Acarologia
Open Science in Acarology

First description of phoretic and redescription of non-phoretic females of *Pediculaster nidicolus* (Mahunka) (Acari: Pygmephoridae) from Western Siberia, Russia

Alexander A. Khaustov[a]

[a] Tyumen State University, Tyumen, Volodarskogo 6, 625003 Russia.

Original research

ABSTRACT

Phoretic and non-phoretic females of *Pediculaster nidicolus* (Mahunka) (Acari: Pygmephoridae) are recorded from Russia for the first time. Mites were collected from the nest of undetermined small mammal in Western Siberia, Russia. Non-phoretic female is redescribed, and phoretic female is described for the first time. An updated key to phoretic females of Palaearctic *Pediculaster* species is provided.

Keywords Pygmephoroidea ; systematics ; morphology ; female dimorphism ; Tyumen Region
Zoobank http://zoobank.org/022BDC53-CB93-4CFF-BA55-1DE9153AD7CA

Introduction

The genus *Pediculaster* Vitzthum, 1931 (Acari: Pygmephoroidea) is the largest in the family Pygmephoridae and comprises more than 100 described species in the world fauna (Khaustov 2020; Seyedein *et al.* 2021). Mites of the genus *Pediculaster* are fungivorous and inhabit a great variety of habitats, e.g. soil, litter, mosses, dung, nest material, decaying organic matter (Camerik and Kheradmand 2010). Some species are considered as pests of mushrooms in commercial mushroom-houses (Cross and Kaliszewski 1988). *Pediculaster*-mites are characterized by the presence of two morphologically different forms of females: non-phoretic or "normal" and phoretic (Martin 1978; Camerik *et al.* 2006). For most species of *Pediculaster* non-phoretic females still unknown. At the same time, some species were described based only on non-phoretic females. Until now eight species of *Pediculaster* have been reported from Western Siberia, namely: *P. bisetus* Khaustov, 2020, *P. camerikae* Khaustov, 2008b, *P. dudinskii* Khaustov, 2011, *P. ermilovi* Khaustov, 2015, *P. lignarius* Khaustov, 2015, *P. montanus* Khaustov, 2008b, *P. rarus* Khaustov, 2020, and *P. tjumeniensis* Khaustov, 2020 (Khaustov 2015, 2020).

Non-phoretic females of *Pediculaster nidicolus* (Mahunka, 1972) were described from the nest of mole (*Talpa europaea*) from Austria (Mahunka 1972). Later it was also recorded from Slovenia (Mahunka 1975). Phoretic female of this species were unknown up till now.

During the study of heterostigmatic mites of Western Siberia, I found numerous specimens of phoretic and non-phoretic females of *Pediculaster nidicolus* from the nest of undetermined small mammal. The main goal of this paper is to redescribe non-phoretic and describe phoretic females of *Pediculaster nidicolus* based on material from Western Siberia.

Received 03 February 2022
Accepted 24 March 2022
Published 28 March 2022

Corresponding author
Alexander A. Khaustov:
alex1973khaustov@gmail.com

Academic editor
Auger, Philippe

https://doi.org/
10.24349/zk54-xqx6

ISSN 0044-586X (print)
ISSN 2107-7207 (electronic)

Khaustov A. A.

Licensed under
Creative Commons CC-BY 4.0

OPEN ACCESS

How to cite this article Khaustov A. A. (2022), First description of phoretic and redescription of non-phoretic females of *Pediculaster nidicolus* (Mahunka) (Acari: Pygmephoridae) from Western Siberia, Russia. **Acarologia 62(2): 359-377. https://doi.org/10.24349/zk54-xqx6**

Material and methods

The mites were collected from sample of small mammal nest using Berlese funnels and mounted in Hoyer's medium. Numerous phoretic females were attached to various insects (rove beetles, insect larvae) and bigger mites (Figs 9A, B).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 Pygmephoroidea follows that of Khaustov (2004, 2008a). All measurements are given in micrometers (μm). 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) illumination. Photomicrographs were taken with a digital camera AxioCam ICc5 (Carl Zeiss, Germany). For SEM microscopy, alcohol-preserved mites were dried in a freeze drying device JFD 320 (JEOL, Japan), dusted with gold and scanned with the aid of a JEOL–JSM-6510LV SEM microscope.

Abbreviations: ap1-ap5 - apodemes 1-5, appr - prosternal apodeme, appo - poststernal apodeme, apsej - sejugal apodeme, Tr - trochanter, Fe - femur, Ge - genu, Ti - tibia, Ta - tarsus, TiTa - tibiotarsus, ass - accessory setigenous structure, php 1-3 - pharyngeal pumps 1-3.

Systematics

Family Pygmephoridae Cross, 1965

Genus *Pediculaster* Vitzthum, 1931

Type species: *Pygmephorus mesembrinae* Canestrini, 1881, by original designation.

Pediculaster nidicolus (Mahunka, 1972)

Siteroptes nidicolus Mahunka, 1972, 58
Siteroptes (*Siteroptoides*) *nidicolus*: Martin 1978, 125
Pediculaster nidicolus: Mahunka 1979, 133

(Figs 1–10)

Redescription of non-phoretic female

(Figs 1–4)

Length of idiosoma 255–315, width 130–160.

Idiosomal dorsum (Fig. 1A). All dorsal shields with numerous small round puncta. Stigmata small, oval, one-chambered and associated with long tracheal trunks. Setae *h2* pointed and smooth, other dorsal setae blunt-tipped and barbed; trichobothria *sc1* short, spherical. Cupuli *ia* on tergite D and *ih* on tergite H very small, round. Setae *v1* situated distinctly anteriad *v2*. Lengths of dorsal setae: *v1* 27–33, *v2* 22–25, *sc2* 55–64, *c1* 42–48, *c2* 55–63, *d* 47–60, *e* 26–30, *f* 48–59, *h1* 45–53, *h2* 11–14. Distances between setae: *v1–v1* 8–9, *v2–v2* 30–36, *sc2–sc2* 30–40, *c1–c1* 44–55, *c1–c2* 25–30, *d–d* 66–76, *e–f* 13–14, *f–f* 51–61, *h1–h1* 36–46, *h1–h2* 17–19.

Idiosomal venter (Fig. 1B). Ventral plates with numerous small round puncta. Sternocoxal fields I and II with three pairs of setae each. Setae *1c*, *2b*, *3c* and *4c* usually pointed; other ventral setae blunt-tipped; setae *1c*, *ps1* and *ps2* smooth, other ventral setae weakly barbed; setae *2a* subequal with *2b*; setae *ps3* much longer than *ps1-2*. Ap1, ap2 and apsej well developed and joined with appr; ap3, ap4 and ap5 well developed and joined with appo. Posterior margin of poststernal plate almost straight, without median lobe. Only one horn-shaped genital sclerite clearly visible. Lengths of ventral setae: *1a* 13–17, *1b* 18–23, *1c* 17–19, *2a* 14–18, *2b* 15–21, *2c* 16–18, *3a* 17–19, *3b* 15–18, *3c* 20–22, *4a* 14–18, *4b* 17–19, *4c* 18–21, *ps1* 7–8, *ps2* 8–11, *ps3* 27–30.

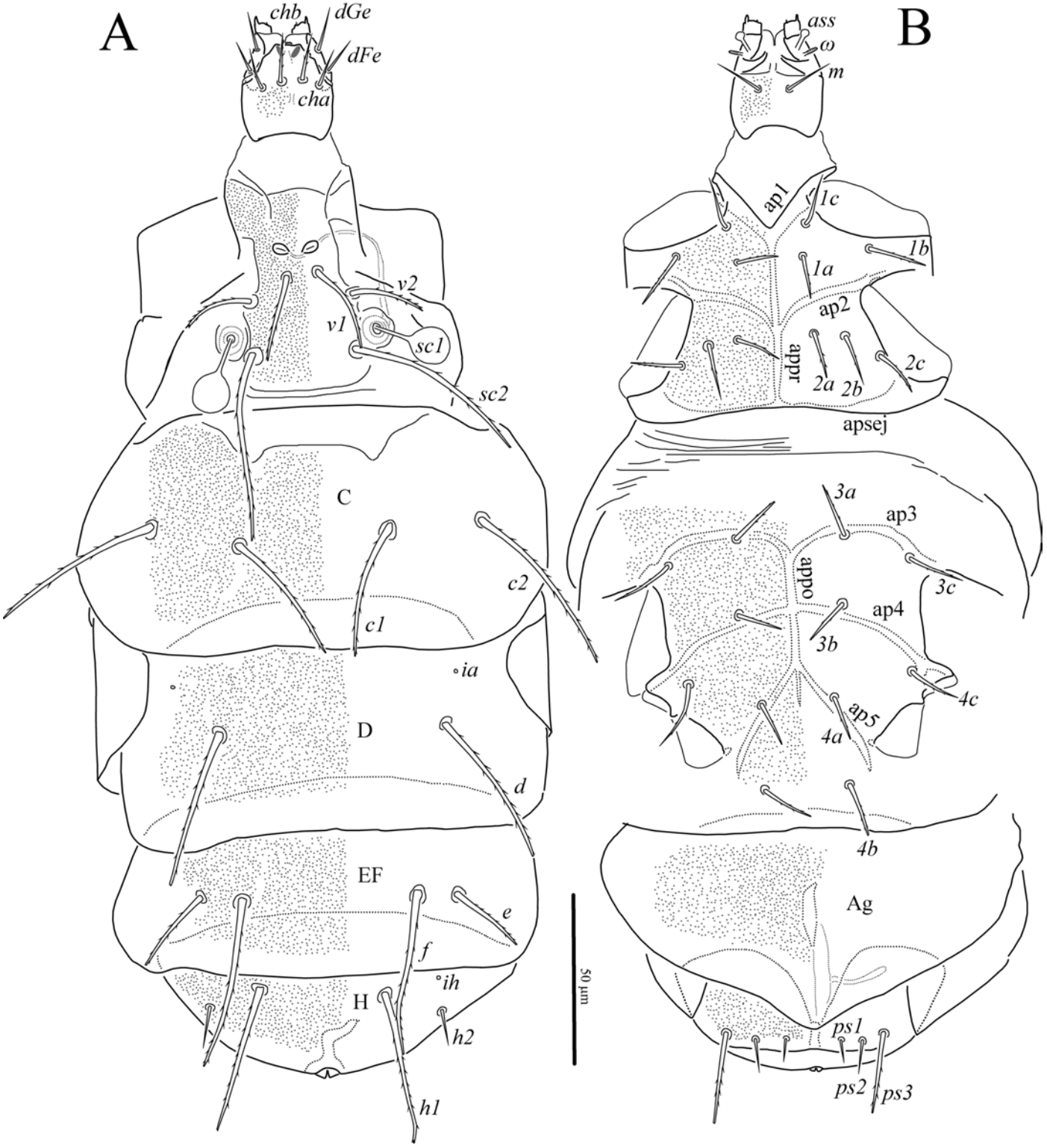


Figure 1 *Pediculaster nidicolus* (Mahunka, 1972), non-phoretic female: A – dorsum of body, B – venter of body. Legs omitted.

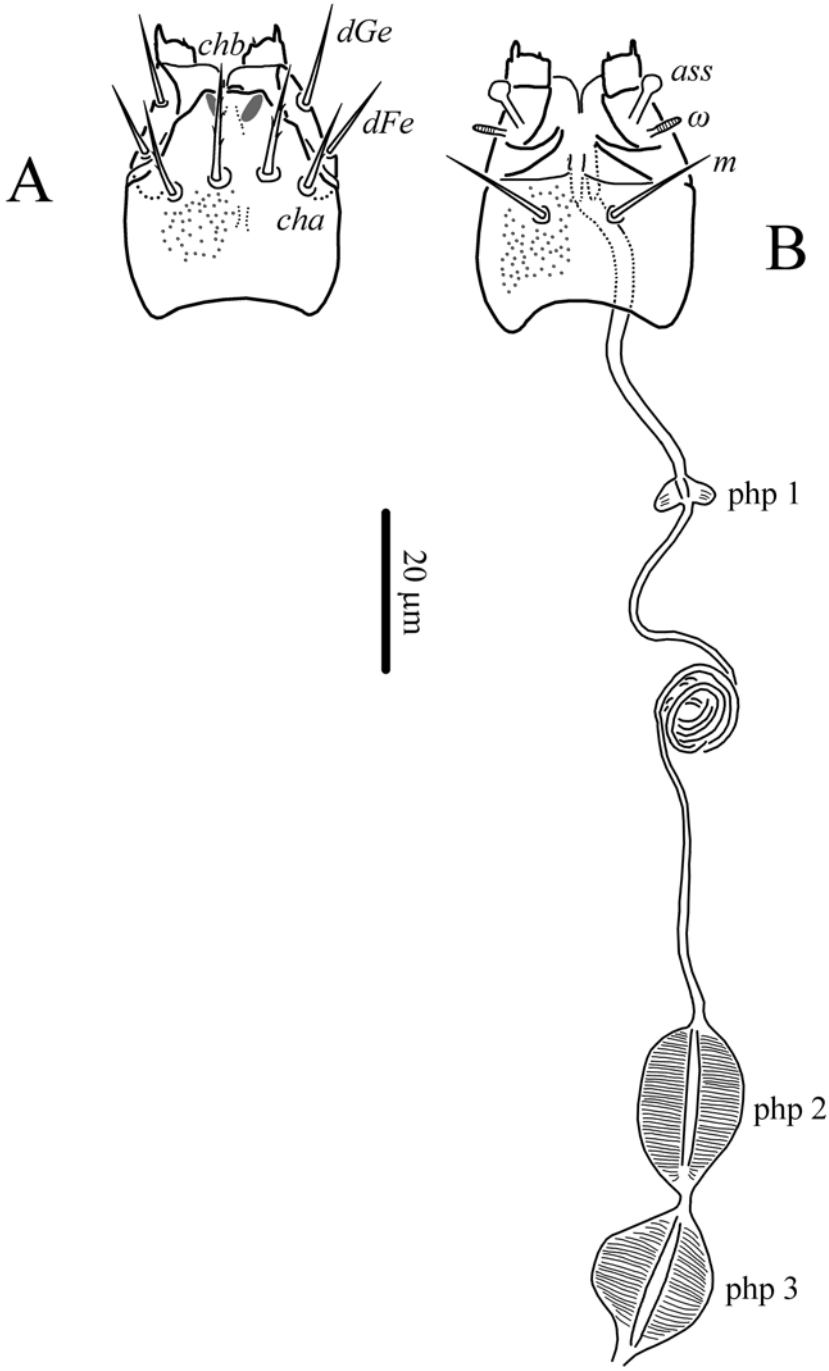


Figure 2 *Pediculaster nidicolus* (Mahunka, 1972), non-phoretic female: A – gnathosoma, dorsal aspect, B – gnathosoma and pharyngeal pumps, ventral aspect.

Gnathosoma (Fig. 2). Length of gnathosomal capsule 26–30, width 27–31. Dorsal median apodeme weakly developed. All gnathosomal setae pointed; setae *cha* and *chb* weakly barbed, other gnathosomal setae smooth. Palp tibiotarsus with well-developed blunt-tipped claw and tiny eupathid-like seta; palps with well-developed solenidion and mushroom-shaped accessory setigenous structure ventrally. Php 1 small, bow-shaped, located outside gnathosomal capsule; php 2 and 3 oval (Fig. 2B), situated close to each other on long oesophagus and far from php

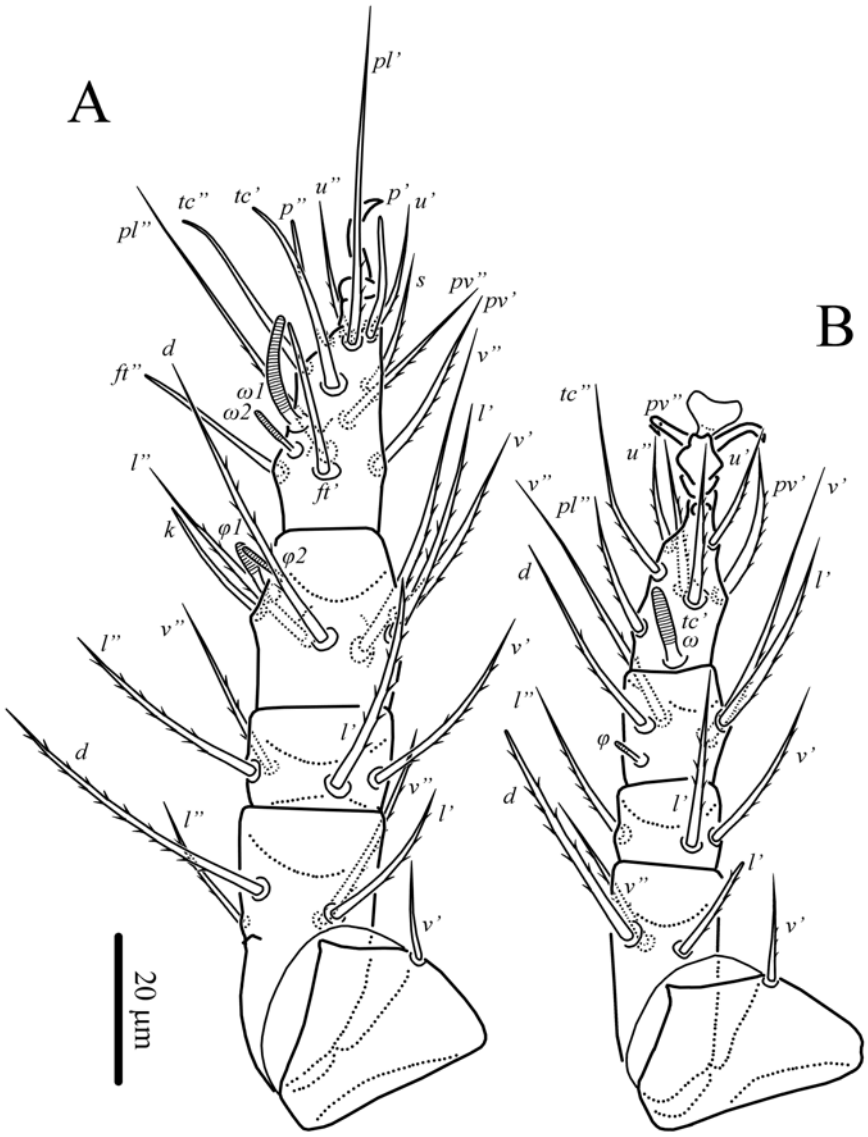


Figure 3 *Pediculaster nidicolus* (Mahunka, 1972), non-phoretic female: A – left leg I, dorsal aspect, B – left leg II, dorsal aspect.

1. Lengths of gnathosomal setae: *cha* 12–13, *chb* 14–18, *dFe* 11–12, *dGe* 13–16, *m* 14–17. Palpcoxal (postpalpal) setae and pits *m* absent.

Legs (Figs 3, 4). Leg I (Fig. 3A). Setation: Tr 1 (*v'*), Fe 4 (*d*, *l'*, *l"*, *v"*), Ge 4 (*l'*, *l"*, *v'*, *v"*), Ti 6(2) (*d*, *l'*, *l"*, *v'*, *v"*, *k*, *φ1*, *φ2*), Ta 13(2) (*pl'*, *pl"*, *p'*, *p"*, *tc'*, *tc"*, *ft'*, *ft"*, *s*, *pv'*, *pv"*, *u'*, *u"*, *ω1*, *ω2*). Tarsus with simple hooked claw. Lengths of solenidia *ω1* 15–17, *ω2* 7–8, *φ1* 8–9, *φ2* 7–9; solenidion *ω1* digitiform, solenidion *φ1* slightly clavate, other solenidia baculiform. Setae (*p*), (*tc*) and (*ft*) eupathid-like, smooth and weakly blunt-tipped; seta *k* of tibia smooth and weakly blunt-tipped; other leg setae pointed and barbed, sometimes seta *v'* of trochanter smooth. Leg II (Fig. 3B). Setation: Tr 1 (*v'*), Fe 3 (*d*, *l'*, *v"*), Ge 3 (*l'*, *l"*, *v'*), Ti 4(1) (*d*, *l'*, *v'*, *v"*, *φ*), Ta 7(1) (*pl"*, *tc'*, *tc"*, *pv'*, *pv"*, *u'*, *u"*, *ω*). Solenidion *ω* 10–12 digitiform, solenidion *φ* 4–5 erect, baculiform. Tarsal claws simple, hooked; empodium short and wide, flipper-like. All leg setae barbed; setae *d* and *l'* of femur blunt-tipped, other leg setae pointed. Leg III (Fig. 4A).

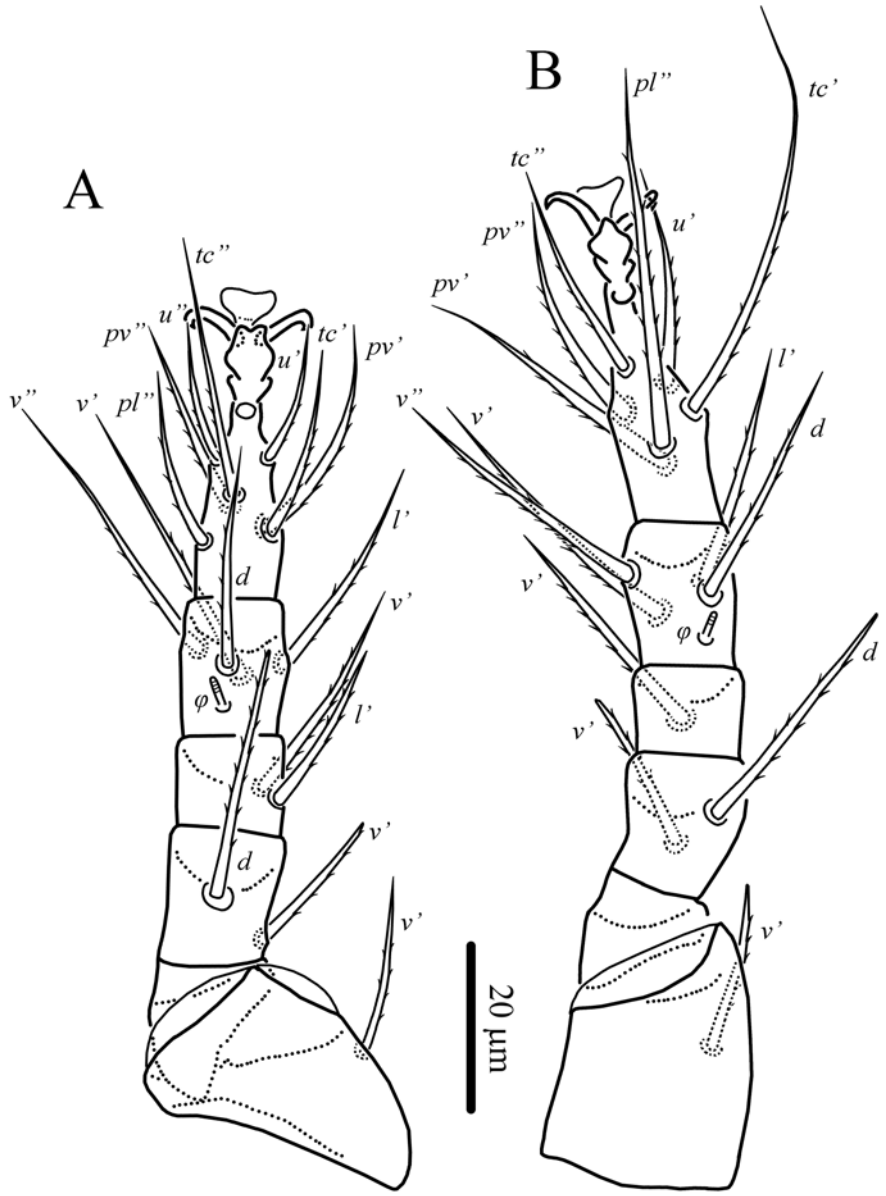


Figure 4 *Pediculaster nidicolus* (Mahunka, 1972), non-phoretic female: A – left leg III, dorsal aspect, B – left leg IV, dorsal aspect.

Setation: Tr 1 (*v′*), F2 3 (*d*, *v′*), Ge 2 (*l’*, *v′*), Ti 4(1) (*d*, *l’*, *v′*, *v”*, *φ*), Ta 7 (*pl”*, *tc′*, *tc”*, *pv′*, *pv”*, *u′*, *u”*). Claws and empodium as on tarsus II. Solenidion *φ* 4–5 erect, baculiform. All leg setae barbed; setae *d*, *v′* of femur and *l’* of genu blunt-tipped, other leg setae pointed. Leg IV (Fig. 4B). Setation: Tr 1 (*v′*), Fe 2 (*d*, *v′*), Ge 1 (*v′*), Ti 4(1) (*d*, *l’*, *v′*, *v”*, *φ*), Ta 6 (*pl”*, *tc′*, *tc”*, *pv′*, *pv”*, *u′*). Claws and empodium as on tarsi II and III. Solenidion *φ* 3–4 erect, baculiform. All leg setae barbed; setae *v′* of trochanter, *d* and *v′* of femur blunt-tipped, other leg setae pointed.

Description of phoretic female

(Figs 5–10)

Length of idiosoma 260–335, width 145–165. Sclerotization of body stronger than in non-phoretic female.

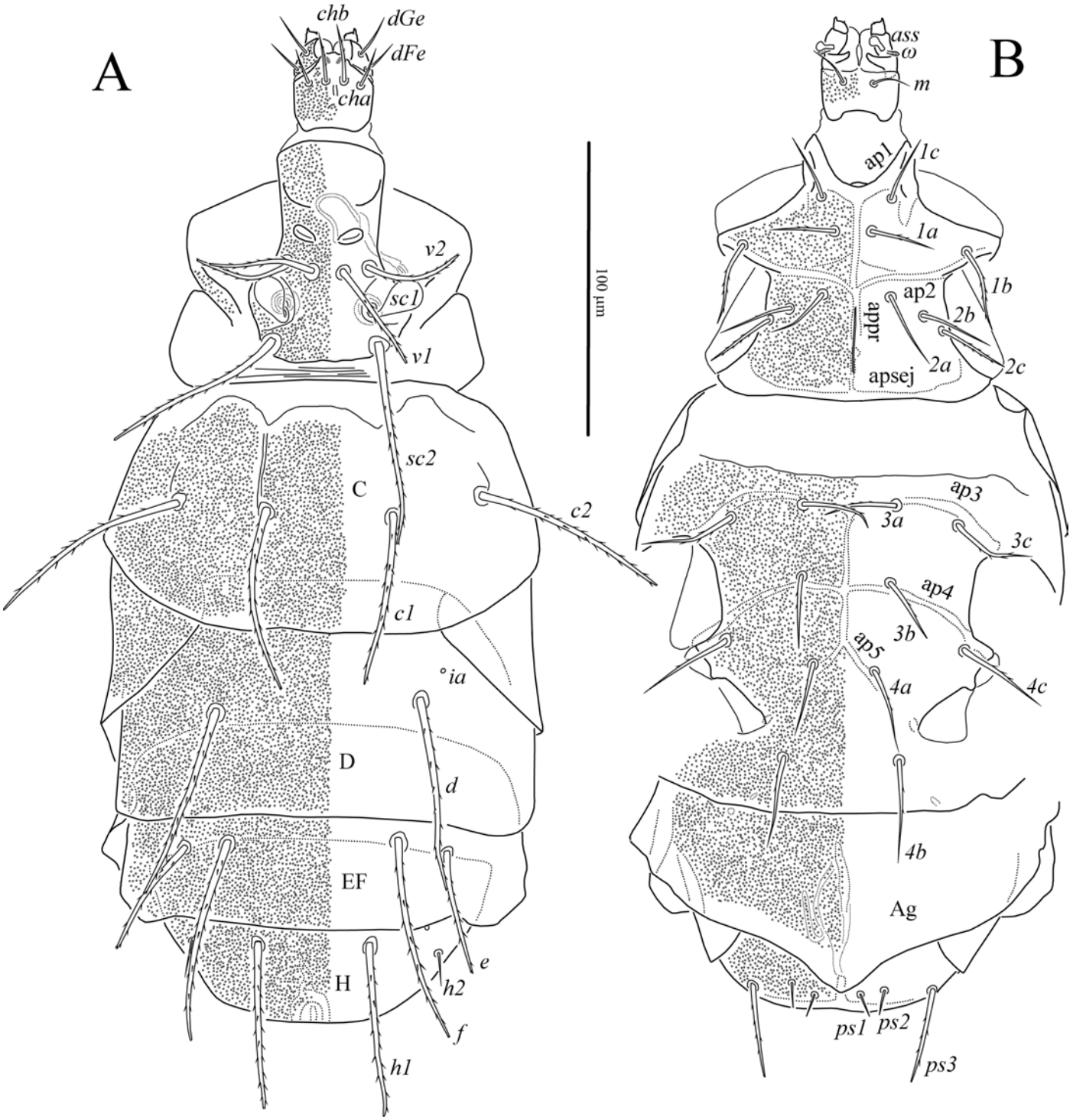


Figure 5 *Pediculaster nidicolus* (Mahunka, 1972), phoretic female: A – dorsum of body, B – venter of body. Legs omitted.

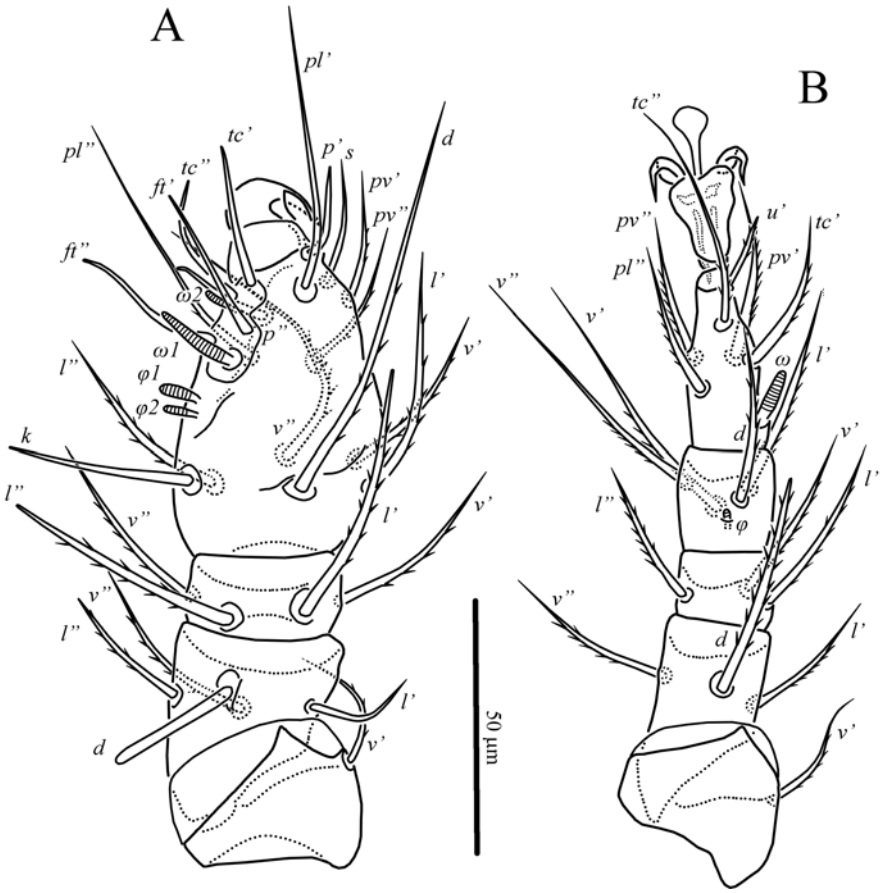


Figure 6 *Pediculaster nidicolus* (Mahunka, 1972), phoretic female: A – left leg I, dorsal aspect, B – left leg II, dorsal aspect.

Idiosomal dorsum (Figs 5A, 8A, 9C, D) as in phoretic female, but dorsal setae usually longer and puncta on dorsal shields slightly bigger. Setae *v1* and *v2* situated in one transverse row. Prodorsum anterolaterally with pocket-like depressions (Fig. 9C). Lengths of dorsal setae: *v1* 35–41, *v2* 32–35, *sc2* 67–69, *c1* 57–71, *c2* 69–81, *d* 59–73, *e* 39–50, *f* 66–77, *h1* 55–69, *h2* 12–16. Distances between setae: *v1–v1* 10–12, *v2–v2* 26–28, *sc2–sc2* 30–36, *c1–c1* 42–46, *c1–c2* 29–33, *d–d* 70–77, *e–f* 14–22, *f–f* 56–62, *h1–h1* 37–47, *h1–h2* 19–23.

Idiosomal venter (Figs 5B, 8B, 9E, F, 10B, C) similar to that of non-phoretic female, but plates sclerotized stronger, setae usually longer, ap5 sclerotized weaker and usually not extending beyond bases of setae *4a* and puncta on ventral plates bigger. Setae *1b*, *2c*, and *ps1-3* weakly blunt-tipped, other ventral setae pointed; in some specimens setae *1a*, *2a* and *3a* weakly blunt-tipped. Lengths of ventral setae: *1a* 22–28, *1b* 28–31, *1c* 23–26, *2a* 23–31, *2b* 27–30, *2c* 23–26, *3a* 22–29, *3b* 24–29, *3c* 26–34, *4a* 24–33, *4b* 28–38, *4c* 28–32, *ps1* 8–11, *ps2* 9–11, *ps3* 31–35.

Gnathosoma (Fig. 10A). Length of gnathosomal capsule 25–29, width 27–31. Gnathosoma and pharyngeal pumps as in non-phoretic female. Lengths of gnathosomal setae: *cha* 14–18, *chb* 16–23, *dFe* 12–14, *dGe* 15–17, *m* 16–18.

Legs (Figs 6, 7, 10D–F). Leg I (Figs 6A, 10E, F). Tibia and tarsus fused into massive ovate tibiotarsus. Tarsal claw thicker than in non-phoretic female; Unguinal setae fused into subtriangular structure opposing to claw. Seta *d* of femur spatulate; setae (*l*) of genu, *k*, (*p*), (*tc*), and (*ft*) of tibiotarsus blunt-tipped, other leg setae pointed; setae *l'* of femur, *pl'*, *k*, (*p*), (*tc*), and (*ft*) of tibiotarsus smooth, other leg setae barbed. Leg setation: Tr 1 (*v'*), Fe 4 (*d*, *l'*, *l''*, *v''*),

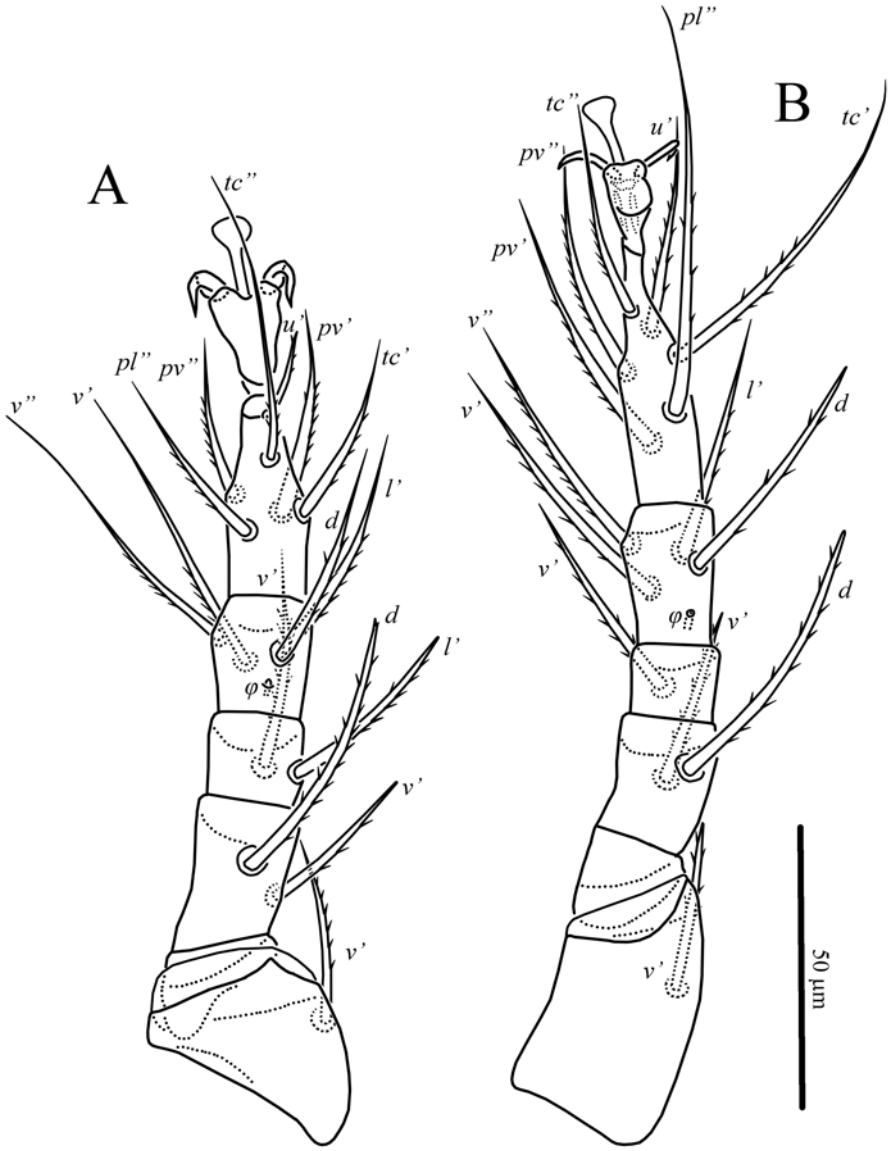


Figure 7 *Pediculaster nidicolus* (Mahunka, 1972), phoretic female: A – left leg III, dorsal aspect, B – left leg IV, dorsal aspect.

Ge 4 (*l'*, *l"*, *v'*, *v"*), TiTa 17(4) (*d*, *l'*, *l"*, *v'*, *v"*, *k*, *pl'*, *pl"*, *p'*, *p"*, *tc'*, *tc"*, *ft'*, *ft"*, *s*, *pv'*, *pv"*, *φ1*, *φ2*, *ω1*, *ω2*). Lengths of solenidia *ω1* 15–17, *ω2* 7–9, *φ1* 9–11, *φ2* 7–9; shape of solenidia as in non-phoretic female. Leg II (Figs 6B, 10D). Leg setation: Tr 1 (*v'*), Fe 3 (*d*, *l'*, *v"*), Ge 3 (*l'*, *l"*, *v'*), Ti 4(1) (*d*, *l'*, *v'*, *v"*, *φ*), Ta 6(1) (*pl"*, *tc'*, *tc"*, *pv'*, *pv"*, *u'*, *ω*). Solenidion *ω* 9–11 digitiform; solenidion *φ* 4–5 weakly clavate, situated in deep depression and only distal half visible (Fig. 10D). Tarsal claws thickened basally; empodium long and narrow. All leg setae barbed; setae *d* of femur and *u'* of tarsus blunt-tipped, other leg setae pointed. Leg III (Fig. 7A). Leg setation: Tr 1 (*v'*), F2 3 (*d*, *v'*), Ge 2 (*l'*, *v'*), Ti 4(1) (*d*, *l'*, *v'*, *v"*, *φ*), Ta 6 (*pl"*, *tc'*, *tc"*, *pv'*, *pv"*, *u'*). Claws, empodium and solenidion *φ* 4 as on tarsus II. All leg setae barbed; setae *d*, *v'* of femur, *l'* of genu, and *u'* of tarsus blunt-tipped, other leg setae pointed. Leg IV (Fig. 7B). Leg setation: Tr 1 (*v'*), Fe 2 (*d*, *v'*), Ge 1 (*v'*), Ti 4(1) (*d*, *l'*, *v'*, *v"*, *φ*), Ta 6 (*pl"*, *tc'*, *tc"*, *pv'*,

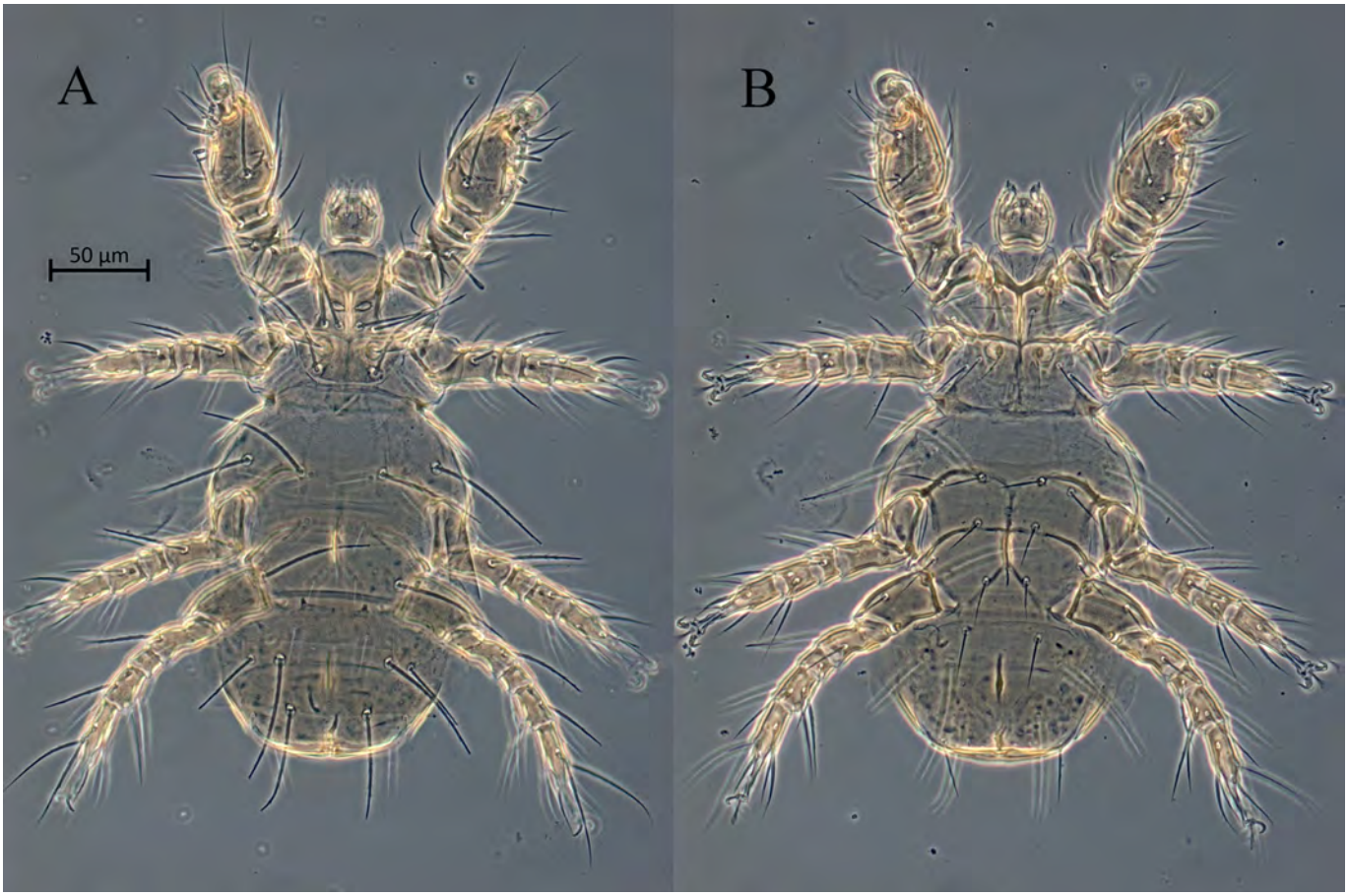


Figure 8 Phase contrast micrograph of *Pediculaster nidicolus* (Mahunka, 1972), phoretic female: A – general view dorsally, B – general view ventrally.

pv", *u'*). Empodium as on tarsi II and III; claws simple, hooked. Solenidion *φ* 3–4 situated in deep depression with terminal pore. All leg setae barbed; setae *v'* of trochanter, *d*, *v'* of femur, and *d* of tibia blunt-tipped, other leg setae pointed.

Larva and **male** unknown.

Material examined

Sixteen phoretic and seven non-phoretic females, Russia, city of Tyumen, Gagarin park, in nest of undetermined small mammal, 57°10′17.0″N 65°36′25.1″E, 10 October 2021, coll. A.A. Khaustov.

Material deposition

All examined materials are deposited in the mite collection of the Tyumen State University Museum of Zoology, Tyumen, Russia.

Remarks

Non-phoretic females of *Pediculaster nidicolus* are completely congruent with original description and undoubtedly conspecific with specimens from Austria. Phoretic females are very similar to *P. altaicus* Mahunka, 1969, described from the nest of *Microtus* sp. from Mongolia (Mahunka 1969). However, based on original description, *P. altaicus* has longer dorsal hysterosomal setae. For example, setae *c2* are longer than distance between their bases

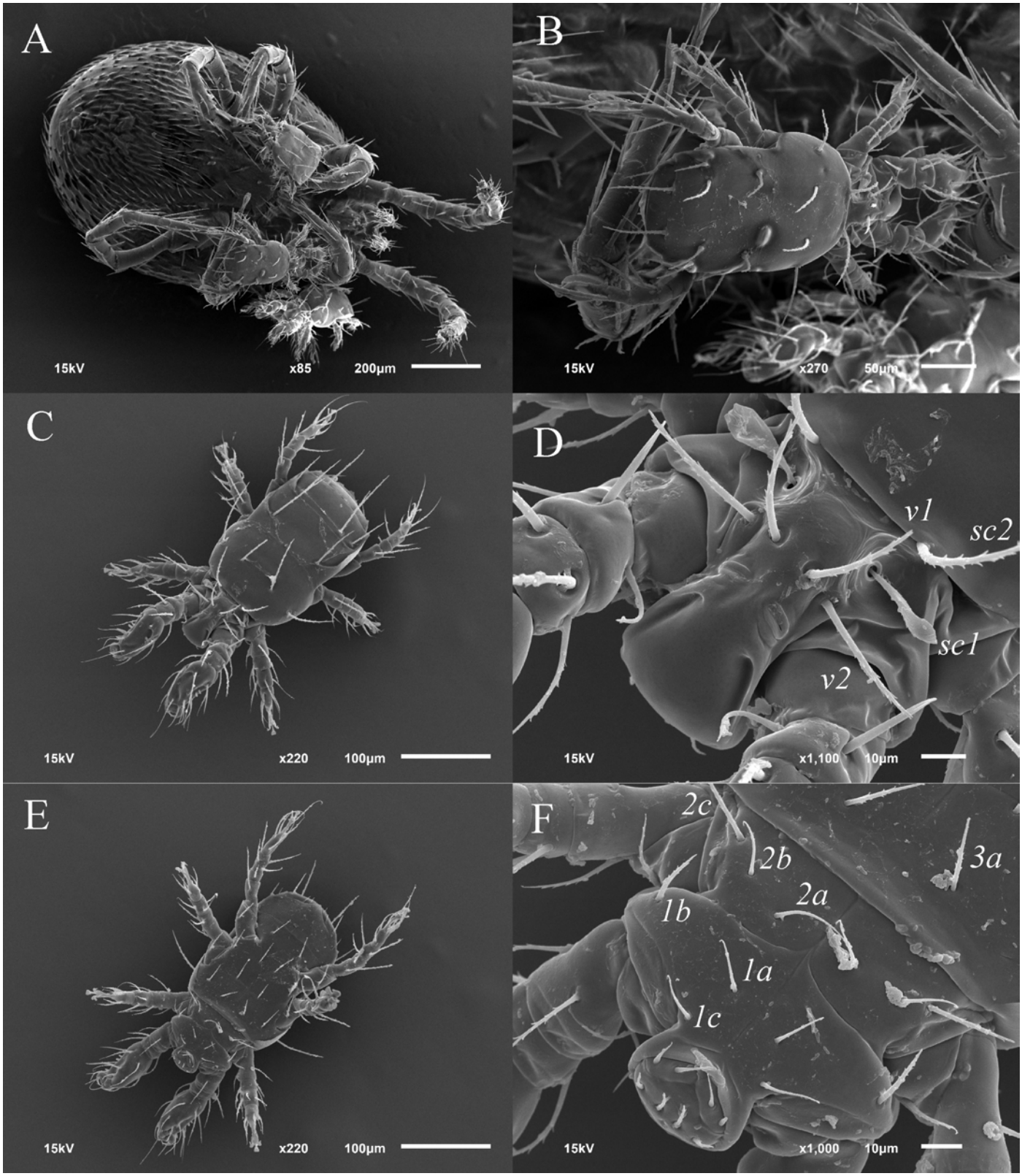


Figure 9 SEM micrographs of *Pediculaster nidicolus* (Mahunka, 1972), phoretic female: A – several females attached to gamasid mite *Haemogamasus ambulans* (Haemogamasidae), B – one female attached to *Haemogamasus ambulans*, C – general view dorsally, D – prodorsum, E – general view ventrally, F – prosoma, ventral aspect.

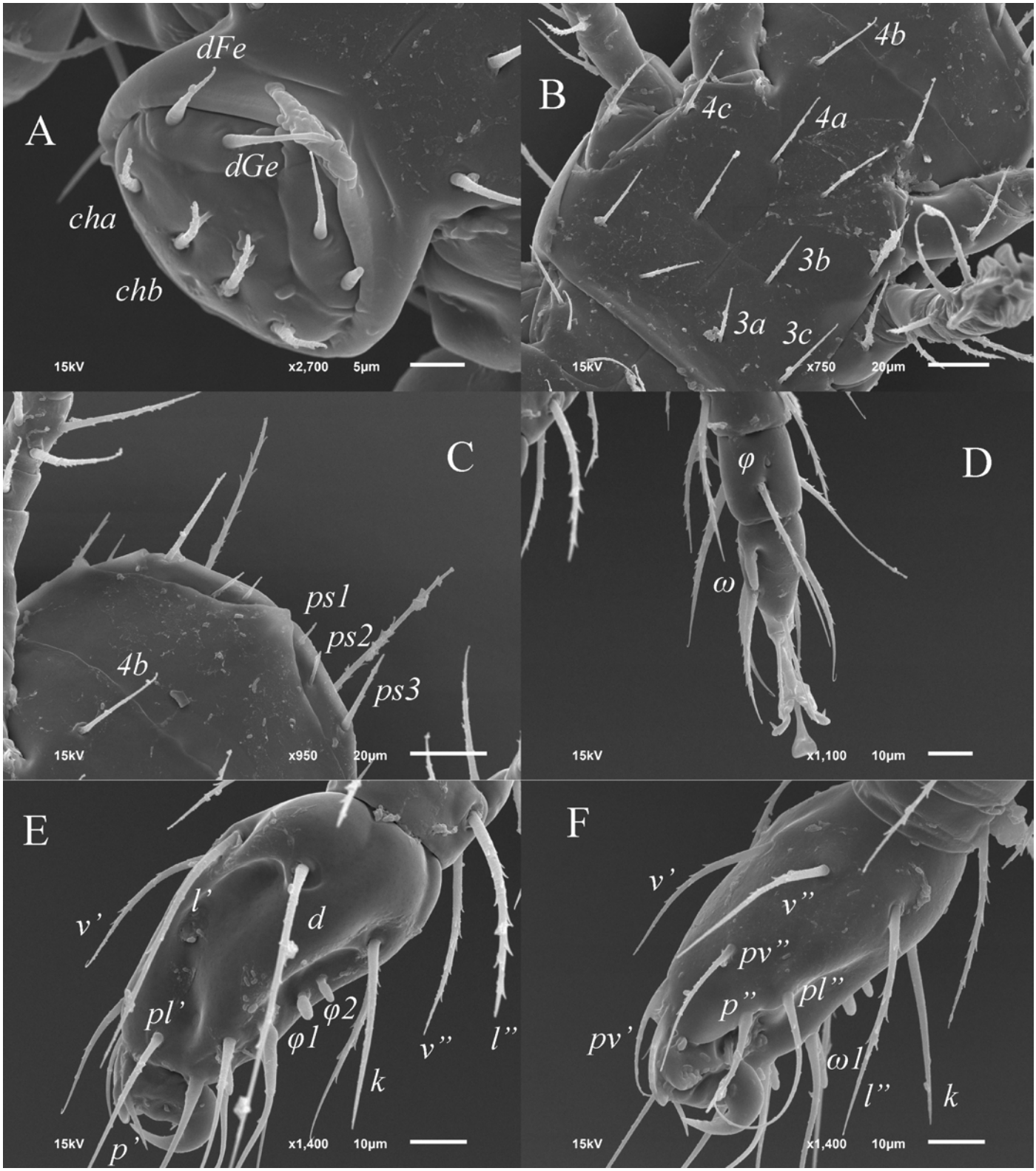


Figure 10 SEM micrographs of *Pediculaster nidicolus* (Mahunka, 1972), phoretic female: A – gnathosoma, B – metapodosoma, ventral aspect, C – opisthosoma, ventral aspect, D – tibia and tarsus II, dorsal aspect, E – tibiotarsus I, dorsal aspect, F – tibiotarsus I, ventral aspect.

(clearly shorter in *P. nidicolus*). However, the length of dorsal setae is highly variable in *Pediculaster* species and it could be a result of intraspecific variability. Potentially *P. nidicolus* could be a junior synonym of *P. altaicus*. The comparison of phoretic females of *P. nidicolus* with the type material of *P. altaicus* is necessary for the final clarification of the synonymy of these species.

Pediculaster nidicolus is recorded from Russia for the first time.

Key to phoretic females of *Pediculaster* of Palaearctic

Modified from Khaustov 2015; *P. egypticus* Omar, 2014, *P. gallinae* Zacher and Kandeel, 1986 and *P. arabicus* Zacher and Kandeel, 1986 are not included because of incomplete description; *P. limosinae* Samšińak, 1984, *P. incompletus* Samšińak, 1984 and *P. kaszabi* Mahunka, 1970a not included as suspected synonyms of *P. sellickianus*, *P. morelliae* and *P. dominguesi*, respectively.

1. Coxisternal fields I with two pairs of setae (*1c* absent) 2
— Coxisternal fields I with three pairs of setae 5

2. Ap5 well-developed 3
— Ap5 absent . . . . . *P. minagarici* Gao and Zou, 2000

3. Dorsal hysterosomal setae relatively short: setae *d* distinctly shorter than distance *d–d* 4
— Dorsal hysterosomal setae very long: setae *d* distinctly longer than distance *d–d* . . . . . *P. arcanus* (Rack, 1967)

4. Setae *e* and *h2* subequal, setae *v1* more than three times longer than v_2 . . . . . *P. subarcanus* Gao and Zou, 2000
— Setae *e* about three times longer than *h2*, setae *v1* less than two times longer than *v2* . . . . . *P. ermilovi* Khaustov, 2015

5. Setae (*u*) of tibiotarsus I fused together forming structure opposing to tarsal claw 6
— Setae (*u*) of tibiotarsus I separated, spine-like . . . . . *P. amerahae* Sevastianov and Abo-Korah, 1984

6. Coxisternal fields II with two pairs of setae 7
— Coxisternal fields II with three pairs of setae 15

7. Setae *e* present 8
— Setae *e* absent . . . . . *P. absentia* Rahiminejad and Seyedein, 2021

8. Setae *h2* shorter than *h1* 9
— Setae *h2* about two times longer than *h1* . . . . . *P. manicatus* (Berlese, 1904)

9. Setae *v1* and *v2* subequal 10
— Setae *v1* longer than *v2* 12

10. Stigmata two-chambered, trochanter IV with seta *v′* 11
— Stigmata one-chambered, trochanter IV without seta *v′* . . . . . *P. bisetus* Khaustov, 2020

11. Ap5 long, reaching almost to bases of setae *4b*, setae *e* about five times longer than *h2* . . . . . *P. athiasae* (Wicht, 1970)
— Ap5 short, reaching to bases of setae *4a*, setae *e* about three times longer than *h2* . . . . . *P. sterculinicola* Sevastianov, 1981

12. Empodia on tarsi II and III with rounded tips, setae *f* shorter or subequal to *h1* 13
— Empodia on tarsi II and III with pointed tips, setae *f* much longer than *h1* ..... *P. mendli* Rack, 1976

13. Setae *f* and *h1* subequal 14
— Setae *f* distinctly shorter than whip-like *h1* ..... *P. weidneri* Rack, 1976

14. Solenidion *φ1* situated close to *ω1* ..... *P. pfefferianus* Samšińak, 1984
— Solenidion *φ1* situated close to *φ2* ..... *P. muraiae* Mahunka and Zaki, 1984

15. Setae *tc"* of tarsus IV situated on distinct protuberance 16
— Setae *tc"* of tarsus IV not on protuberance 17

16. Setae *h1* long, whip-like, much longer than *f* ..... *P. calcaratus* (Mahunka, 1965)
— Setae *h1* short, blunt-tipped, subequal to *f* ..... *P. ensifer* (Savulkina, 1978)

17. Three pairs of pseudanal setae 18
— Two pairs of pseudanal setae ..... *P. turkiensis* (Ramaraju and Madanlar, 1997)

18. Setae *ps3* distinctly longer than *ps1* and *ps2* 19
— Setae *ps2* distinctly longer than *ps1* and *ps3* 31

19. Setae *ps1* and *ps*2 subequal 20
— Setae *ps1* distinctly shorter than *ps2* ..... *P. sklarii* Sevastianov and Chydyrov, 1994

20. Setae *v1* subequal to or longer than *v2* 21
— Setae *v1* distinctly shorter than *v2* ..... *P. hungaricus* Mahunka and Zaki, 1982

21. Setae *v1* distinctly longer than *v2* 22
— Setae *v1* subequal to *v2* 23

22. Setae *2b* about two times longer than *2a* ..... *P. janvaryorum* Mahunka, 1986
— Setae *2b* extremely long, many times longer than *2a* ..... *P. mongolicus* Mahunka, 1970a

23. Setae *e* and *h2* subequal 24
— Setae *e* distinctly longer than *h2* 25

24. Setae *2b* much longer than *2a* ..... *P. dudichi* Mahunka, 1970b
— Setae *2b* and *2a* subequal ..... *P. ignotus* (Krczal, 1959)

25. Setae *2b* no longer, or slightly longer than *2a* 27
— Setae *2b* several times longer than *2a* 26

26. Setae *sc2*, *c2*, *f* and *h1* pointed, ap5 absent, seta *ps2* situated on the same transverse level as *ps1*, setae *d* on femur and tibia IV very long and exceed beyond tip of tarsus ..... *P. chistyakovi* Khaustov and Ermilov, 2008
— Setae *sc2*, *c2*, *f* and *h1* blunt-tipped, ap5 present, seta *ps2* situated distinctly anteriad *ps1*, setae *d* on femur and tibia IV not exceed beyond tip of tarsus ..... *P. rarus* Khaustov, 2020

27. Bases of setae *h1* situated very close to bases of *h2* 28
— Bases of setae *h1* and *h2* distinctly separated 29

28. Ap5 present, solenidion *φ1* situated closer to setae *p"* than to solenidion *φ2* ..... *P. dudinskii* Khaustov, 2011
— Ap5 absent, solenidion *φ1* situated close to solenidion *φ2* ..... *P. zachvatkini* (Savulkina, 1978)

29. Setae *3a*, *3b*, and *4a* long, reaching bases of subsequent posterior setae 30
— Setae *3a*, *3b*, and *4a* short, not reaching bases of subsequent posterior setae ..... *P. similis* Mahunka, 1975

30. Setae *c2* longer than distance between their bases ..... *P. altaicus* Mahunka, 1969
— Setae *c2* shorter than distance between their bases ..... *P. nidicolus* (Mahunka, 1972)

31. Hysterosomal tergites without longitudinal wrinkles 32
— Hysterosomal tergites with distinct longitudinal wrinkles ..... *P. rugosus* Mahunka, 1973

32. Setae *2a* no longer than *2b* 34
— Setae *2a* much longer than *2b* 33

33. Setae *c1* and *c2* subequal, ap5 absent, setae *e* more than three times longer than *h2* ..... *P. sellnickianus* (Rack, 1964)
— Setae *c2* longer tnan *c1*, ap5 present, setae *e* less than three times longer than *h2* ..... *P. tjumeniensis* Khaustov, 2020

34. Setae *2b* distinctly longer than *2a* 35
— Setae *2b* and *2a* subequal 37

35. Stigmata two-chambered 36
— Stigmata one-chambered ..... *P. portatus* (Martin, 1978)

36. Ap5 absent, setae *d*, *f*, and *h1* much shorter than distance between their bases ..... *P. muscarius* (Martin, 1978)
— Ap5 present, setae *d*, *f*, and *h1* longer than distance between their bases ..... *P. neutarii* Khaustov, Lee, Lee and Kim, 2014

37. Empodia on tarsi II and III distinctly thickened distally, relatively short 38
— Empodia on tarsi II and III long and narrow ..... *P. meszarosi* Mahunka, 1973

38. Setae *f* longer than *e* 39
— Setae *f* and *e* subequal ..... *P. morelliae* Rack, 1974

39. Setae *v1* at least 2.5 times longer than *v2* 40
— Setae *v1* no more than 1.5 times longer than *v2* 43

40. Stigmata one-chambered 41
— Stigmata two-chambered ..... *P. malyi* Samšińak, 1989

41. Ap5 absent 42
— Ap5 present ..... *P. kneeboni* (Wicht, 1970)

42. Setae *ps1* and *ps3* subequal, tibiotarsus I about three times longer than its width ..... *P. camerikae* Khaustov, 2008b
— Setae *ps1* longer than *ps3*, tibiotarsus I about 1.5 times longer than its width ..... *P. eccoptomeralis* Camerik, 2010

43. Solenidion *φ1* situated laterally between bases of setae *pl"* and *l"* 44
— Solenidion *φ1* situated close to solenidion *φ2* or *ω1* 47

44. Setae *c1* shorter or subequal to *d* 45
— Setae *c1* longer than *d* ..... *P. confusus* Khaustov, 2008b

45. Ap5 absent 46
— Ap5 present ..... *P. ghilarovi* Sevastianov, 1988

46. Setae *c1* subequal to distance *c1–c1*, setae *c2* distinctly longer than *d* ..... *P. tauricus* Khaustov, 2008b
— Setae *c1* distinctly longer than distance *c1–c1*, setae *c2* subequal to *d* ..... *P. amuriensis* Sevastianov, Chydyrov and Marroch, 1994

47. Setae *ps3* distinctly longer than *ps1* 48
— Setae *ps3* shorter or subequal to *ps1* 49

48. Stigmata one-chambered ..... *P. montanus* Khaustov, 2008b
— Stigmata two-chambered ..... *P. zacheri* Sevastianov and Abo-Korah, 1984

49. Ap5 present 50
— Ap5 absent 52

50. Setae *e* at least half of length of setae *f* 51
— Setae *e* shorter than half of length of setae *f* ..... *P. helomyzalis* Camerik, 2006

51. Setae of posterior sternal plate smooth ..... *P. jaltensis* Sevastianov, 1974
— Setae of posterior sternal plate barbed ..... *P. dominguesi* (Athias-Henriot, 1961)

52. Stigmata two-chambered 53
— Stigmata one-chambered 55

53. Setae *e* longer and thicker than *h2* 54
— Setae *e* and *h2* of similar width and length ..... *P. martyani* Khaustov, 2008b

54. Setae *e* only slightly shorter than *f* ..... *P. moravicus* Samšińak, 1984
— Setae *e* about two times shorter than *f* ..... *P. pseudomanicatus* Camerik, 2001

55. Setae *e* at least two times longer than *h2* 56
— Setae *e* less than two times longer than *h2* 60

56. Setae c_2 no shorter than *c1* 57
— Setae *c2* shorter than *c1* ..... *P. collinellularis* Camerik, 2006

57. Distance *e–f* less than half of distance *f–f* 58
— Distance *e–f* at least half of distance *f–f* ..... *P. gautengensis* Camerilk, 1996

58. Dorsal hysterosomal setae relatively long, setae *c1* shorter than *c2* 59
— Dorsal hysterosomal setae relatively short, setae *c1* and *c2* subequal . . . . . *P. bureschi* (Savulkina, 1978)

59. Setae *f* about two times longer than *e* . . . . . *P. horricomus* (Savulkina, 1978)
— Setae *f* no more 1/3 longer than *e* . . . . . *P. microsaniae* (Martin, 1978)

60. Setae *e* situated slightly posteriad bases of setae *f* 61
— Setae *e* situated distinctly anteriad bases of setae *f* . . . . . *P. lignarius* Khaustov, 2015

61. Setae *c1* subequal or longer than distance *c1–c1* 62
— Setae *c1* shorter than distance *c1–c1* . . . . . *P. mesembrinae* (Canestrini, 1881)

62. Setae *f* more than four times longer than *e* 63
— Setae *f* no more than three times longer than *e* . . . . . *P. rysanovi* Samšińak, 1989

63. Setae *tc"* of tarsus IV very long, whip-like, distinctly longer than combined length of genu, tibia and tarsus IV . . . . . *P. koreensis* (Mahunka and Rack, 1977)
— Setae *tc"* of tarsus IV distinctly shorter than combined length of genu, tibia and tarsus IV . . . . . *P. perottii* Camerik and Coetzee, 1998

Acknowledgements

The author thank to Alexey Gubin (Tyumen State University, Russia) for the preparation of SEM photos. The research was supported by the cooperative agreement No. FEWZ-2021-0004, funded by the Russian Ministry of Science and Higher Education.

References

Athias-Henriot C. 1961. *Pygmephorus dominguezi*, nouveau pyémotidae algerien (Acariformes, Tarsonemini). Acarologia, 3: 571-574. [in French]
Berlese A. 1904. Acari nuovi. Manipulus III. Redia, 2: 10-32. [in Italian]
Camerik A.M. 1996. Phoretic females of *Pediculaster gautengensis* sp. n. (Acari: Pygmephoridae) associated with insects collected from dung in South Africa. Mitt. Hamburg. Zool. Mus. Inst., 93: 161-170.
Camerik A.M. 2001. Description of holotype of *Pediculaster manicatus* (Berlese), 1904 and description of *P. pseudomanicatus* n. sp. (Acari: Pygmephoridae). Internat. J. Acarol., 27: 13-28. https://doi.org/10.1080/01647950108684219
Camerik A.M. 2006. Some *Pediculaster* (Acari: Siteroptidae) species from Belgium and Kenya. Bull. Soc. Roy. Belg. Entomol., 142: 140-155.
Camerik A.M., Goetzee S.H. 1998. *Pediculaster perottii* spec. nov. (Acari: Pygmephoridae), phoretic females collected from *Haematobia* (Diptera: Muscidae) in Argentina, South America. Bull Inst. R. sci. Nat. Belg. (Entomol.), 68: 29-36.
Camerik A.M., Kheradmand K. 2010. New species of *Pediculaster* (Acari: Siteroptidae) from Belgium and Rwanda. Internat. J. Acarol., 36: 91-99. https://doi.org/10.1080/01647950903505074
Camerik A.M., de Lillo E., Lalkhan C. 2006. The neotype of *Pediculaster mesembrinae* (Canestrini, 1881) (Acari: Siteroptidae) and the description of all life stages. Internat. J. Acarol., 32: 45-67. https://doi.org/10.1080/01647950608684442
Camerik A.M., Kheradmand K. 2010. New species of *Pediculaster* (Acari: Siteroptidae) from Belgium and Rwanda. Internat. J. .Acarol., 36: 91-99. https://doi.org/10.1080/01647950903505074
Canestrini R. 1881. Contribuzione allo studio degli Acari parassiti degli insetti. Atti Soc. Veneto. -Trent. Sci. Nat, Padova, 7: 154-155. [in Italian]
Cross E.A. 1965. The generic relationships of the family Pyemotidae (Acarina, Trombidiformes). Univ. Kans. Sci. Bull., 45: 29-215.
Cross E.A., Kaliszewski M.J. 1988. The life history of a mushroom pest mite, Pediculaster fletchmanni (Wicht) (Acari: Pygmephoridae) with studies of alternate morph formation. Environ. Entomol., 17: 309-315. https://doi.org/10.1093/ee/17.2.309
Gao J.-R., Zou P. 2000. Two new species of the genus *Pediculaster* from China (Acari: Pygmephoridae). Acta Zootax. Sin., 25: 387-390. [in Chinese]

Grandjean F. 1944. Observations sur les Acariens de la famille des Stigmaeidae. Arch. Sci. Phys. Natur., 26: 103-131. [in French]
Grandjean F. 1947. L'origine pileuse des mors et la chaetotaxie de la mandibule chez les Acariens actinochitineux. C. rend. Séanc. Acad. Sci., 224, 1251-1254. [in French]
Khaustov A.A. 2004. Mites of the family Neopygmephoridae Cross, 1965 stat. n. and their position in Heterostigmata. *In*: Balashov Y.S. (Ed.), VIII Russian Acarological Conference, St.Petersburg. Zoological Institute of RAS, St.Petersburg, p. 137. [in Russian]
Khaustov A.A. 2008a. Mites of the family Scutacaridae of Eastern Palaearctic. Akademperiodyka, Kiev, 291 pp.
Khaustov A.A. 2008b. A review of the genus *Pediculaster* Vitzthum, 1927 (Acari: Pygmephoridae) of Ukraine. Acarina, 16: 159-175.
Khaustov A.A. 2011. New species and new records of mites of the genus *Pediculaster* (Acari, Heterostigmata, Pygmephoridae) from Ukraine. Vestn. Zool., 45: 265-268. https://doi.org/10.2478/v10058-011-0016-3
Khaustov A.A. 2015. Two new species of the genus *Pediculaster* (Acari: Pygmephoridae) from Western Siberia, Russia. Zootaxa, 3926: 413-429. https://doi.org/10.11646/zootaxa.3926.3.6
Khaustov A. 2020. Three new species and new records of *Pediculaster* (Acari: Pygmephoridae) from Western Siberia, Russia. Acarologia, 60: 317-1337. https://doi.org/10.24349/acarologia/20204370
Khaustov A.A., Ermilov S.G. 2008. Two new species of mites of the superfamily Pygmephoroidea (Acari: Heterostigmata: Pygmephoridae, Neopygmephoridae) from the European part of Russia. Acarina, 16: 39-43.
Khaustov A.A., Lee J.-H., Lee Y.-S., Kim J.R. 2014. A new species of the genus *Pediculaster* (Acari: Heterostigmatina: Pygmephoridae) from commercial oyster mushroom houses in Korea. Acarina, 22: 109-116.
Krczal H. 1959. Systematik und Ökologie der Pyemotiden. Beitr. Syst. Ökol. Mitteleurop. Acarina, 1: 385-625.
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
Mahunka S. 1965. Die Tarsonemini (Acari) Fauna Ungarischer Dauerwiesen und Hutweiden. Acta Zool. Acad. Sci, Hung., 11: 137-151. [in German]
Mahunka S. 1969. 176. Pyemotidae and Scutacaridae IV. Ergebnisse der zoologischen Forschung von Dr. Z. Kaszab in der Mongolei (Acari). Reichenbachia, 12: 83-11. [in German]
Mahunka S. 1970a. Ergebnisse der zoologischen Forschungen von Dr. Z. Kaszab in der Mongolei. 227. Acari: Pygmephoroidea. Ann. Hist.-Nat. Mus. Nat. Hung., 62: 343-362. [in German]
Mahunka S. 1970b. Considerations on the systematics of the Tarsonemina and the description of new European taxa (Acari: Trombidiformes). Acta Zool. Acad. Sci. Hung., 16: 137-174.
Mahunka S. 1972. Neue und interessante Milben aus dem Genfer Museum X. Milben aus Kleinsäugernestern Nordtirols (Österreich) (Acari: Tarsonemida, Acarida und Oribatida). Ber. Nat.-med.Ver. Insbruk, 59, 57-62. [in German]
Mahunka S. 1973. Neue Tarsonemiden (Acari) aus der Mongolei. Ann. Hist.-Nat. Mus. Nat. Hung., 65: 309-315. [in German]
Mahunka S. 1975. Beiträge zur Kenntnis der Tarsonemiden (Acari) von Kleinsäugernestern aus der Umgebung von Ljubljana (Jugoslawien). Paras. Hung., 8: 75-83. [in German]
Mahunka S. 1979. Some remarks on the polymorphism (phoretomorphism) in Tarsonemid mites. Folia Entomol. Hung., 32(2): 133-137.
Mahunka S. 1986. Tarsonemids of the Kiskunság National park (Acari). Fauna Kiskunság Nat. park, 1: 435-455.
Mahunka S., Rack G. 1977. Zwei neue Arten der Familien Acarophenacidae und Pygmephoridae (Acarina: Tarsonemida). Ann. Hist.-Nat. Mus. Nat. Hung., 69: 305-309. [in German]
Mahunka S., Zaki A. M. 1982. New Tarsonemina species from Hungary (Acari). Fol. Entomol. Hung., 43: 87-93.
Mahunka S., Zaki A.M. 1984. Data to the Tarsonemina (Acari) fauna of the Bakony Mountains and its environs, Hungary. Parasitol. Hung., 17: 75-82.
Martin N.A. 1978. *Siteroptes* (*Siteroptoides*) species with *Pediculaster*-like phoretomorphs (Acari: Tarsonemida: Pygmephoridae) from New Zealand and Polynesia. NZ J. Zool., 5: 121-155. https://doi.org/10.1080/03014223.1978.10423745
Omar N.A. 2014. Revision of the genus *Pediculaster* Vitzthum, 1927 (Acari: Pygmephoridae) of Egypt with the description of a new species. J. Product. Dev., 19: 13-23. https://doi.org/10.21608/jpd.2014.42608
Rack G. 1964. Über die bisher in Hamburg gefundenen Pyemotidae (Acarina, Trombidiformes) mit Beschreibung von zwei neuen Arten. Ent. Mitt. Zool. Staat. Zool. Mus. Hamburg, 3: 21-29. [in German]
Rack G. 1967. Neue Pyemotidenfunde in Hamburg (Acarina, Pyemotidae). Entomol. Mitt. Zool. Staats.Zool. Mus. Hamburg, 3: 163-179. [in German]
Rack G. 1974. Zwei neue Arten der Gattung *Pediculaster* von Australischen Dipteren (Acarina, Tarsonemida, Pygmephoridae). Acarologia, 26: 500-505. [in German]
Rack G., 1976. Milben (Acarina) von europäischen Limoniinen (Diptera, Nematocera). Mitt. Zool. Mus. Inst. Hamburg, 72: 63-86. [in German]
Ramaraju K., Madanlar N. 1997. Three new *Pygmephorus* Kramer (Acari: Pygmephoridae) species from Turkey. Turk. Entomol. Der., 21: 83-93.
Samšińak K. 1984. Mites on flies of the family Sphaeroceridae. Věst ČS. spol. Zool., 48: 45-63.
Samšińak K. 1989. Mites on flies of the family Sphaeroceridae. II. Acarologia, 30: 85-105.

Savulkina M.M. 1978. Neue Pygmephoriden-Arten (Trombidiformes, Pygmephoridae) aus Nagernestern von Bulgarien und der Sowjetunion. Parasitol. Hung., 11: 127-140. [in German]
Sevastianov V.D. 1974. New species of the family Pygmephoridae (Trombidiformes). Zool. Zh., 53: 848-857. [in Russian]
Sevastianov V.D. 1981. New mite species of the family Pygmephoridae (Tarsonemina, Trombidiformes). Vestn. zool, 6: 25-30. [in Russian]
Sevastianov V.D. 1988. Review of the mite genus *Pediculaster* Vitzthum (Pygmephoridae, Trombidiformes) of the world fauna. Proc. All-Union Entomol. Soc., 70: 217-222. [in Russian]
Sevastianov V.D., Abo-Korah S.M. 1984. A new genus and species of the family Pygmephoridae (Trombidiformes). Zool. Zh., 63: 1797-1807. [in Russian]
Sevastianov V.D., Chydyrov P.R., Marroch T.N. 1994. New mite species of the cohort Tarsonemina (Trombidiformes) from Turkmenistan, Ukraine and Russian Federation. Vestn. Zool., 28: 3-10. [in Russian]
Seyedein S., Rahiminejad V., Nadimi A. 2021. New records of the genus Pediculaster Vitzthum, 1931 (Acari: Heterostigmata: Pygmephoridae) with description of a remarkable new species, associated with Helina sp. (Diptera: Muscidae) from Iran. Biologia, 76: 1509-1516. https://doi.org/10.2478/s11756-020-00657-x
Vitzthum H. 1931. Resultats Scientifiques du Voyage aux Indes Orientales Neerlandaises de LL. AA. RR. le Prince et la Princesse Leopold de Belgique. Mem. Mus. Hist. Nat. Belg., 3: 1-55.
Wicht M.C. 1970. Three new species of pyemotid mites associated with commercial mushrooms. Acarologia, 12: 262-268.
Zaher M. A. 1986. Survey and ecological studies on phytophagous & predaceous and soil mites in Egypt: II - (A and B), Predaceous & Nonphytophagous mites (Nile Valley and Delta): Report of PL., 480 Program, U.S.A. Project No. EG- ARS- 30, Grant No. F.G.EG-139. Tex, 564 pp. and Figures, 279 pp.