tibiotarsus I absent *P. altaicus* Khaustov sp. nov.
- 4a. Setae *d* and *f* subequal in length *P. pumilis*
- 4b. Setae *d* distinctly longer than *f* *P. fageus*

DISCUSSION

Using of scanning electron microscope for the study of the external morphology of *Promicrodispus altaicus* Khaustov sp. nov. revealed several structures of gnathosoma previously unknown in Microdispidae. The most expected is the presence of palpal solenidion ω . This solenidion is usually present in other pygmephoroid mites (Pygmephoridae, Neopygmephoridae, Scutacaridae) as well as in other early derivative Heterostigmata (Lindquist, 1986; Dastych and Rack, 1993). In *P. altaicus* Khaustov sp. nov. palpal solenidion is very small (about 0.5) and almost invisible in the light microscope. Despite some SEM photos of the gnathosoma in several representatives of Microdispidae (Khaustov, 2014; Khaustov et al., 2019) it has never been

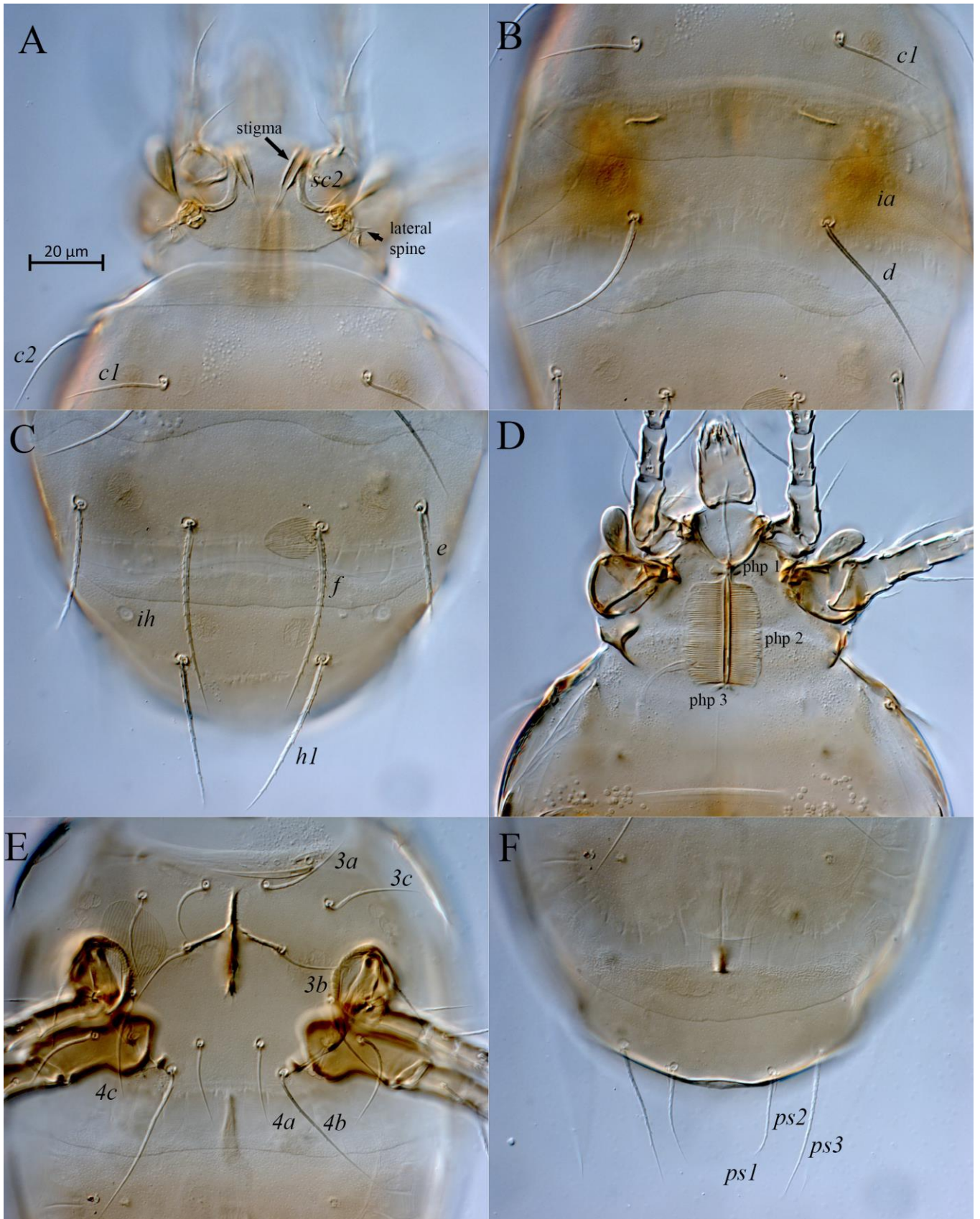


Figure 5. DIC micrographs of *Promicrodispus altaicus* Khaustov sp. nov., female (holotype): **A.** Proterosoma, dorsal aspect; **B.** Metapodosoma, dorsal aspect; **C.** Opisthosoma, dorsal aspect; **D.** Pharyngeal pumps; **E.** Metapodosoma, ventral aspect; **F.** Opisthosoma, ventral aspect.

found. Other unexpected structures are spiniform seta (probably *l'*) laterad tibial claw and tiny structure (probably of setal origin) mesad tibial claw and indicated by “?” in Figure 8B.

Seta *l'* of palpal tibiotarsus has never been reported in Pygmephoroida. However, it was found in early derivative Tarsonemina, such as Dolichocybidae (Khaustov and Trach, 2018) and Athyreacaridae (Khaustov and Frolov,

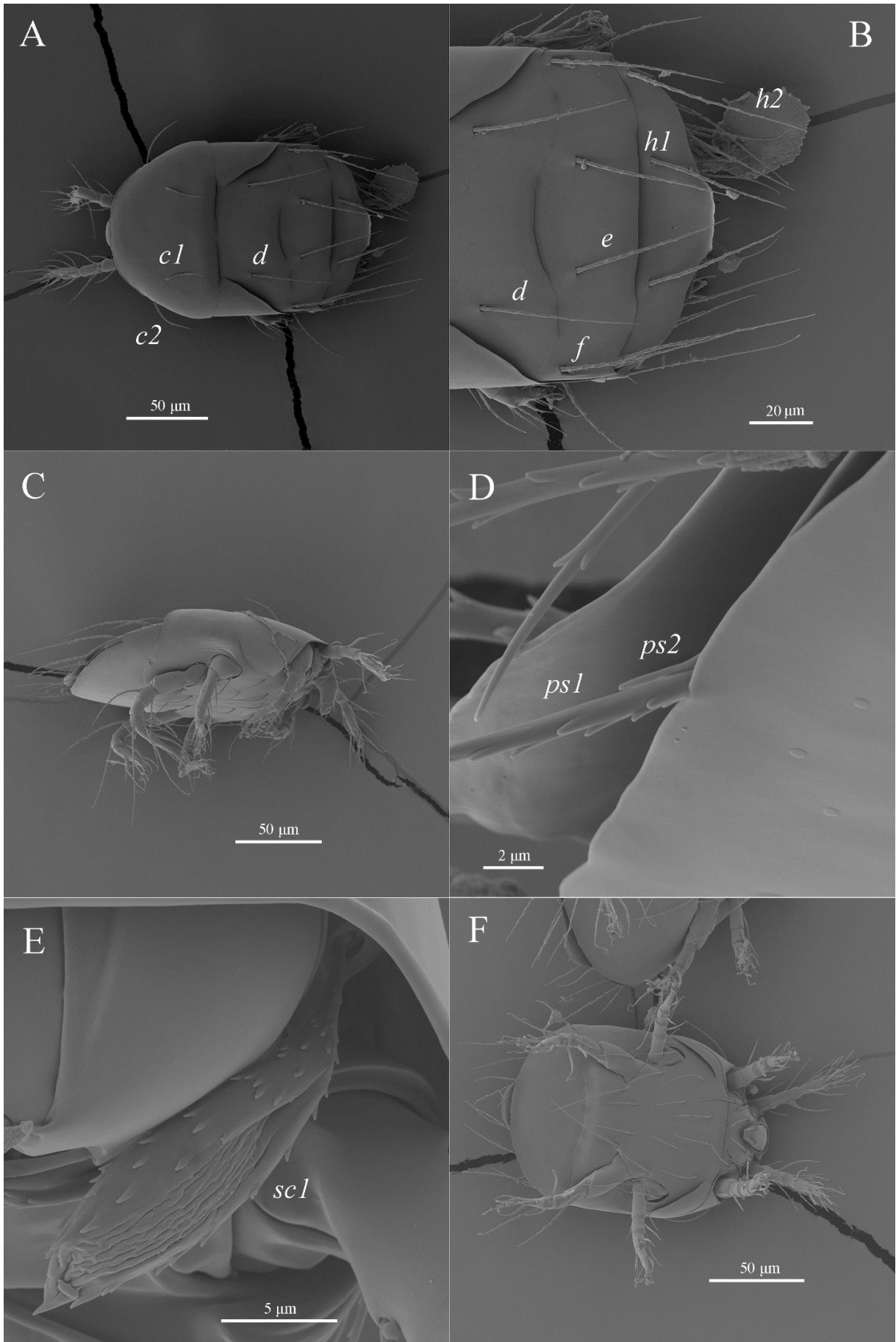


Figure 6. SEM micrographs of *Promicrodispus altaicus* Khaustov sp. nov., female: **A.** General view dorsally; **B.** Hysterosoma, dorsal aspect; **C.** General view laterally; **D.** Pseudanal setae *ps1* and *ps2*; **E.** Trichobothrium; **F.** General view ventrally.

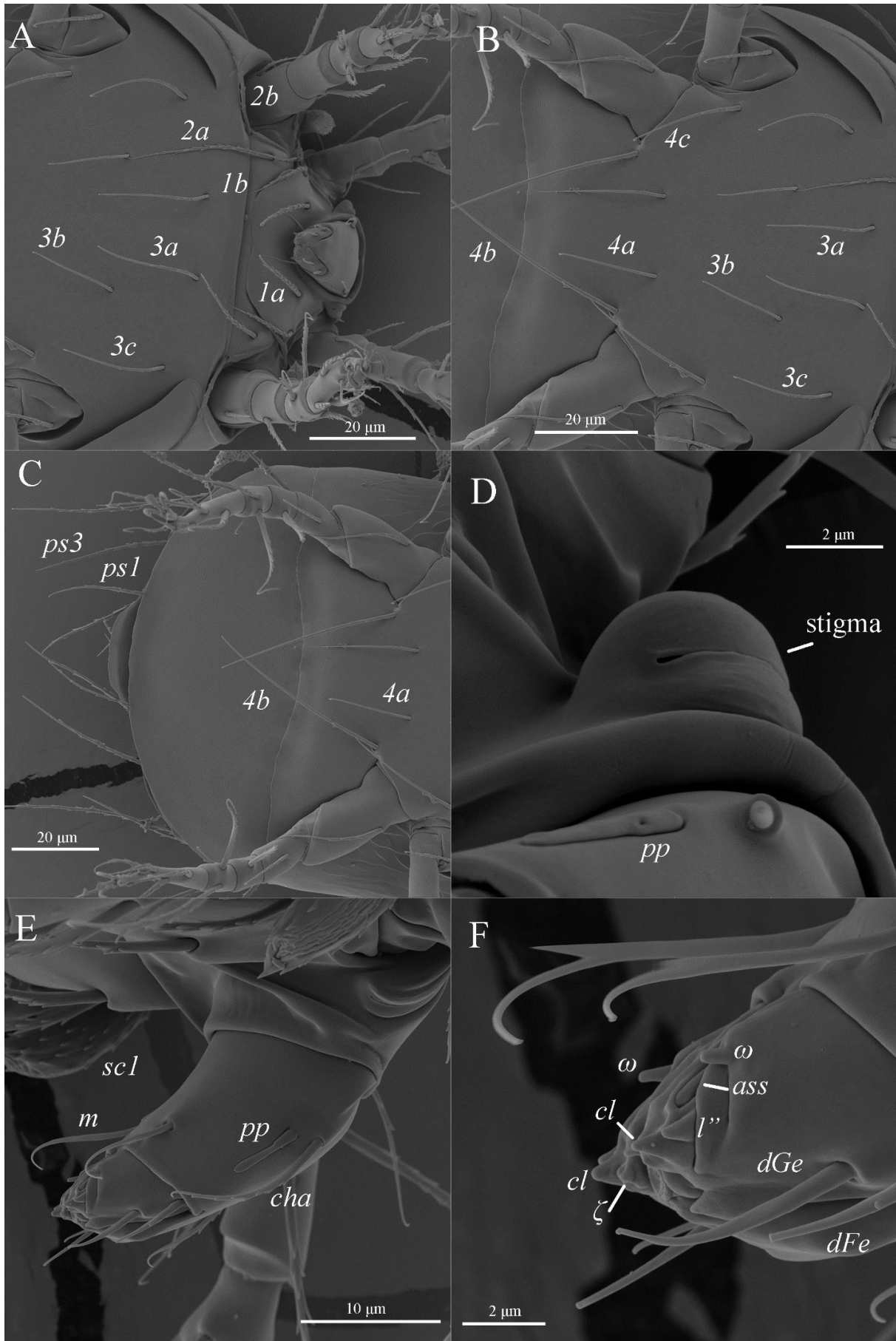


Figure 7. SEM micrographs of *Promicrodispus altaicus* Khaustov sp. nov., female: **A.** Proterosoma, ventral aspect; **B.** Metapodosoma, ventral aspect; **C.** Opisthosoma, ventral aspect; **D.** Stigma; **E.** Gnathosoma, lateral aspect; **F.** Distal part of gnathosoma, lateral aspect.

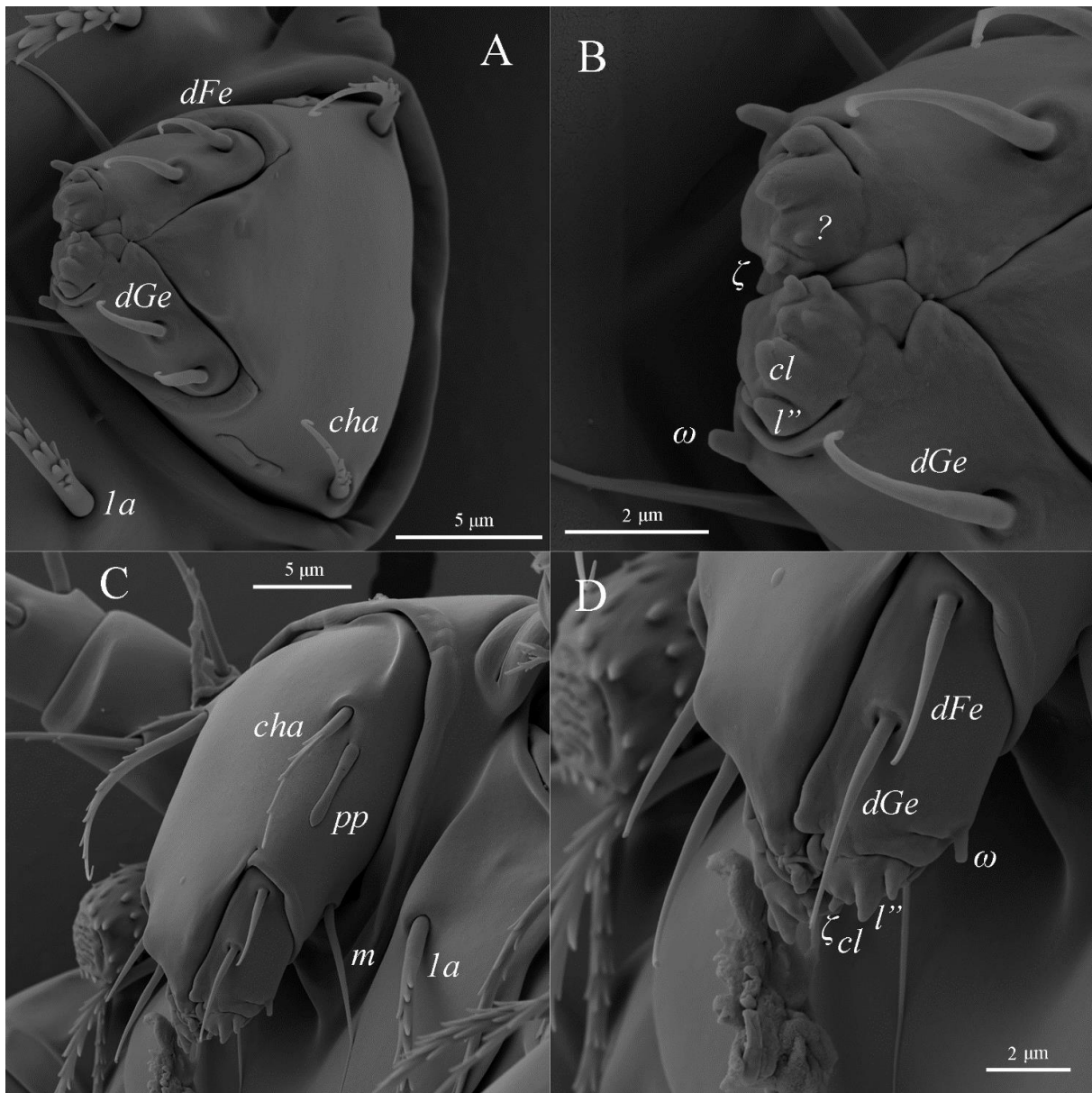


Figure 8. SEM micrographs of *Promicrodispus altaicus* Khaustov sp. nov., female: **A.** General view of gnathosoma, dorsal aspect; **B.** Distal part of gnathosoma, dorsal aspect; **C.** Gnathosoma, doesolateral aspect; **D.** Distal part of gnathosoma, dorsolateral aspect.

2022). The tiny structure (?) located posteriad eupathid-like seta is probably was discovered in *Pygmephorus* species (Pygmephoridae) and indicated by arrow in Figure 4 in Dastych and Rack (1993). This seta of unknown homology was also reported in *Bembidiacarus* (Khaustov, 2000). Based on the present study, the gnathosoma of *P. altaicus* Khaustov sp. nov. includes almost the full set of setiform gnathosomal structures (except absence of setae *chb*) and represents plesiomorphic character states in Microdispidae.

Authors' contributions

Alexander A. Khaustov: Identification of mite species, preparation of the manuscript, line drawings and light microscope photos. **Nikita A. Shulaev:** Preparation of samples for electron microscopy, preparation of SEM images, manuscript reviewing.

Statement of ethics approval

Not applicable.

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Conflict of interest

The authors declared that there is no conflict of interest.

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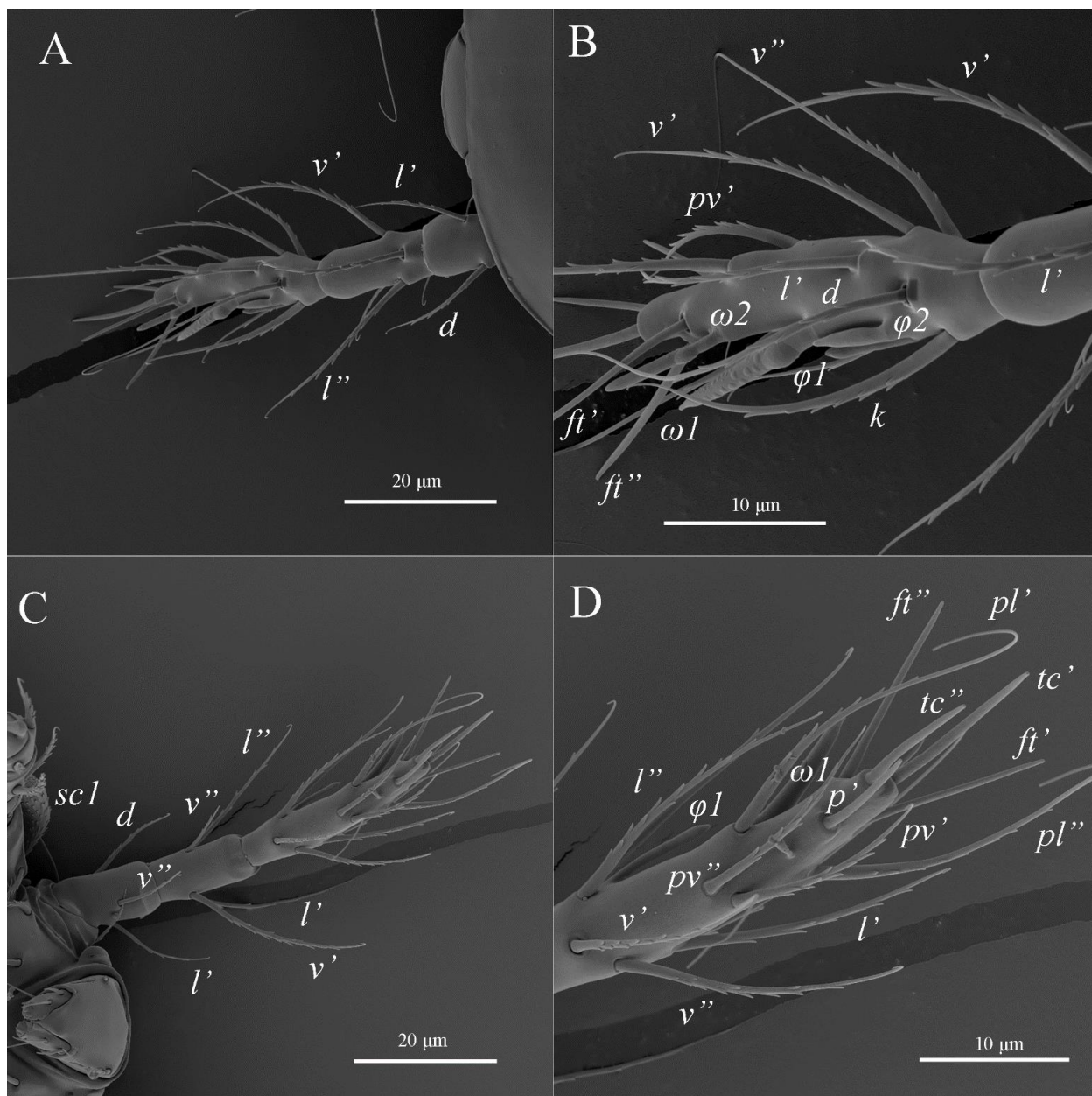


Figure 9. SEM micrographs of *Promicrodispus altaicus* Khaustov sp. nov., female: **A.** Leg I, dorsal aspect; **B.** Tibiotarsus I, dorsal aspect; **C.** Leg I, ventral aspect; **D.** Tibiotarsus I, ventral aspect.

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