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

Alexander A. Khaustov<sup>a</sup>

<sup>a</sup>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 Palearctic *Pediculaster* species is provided.

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

## Introduction

The genus *Pediculaster* Vitzthum, 1931 (Acari: Pygmephoroida) 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.

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Corresponding author

Alexander A. Khaustov:  
[alex1973khaustov@gmail.com](mailto:alex1973khaustov@gmail.com)

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## 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 Pygmephoroida follows that of Khaustov (2004, 2008a). All measurements are given in micrometers ( $\mu\text{m}$ ). 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 anterior *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.



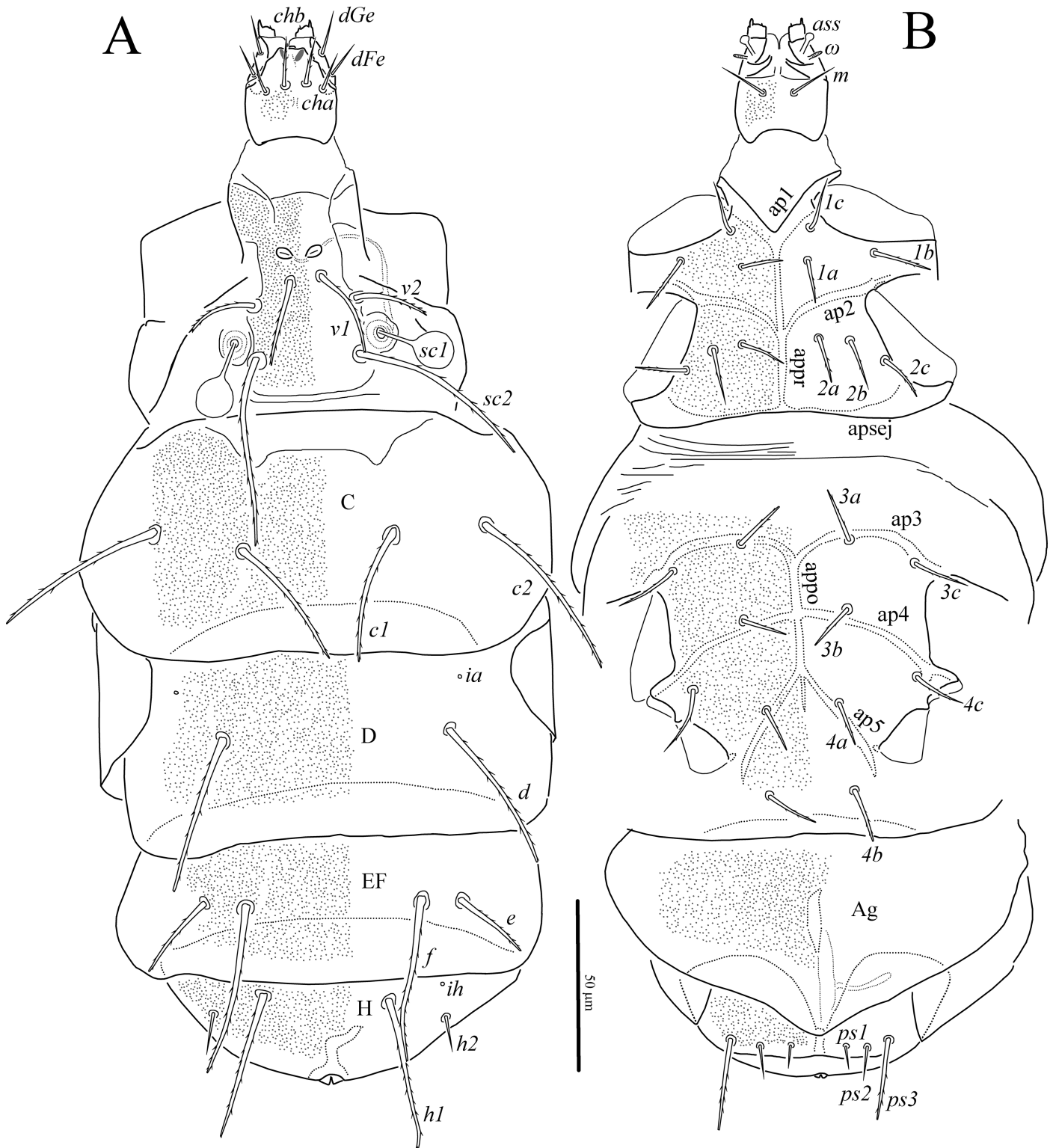
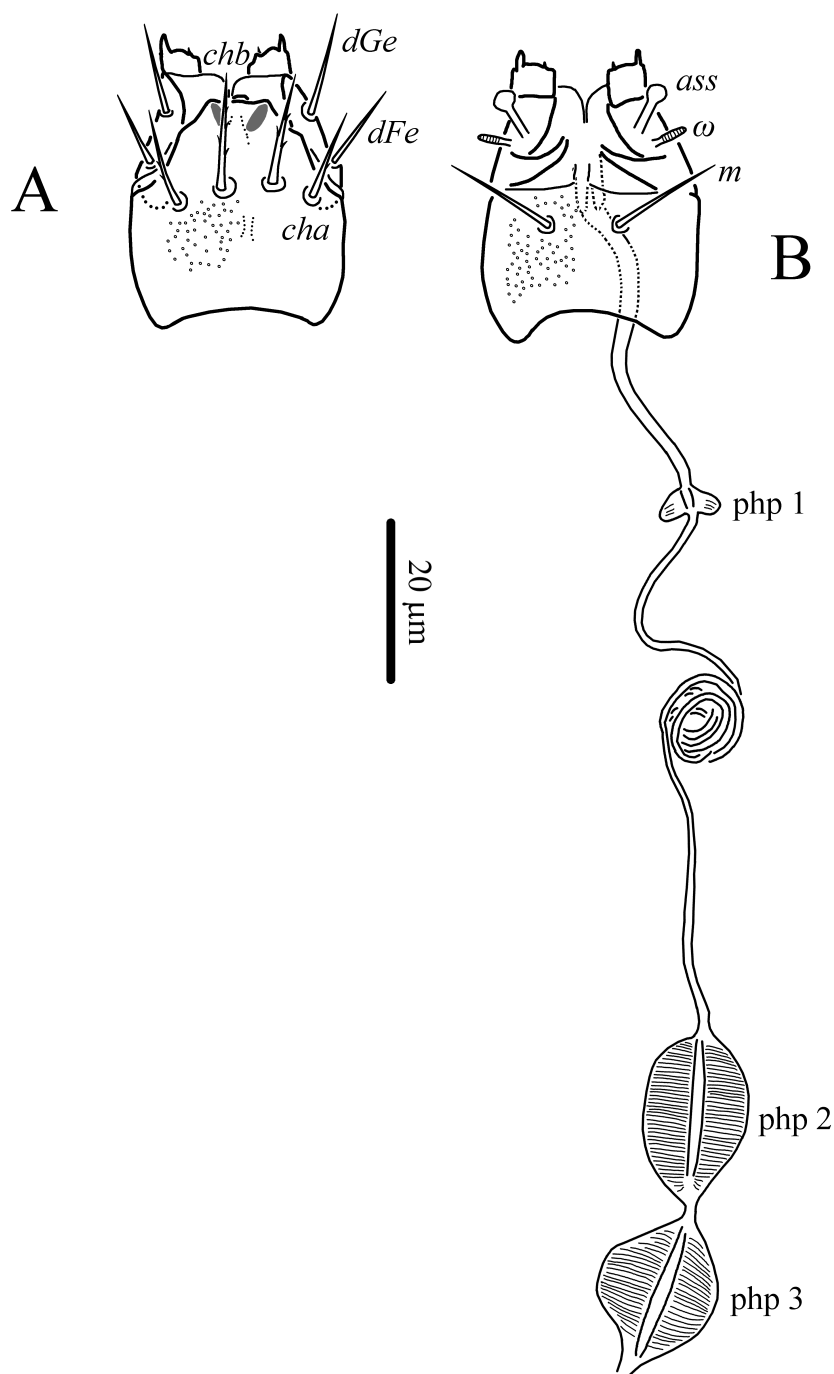
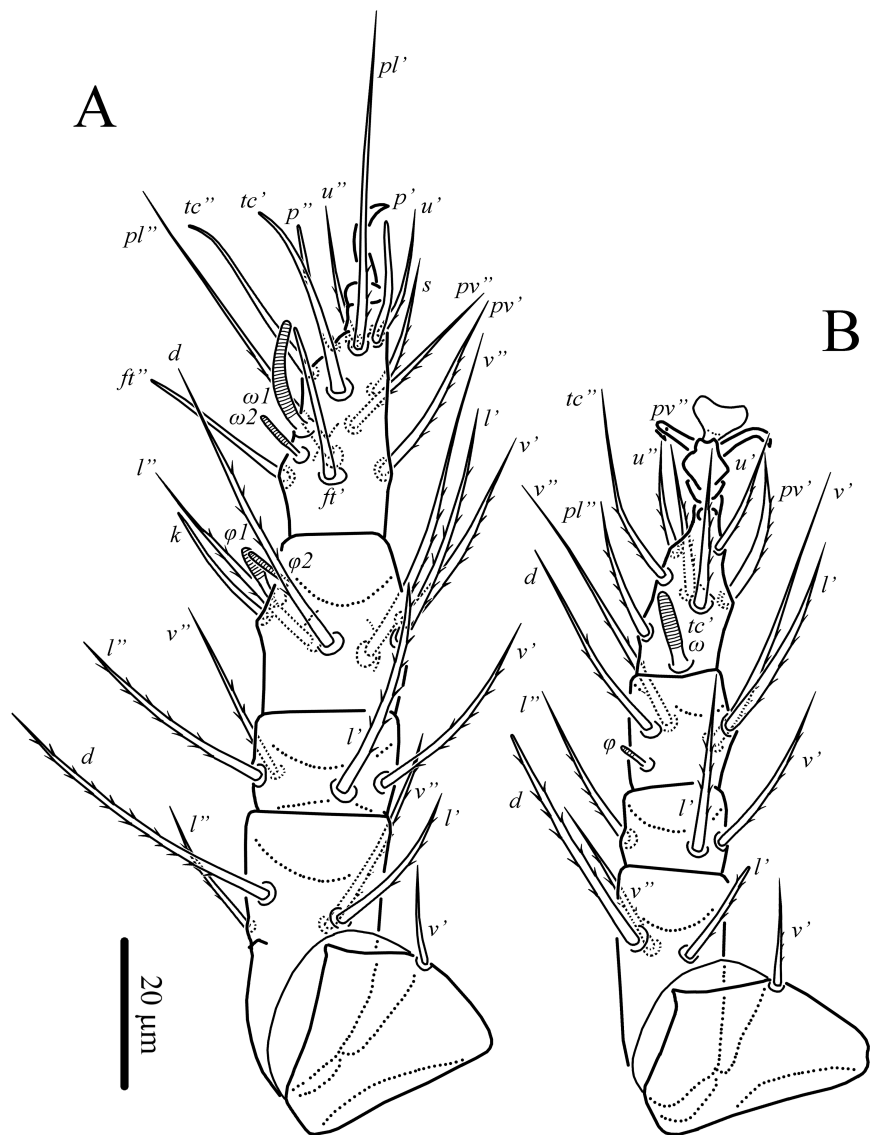


Figure 1 *Pediculaster nidicolus* (Mahunka, 1972), non-phoretic female: A – dorsum of body, B – venter of body. Legs omitted.



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

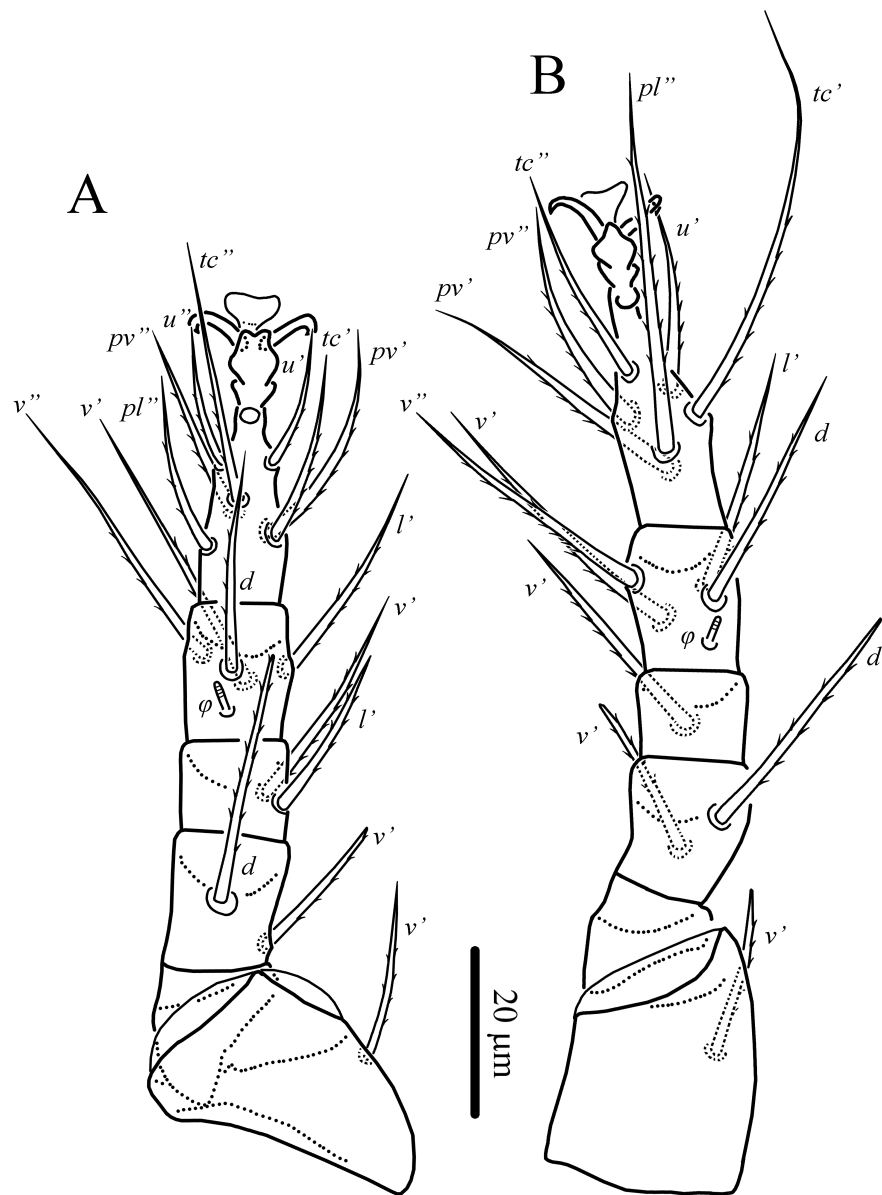
*Gnathosoma* (Fig. 2). Length of gnathosomal capsule 26–30, width 27–31. Dorsal median apodeme weakly developed. All gnathosomal setae pointed; setae *cha* and *chb* weakly barbed, other gnathosomal setae smooth. Palp tibiotarsus with well-developed blunt-tipped claw and tiny eupathid-like seta; palps 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*,  $\phi 1$ ,  $\phi 2$ ), Ta 13(2) (*pl'*, *pl''*, *p'*, *p''*, *tc'*, *tc''*, *ft'*, *ft''*, *s*, *pv'*, *pv''*, *u'*, *u''*,  $\omega 1$ ,  $\omega 2$ ). Tarsus with simple hooked claw. Lengths of solenidia  $\omega 1$  15–17,  $\omega 2$  7–8,  $\phi 1$  8–9,  $\phi 2$  7–9; solenidium  $\omega 1$  digitiform, solenidium  $\phi 1$  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''*,  $\phi$ ), Ta 7(1) (*pl''*, *tc'*, *tc''*, *pv'*, *pv''*, *u'*, *u''*,  $\omega$ ). Solenidium  $\omega$  10–12 digitiform, solenidium  $\phi$  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) ( $d, l', v', v'', \phi$ ), Ta 7 ( $pl'', tc', tc'', pv', pv'', u', u''$ ). Claws and empodium as on tarsus II. Solenidion  $\phi$  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) ( $d, l', v', v'', \phi$ ), Ta 6 ( $pl'', tc', tc'', pv', pv'', u'$ ). Claws and empodium as on tarsi II and III. Solenidion  $\phi$  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.

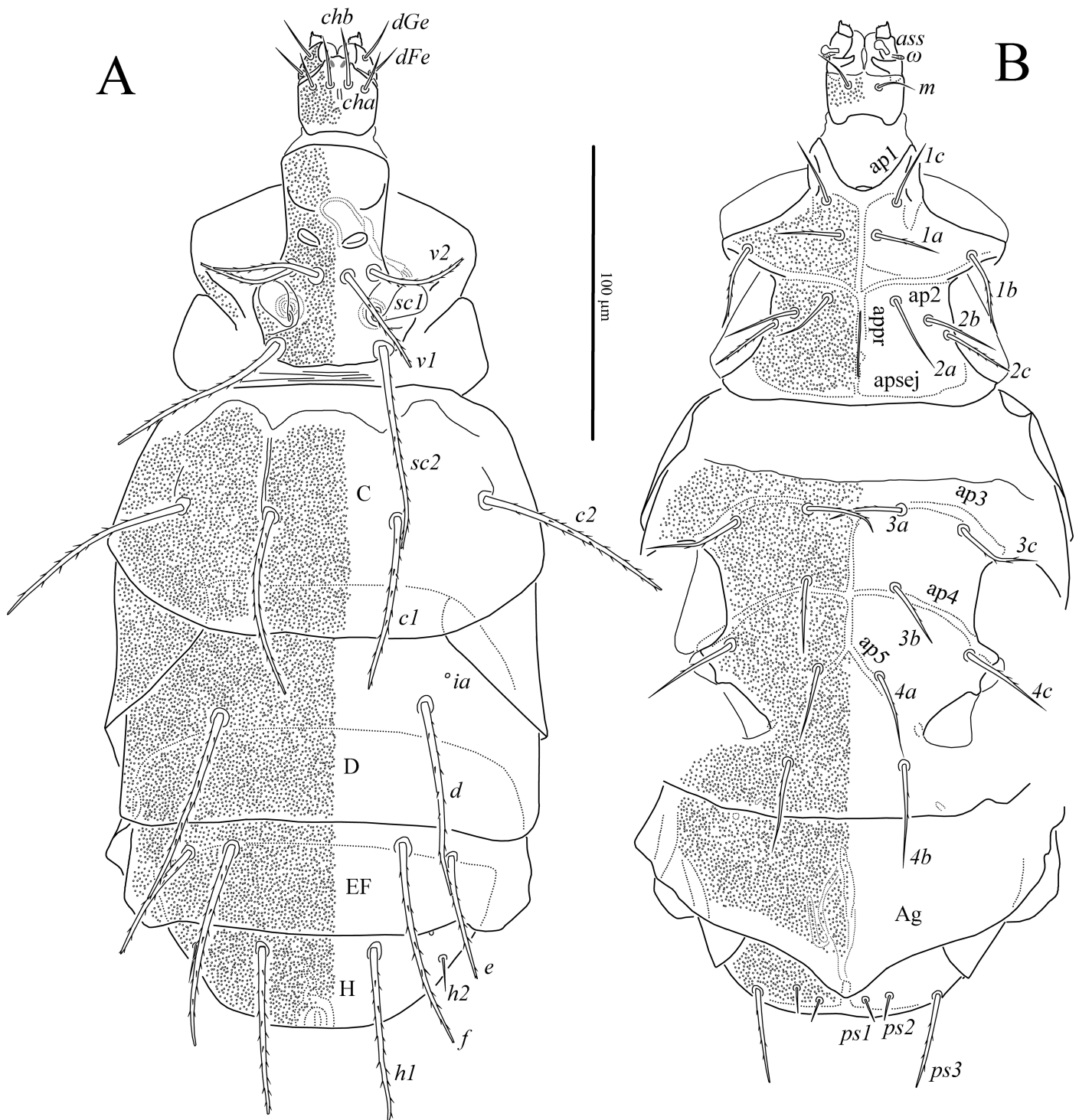
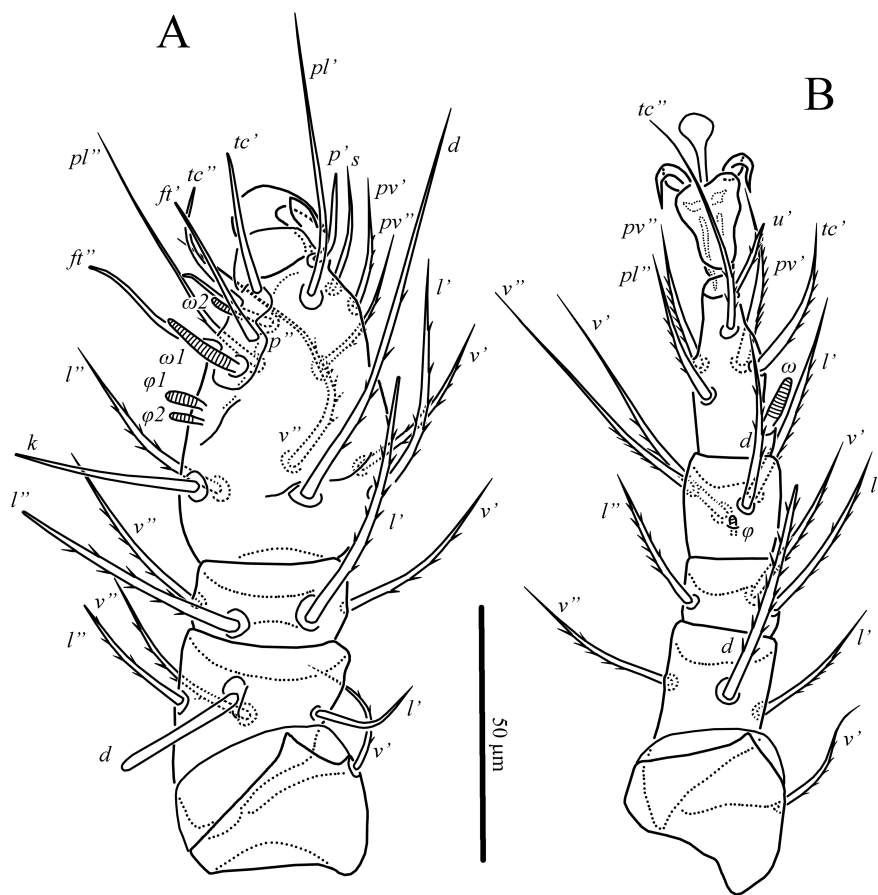


Figure 5 *Pediculaster nidicolus* (Mahunka, 1972), phoretic female: A – dorsum of body, B – venter of body. Legs omitted.



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

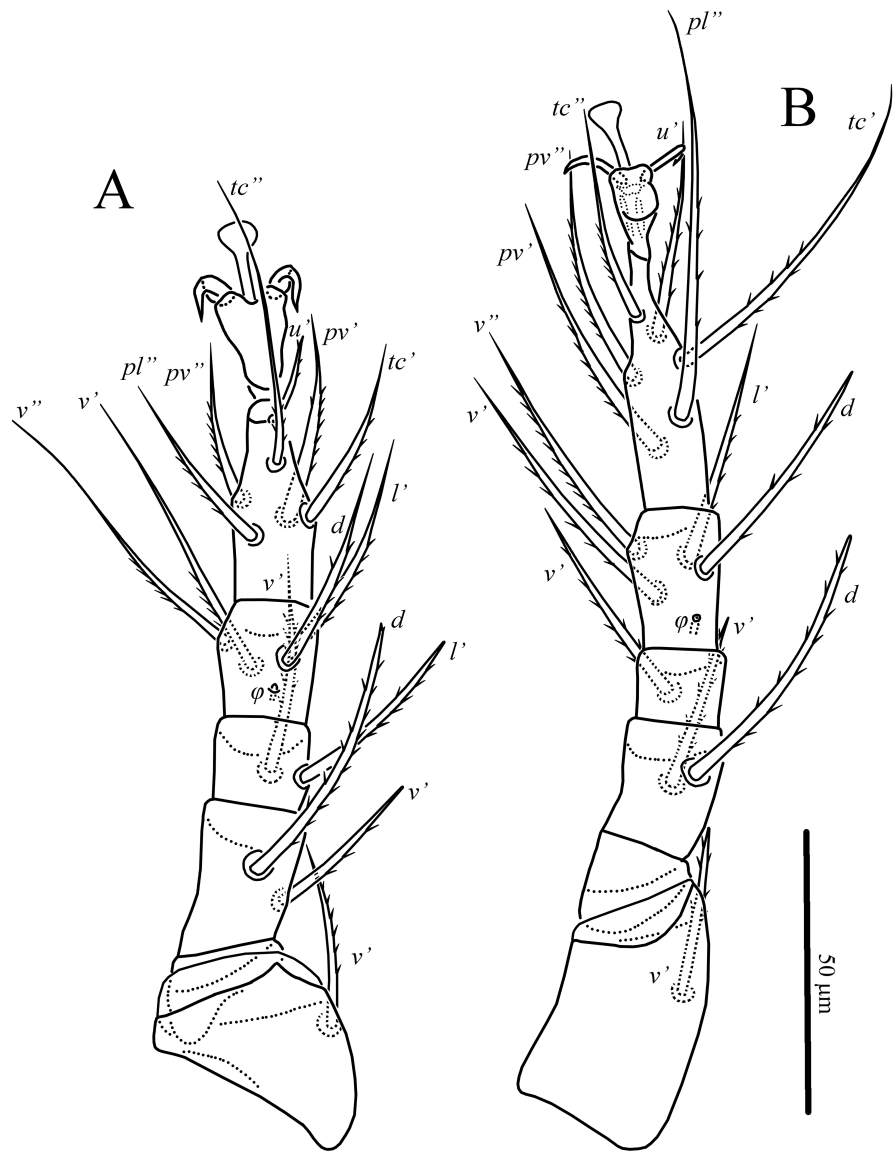
*Idiosomal dorsum* (Figs 5A, 8A, 9C, D) as in phoretic female, but dorsal setae usually longer and puncta on dorsal shields slightly bigger. Setae *v1* and *v2* situated in one transverse row. Prodorsum anterolaterally with pocket-like depressions (Fig. 9C). Lengths of dorsal setae: *v1* 35–41, *v2* 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.

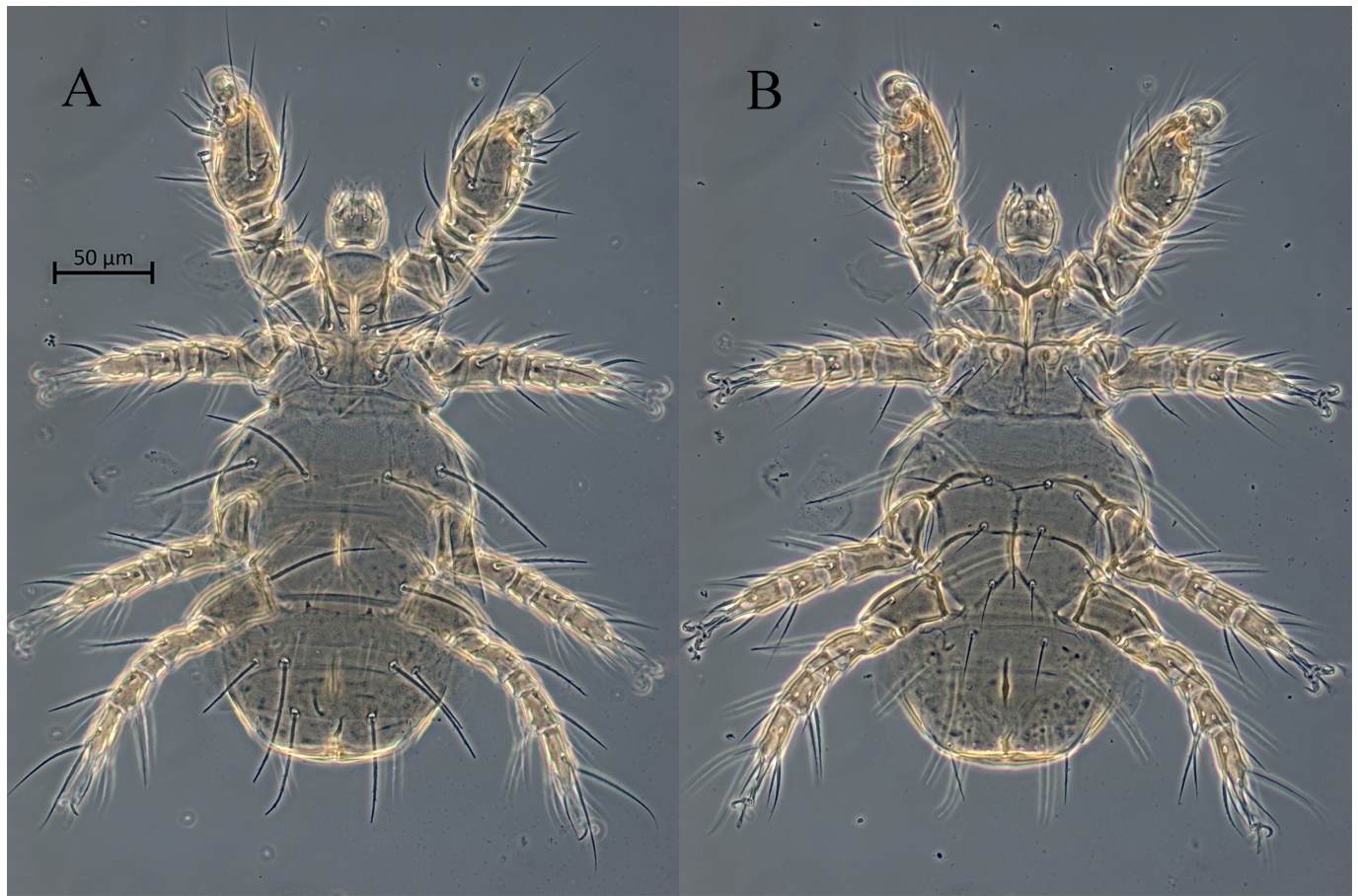
*Legs* (Figs 6, 7, 10D–F). Leg I (Figs 6A, 10E, F). Tibia and tarsus fused into massive ovate tibiotarsus. Tarsal claw thicker than in non-phoretic female; Unguinal setae fused into subtriangular structure opposing to claw. Seta *d* of femur spatulate; setae (*l*) of genu, *k*, (*p*), (*tc*), and (*ft*) 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) ( $d, l', l'', v', v'', k, pl', pl'', p', p'', tc', tc'', ft', ft'', s, pv', pv'', \phi 1, \phi 2, \omega 1, \omega 2$ ). Lengths of solenidia  $\omega 1$  15–17,  $\omega 2$  7–9,  $\phi 1$  9–11,  $\phi 2$  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) ( $d, l', v', v'', \phi$ ), Ta 6(1) ( $pl'', tc', tc'', pv', pv'', u', \omega$ ). Solenidion  $\omega$  9–11 digitiform; solenidion  $\phi$  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) ( $d, l', v', v'', \phi$ ), Ta 6 ( $pl'', tc', tc'', pv', pv'', u'$ ). Claws, empodium and solenidion  $\phi$  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) ( $d, l', v', v'', \phi$ ), 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  $\phi$  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.

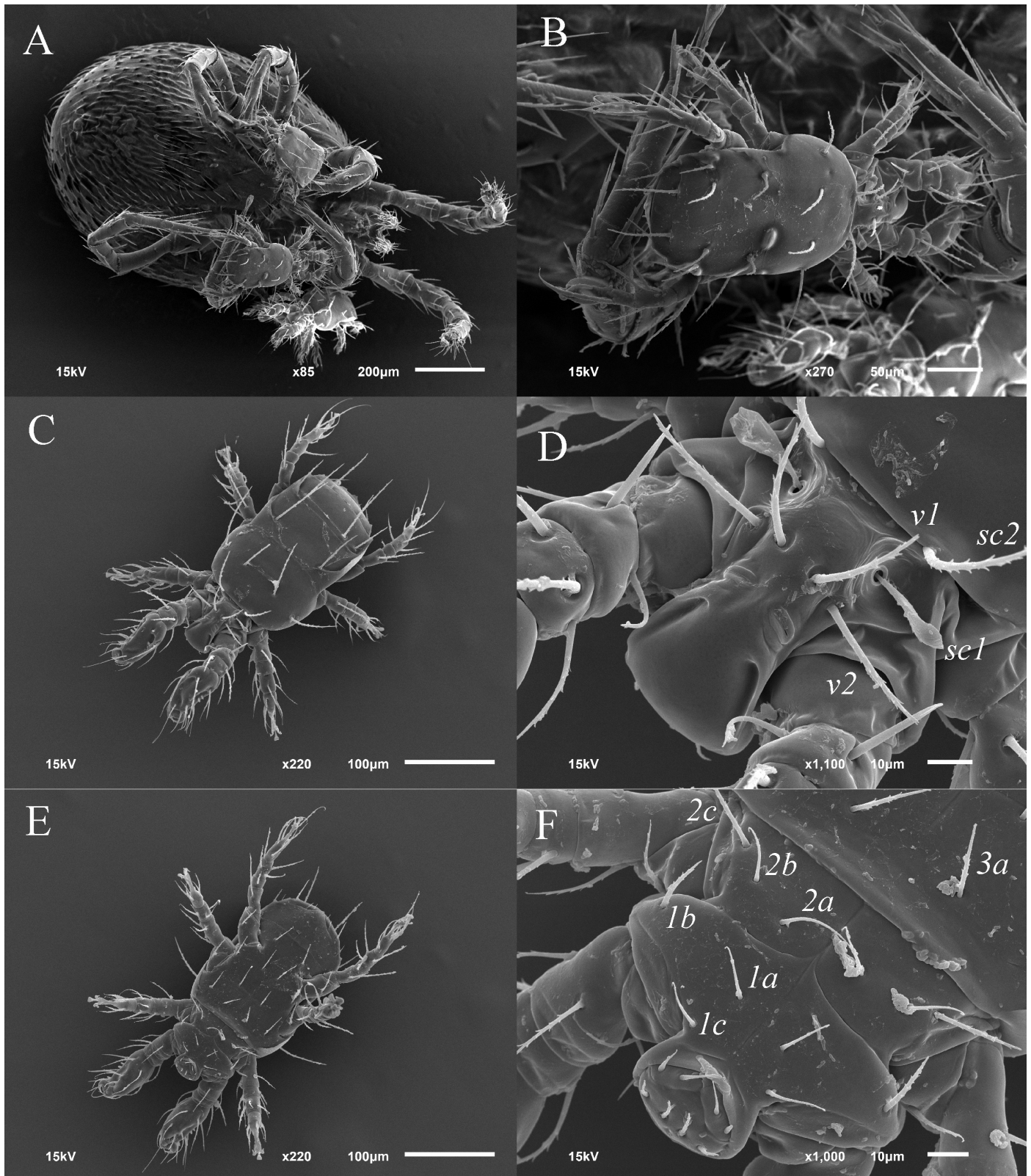
#### Material deposition

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

#### Remarks

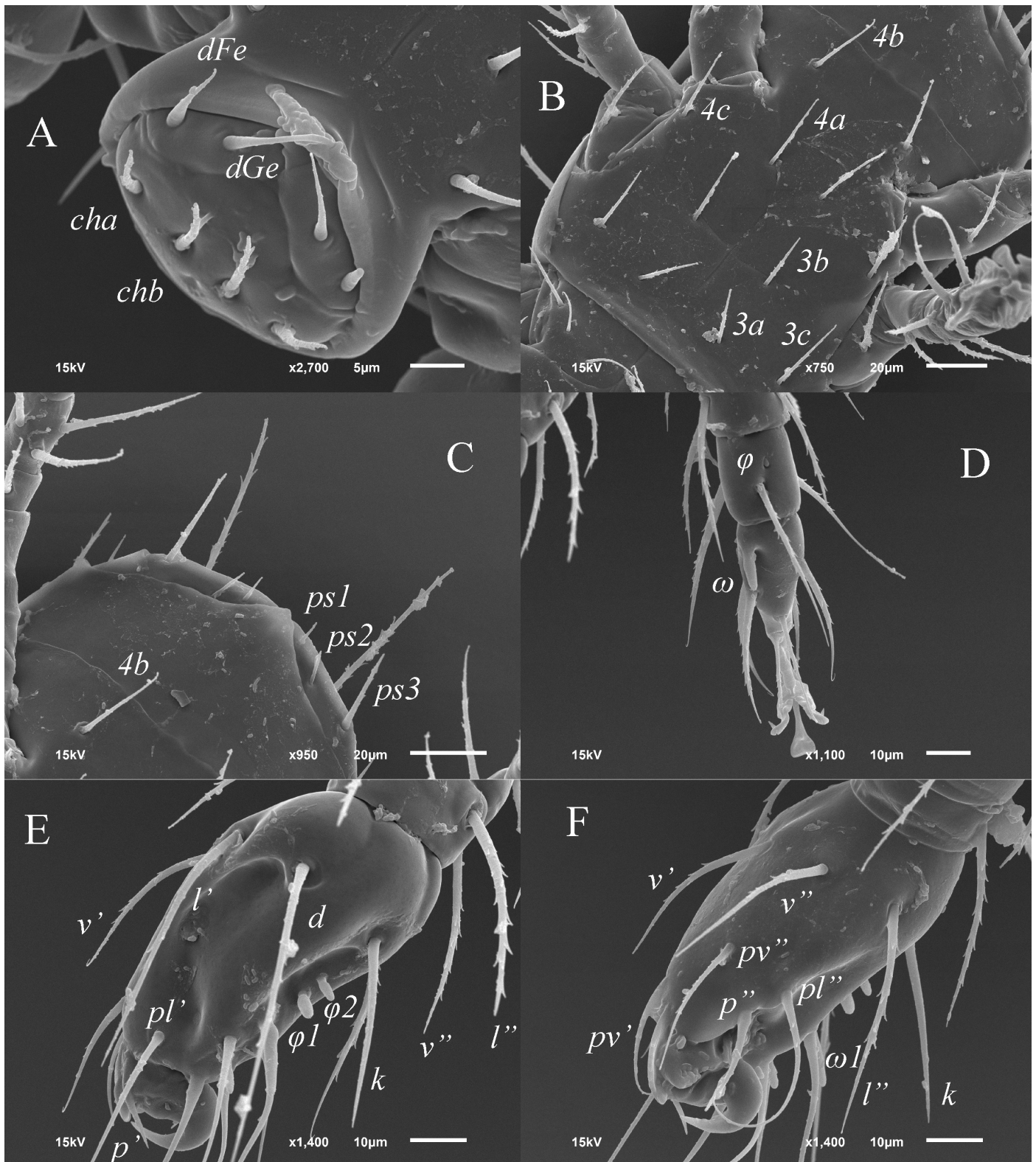
Non-phoretic females of *Pediculaster nidicolus* are completely congruent with original description and undoubtedly conspecific with specimens from Austria. Phoretic females are very similar to *P. altaicus* Mahunka, 1969, described from the nest of *Microtus* sp. from Mongolia (Mahunka 1969). However, 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* Samšićak, 1984, *P. incompletus* Samšićak, 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 (*Ic* 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  
..... 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 *v2* .....  
..... *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 <i>f</i> shorter or subequal to <i>h1</i> . . . . .  | 13   |
| — Empodia on tarsi II and III with pointed tips, setae <i>f</i> much longer than <i>h1</i> . . . . .  |  |
| ..... <i>P. mendli</i> Rack, 1976   |  |
| 13. Setae <i>f</i> and <i>h1</i> subequal . . . . .   | 14   |
| — Setae <i>f</i> distinctly shorter than whip-like <i>h1</i> . . . . .  |  |
| ..... <i>P. weidneri</i> Rack, 1976   |  |
| 14. Solenidion $\varphi 1$ situated close to $\omega 1$ . . . . .   | <i>P. pfefferianus</i> Samšićak, 1984              |
| — Solenidion $\varphi 1$ situated close to $\varphi 2$ . . . . .  | <i>P. murariae</i> Mahunka and Zaki, 1984          |
| 15. Setae <i>tc''</i> of tarsus IV situated on distinct protuberance . . . . .  | 16   |
| — Setae <i>tc''</i> of tarsus IV not on protuberance . . . . .  | 17   |
| 16. Setae <i>h1</i> long, whip-like, much longer than <i>f</i> . . . . .  | <i>P. calcaratus</i> (Mahunka, 1965)               |
| — Setae <i>h1</i> short, blunt-tipped, subequal to <i>f</i> . . . . .   | <i>P. ensifer</i> (Savulkina, 1978)                |
| 17. Three pairs of pseudanal setae . . . . .  | 18   |
| — Two pairs of pseudanal setae . . . . .  | <i>P. turkiensis</i> (Ramaraju and Madanlar, 1997) |
| 18. Setae <i>ps3</i> distinctly longer than <i>ps1</i> and <i>ps2</i> . . . . .   | 19   |
| — Setae <i>ps2</i> distinctly longer than <i>ps1</i> and <i>ps3</i> . . . . .   | 31   |
| 19. Setae <i>ps1</i> and <i>ps2</i> subequal . . . . .  | 20   |
| — Setae <i>ps1</i> distinctly shorter than <i>ps2</i> . . . . .   | <i>P. sklarii</i> Sevastianov and Chydyrov, 1994   |
| 20. Setae <i>v1</i> subequal to or longer than <i>v2</i> . . . . .  | 21   |
| — Setae <i>v1</i> distinctly shorter than <i>v2</i> . . . . .   | <i>P. hungaricus</i> Mahunka and Zaki, 1982        |
| 21. Setae <i>v1</i> distinctly longer than <i>v2</i> . . . . .  | 22   |
| — Setae <i>v1</i> subequal to <i>v2</i> . . . . .   | 23   |
| 22. Setae <i>2b</i> about two times longer than <i>2a</i> . . . . .   | <i>P. janvaryorum</i> Mahunka, 1986                |
| — Setae <i>2b</i> extremely long, many times longer than <i>2a</i> . . . . .  | <i>P. mongolicus</i> Mahunka, 1970a                |
| 23. Setae <i>e</i> and <i>h2</i> subequal . . . . .   | 24   |
| — Setae <i>e</i> distinctly longer than <i>h2</i> . . . . .   | 25   |
| 24. Setae <i>2b</i> much longer than <i>2a</i> . . . . .  | <i>P. dudichi</i> Mahunka, 1970b                   |
| — Setae <i>2b</i> and <i>2a</i> subequal . . . . .  | <i>P. ignotus</i> (Krczal, 1959)                   |
| 25. Setae <i>2b</i> no longer, or slightly longer than <i>2a</i> . . . . .  | 27   |
| — Setae <i>2b</i> several times longer than <i>2a</i> . . . . .   | 26   |
| 26. Setae <i>sc2</i> , <i>c2</i> , <i>f</i> and <i>h1</i> pointed, ap5 absent, seta <i>ps2</i> situated on the same transverse level as <i>ps1</i> , setae <i>d</i> on femur and tibia IV very long and exceed beyond tip of tarsus . . . . . | <i>P. chistyakovi</i> Khaustov and Ermilov, 2008   |
| — Setae <i>sc2</i> , <i>c2</i> , <i>f</i> and <i>h1</i> blunt-tipped, ap5 present, seta <i>ps2</i> situated distinctly anterior to <i>ps1</i> , setae <i>d</i> on femur and tibia IV not exceed beyond tip of tarsus . . . . .                | <i>P. rarus</i> Khaustov, 2020                     |
| 27. Bases of setae <i>h1</i> situated very close to bases of <i>h2</i> . . . . .  | 28   |
| — Bases of setae <i>h1</i> and <i>h2</i> distinctly separated . . . . .   | 29   |



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| 28. Ap5 present, solenidion $\phi 1$ situated closer to setae $p''$ than to solenidion $\phi 2$ ..... |   |
| .....   | <i>P. dudinskii</i> Khaustov, 2011                  |
| — Ap5 absent, solenidion $\phi 1$ situated close to solenidion $\phi 2$ .....                         |   |
| .....   | <i>P. zachvatkini</i> (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 .....          |   |
| .....   | <i>P. similis</i> Mahunka, 1975                     |
| 30. Setae $c2$ longer than distance between their bases .....   | <i>P. altaicus</i> Mahunka, 1969                    |
| — Setae $c2$ shorter than distance between their bases .....  | <i>P. nidicolus</i> (Mahunka, 1972)                 |
| 31. Hysterosomal tergites without longitudinal wrinkles .....   | 32  |
| — Hysterosomal tergites with distinct longitudinal wrinkles .....                                     | <i>P. rugosus</i> 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 $h2$ .....  |   |
| .....   | <i>P. sellnickianus</i> (Rack, 1964)                |
| — Setae $c2$ longer than $c1$ , ap5 present, setae $e$ less than three times longer than $h2$ .....   |   |
| .....   | <i>P. tjumeniensis</i> Khaustov, 2020               |
| 34. Setae $2b$ distinctly longer than $2a$ .....  | 35  |
| — Setae $2b$ and $2a$ subequal .....  | 37  |
| 35. Stigmata two-chambered .....  | 36  |
| — Stigmata one-chambered .....  | <i>P. portatus</i> (Martin, 1978)                   |
| 36. Ap5 absent, setae $d$ , $f$ , and $h1$ much shorter than distance between their bases .....       |   |
| .....   | <i>P. muscarius</i> (Martin, 1978)                  |
| — Ap5 present, setae $d$ , $f$ , and $h1$ longer than distance between their bases .....              |   |
| .....   | <i>P. neutarii</i> Khaustov, Lee, Lee and Kim, 2014 |
| 37. Empodia on tarsi II and III distinctly thickened distally, relatively short .....                 | 38  |
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| 38. Setae $f$ longer than $e$ .....   | 39  |
| — Setae $f$ and $e$ subequal .....  | <i>P. morelliae</i> 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 .....  | <i>P. malyi</i> Samšínák, 1989                      |
| 41. Ap5 absent .....  | 42  |
| — Ap5 present .....   | <i>P. kneeboni</i> (Wicht, 1970)                    |

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| 42. Setae <i>ps1</i> and <i>ps3</i> subequal, tibiotarsus I about three times longer than its width . . . . .     |  |
| .....   | <i>P. camerikae</i> Khaustov, 2008b                          |
| — Setae <i>ps1</i> longer than <i>ps3</i> , tibiotarsus I about 1.5 times longer than its width . . . . .         |  |
| .....   | <i>P. eccoptomeralis</i> Camerik, 2010                       |
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| 44. Setae <i>c1</i> shorter or subequal to <i>d</i> . . . . .   | 45   |
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| 45. Ap5 absent . . . . .  | 46   |
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| 46. Setae <i>c1</i> subequal to distance <i>c1-c1</i> , setae <i>c2</i> distinctly longer than <i>d</i> . . . . . |  |
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| 49. Ap5 present . . . . .   | 50   |
| — Ap5 absent . . . . .  | 52   |
| 50. Setae <i>e</i> at least half of length of setae <i>f</i> . . . . .  | 51   |
| — Setae <i>e</i> shorter than half of length of setae <i>f</i> . . . . .  | <i>P. helomyzalis</i> Camerik, 2006                          |
| 51. Setae of posterior sternal plate smooth . . . . .   | <i>P. jaltensis</i> Sevastianov, 1974                        |
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| 52. Stigmata two-chambered . . . . .  | 53   |
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| 53. Setae <i>e</i> longer and thicker than <i>h2</i> . . . . .  | 54   |
| — Setae <i>e</i> and <i>h2</i> of similar width and length . . . . .  | <i>P. martyani</i> Khaustov, 2008b                           |
| 54. Setae <i>e</i> only slightly shorter than <i>f</i> . . . . .  | <i>P. moravicus</i> Samšínak, 1984                           |
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58. Dorsal hysterosomal setae relatively long, setae *c1* shorter than *c2* ..... 59  
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 — Setae *f* no more than three times longer than *e* ..... *P. ryanovi* Samšić, 1989
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 — Setae *tc''* of tarsus IV distinctly shorter than combined length of genu, tibia and tarsus IV ..  
 ..... *P. perottii* Camerik and Coetzee, 1998

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