A NEW SPECIES OF THE GENUS PROTOPENTHALODES (ACARI: PENTHALODIDAE) FROM CRIMEA

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ABSTRACT: A new species, Protopenthalodes reticulatus sp. n. (Acari: Penthalodidae) is described from moss in Crimea. The taxonomic position of the genus Halotydeus is discussed and this genus is moved from the family Penthaleidae to Penthalodidae.

KEY WORDS: Acarina, Eupodoidea, Protopenthalodes, Halotydeus, systematics, moss, Crimea

INTRODUCTION


This paper presents a description of a new mite species, Protopenthalodes reticulatus sp. n., collected from moss in Crimea, and discusses the taxonomic position of the genus Halotydeus Berlese, 1891.

MATERIALS AND METHODS

Mites were collected from moss using Ber- lese funnels and mounted in Hoyer’s medium. No-...
Fig. 1. *Protopenthalodes reticulatus*, sp. n., female: A — idiosomal dorsum, B — idiosomal venter.

Fig. 2. *Protopenthalodes reticulatus*, sp. n., female: A — palp, B — chelicera, C — distal part of subcapitulum; male: D — genital area.
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lindrical bothridia; remainder, plumose, slightly swollen near base, with smooth fine tip; $h_1$ and $h_2$ inserted ventrally (Fig. 1B). Lyrifissures: three pairs, $ia$, $im$, $ip$ associated with, respectively, $d$, $e$ and $f$ setal rows; roughly circular in dorsal view, cup-shaped with pore perforating base in lateral view. Lengths of dorsal setae: $v_1$, $v_2$, $25$, $sc_1$, $51$, $sc_2$, $26$, $c_1$, $16$, $c_2$, $23$, $d_1$, $16$, $e_1$, $15$, $f_1$, $17$, $f_2$, $21$, $h_1$, $17$, $h_2$, $17$.

Idiosomal venter (Figs 1B, 14). Integument striate-spicate; all setae plumose. Coxal fields faintly defined. Coxisternal setal formula 3–1–3–3; Genital area: usually six pairs subequal eugenital setae, each inserted on separate tubercle, sometimes six pairs of eugenital setae on one side and

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Fig. 3. *Protopenthalodes reticulatus*, sp. n., female: A—leg I in dorsal view, B—tarsus I in ventral view, C—leg II in dorsal view, D—tarsus I in ventral view.

Fig. 4. *Protopenthalodes reticulatus*, sp. n., female: A—leg III in dorsal view, B—tarsus III in ventral view, C—leg IV in dorsal view.
eight on another; two pairs subequal genital papil-
lae; 7–8 pairs genital setae, arranged in more or
less straight line near free edge of shield with one
pair displaced laterally; five pairs aggenital setae;
one pair pseudanal setae ($ps_3$). Anus ventral. Lyri-
fissure $ih$ (Fig. 14A) located laterally to setae $ps_3$.

Gnathosoma (Fig. 2). Subcapitulum roughly
triangular, integument striate-spiculate; adoral se-
tae $or_1$ and $or_2$ short, smooth, located subtermi-
nally on fimbriate malae (Fig. 2C); subcapitular
setae ($sbc$) spinose, located laterally at level of
palp trochanter, approximately 1.3 times length of
($sbc_2$) plumose, inserted ventrally about one third of distance between ($sbc_1$) and tip of sub-
capitulum; labrum ridged, acuminate distally; an-
teromedial corners of internal malae with pair of
short spines. Palp (Fig. 2A) slender, with striate-
spiculate integument, four-segmented, all seg-
ments longer than wide, tarsus tapers to point dis-
tally; setal formula from trochanter to tarsus $0–2–3–9(1)$, $sl''$ very short, smooth, $acm$ and ($p$)
eupathidial, with characteristically curved tips, 
solenidion semi-erect; supracoxal seta short, with
few small branches. Chelicera (Fig. 2B): 105 long
integument of shaft smooth on paraxial face, spic-
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ulate over remainder, seta *cha* smooth, pointed; fixed digit slightly forked in lateral view.

Legs (Figs 3, 4). All segments slender, integument spiculate. Relative lengths of legs: I > IV > III > II. All leg setae densely pilose. Eupathidial setae with characteristically curved and smooth tip. Leg I (Fig. 3A): Supracoxal setae *ep* of the same shape and length as palpal supracoxal setae *ep*. Femur incompletely divided into basi- and telofemur. Setal formula: Tr — 1, Fe — 11/5, Ge — 13 (1σ), Ti — 17 (2φ, 1k), Ta — 29 (2ω, 1ε). Famulus *ε* spine-like, located just near to base of rhagidial solenidion *ω*. Rhagidial solenidia *ω* and *ω* fused (Fig. 15A). Rhagidial solenidion *φ* located anterodorsally and situated in shallow depression; solenidion *φ* erect, located mediadorsally; solenidion *σ* erect, located mediadorsally, subequal to *φ*. Leg II (Fig. 3B): Femur incompletely divided into basi- and telofemur. Setal formula: Tr — 1, Fe — 7/5, Ge — 8 (1σ), Ti — 11 (2φ), Ta — 17 (2ω, 1ε). Famulus *ε* spine-like, located near to base of rhagidial solenidion *ω*. Rhagidial solenidia *ω* and *ω* fused (Fig. 15B). Rhagidial solenidion *φ* located anterodorsally and situated in shallow depression; solenidion *φ* erect, located mediadorsally; solenidion *σ* erect, located mediadorsally, subequal to *φ*. Leg III (Fig. 4A): Setal formula: Tr — 1, Fe — 7/4, Ge — 7 (1σ), Ti — 10 (2φ), Ta — 17; femur completely divided into basi- and telofemur; Rhagidial solenidion *φ* located anterodorsally and situated in shallow depression; solenidion *φ* erect, located mediadorsally; solenidion *σ* erect, located mediadorsally, subequal to *φ*. Leg IV (Fig. 4B): Setal formula: Tr — 1, Fe — 5/4, Ge — 8 (1σ), Ti — 11 (1φ), Ta — 15; femur completely divided into basi- and telofemur; solenidion *φ* erect, located mediadorsally; solenidion *σ* erect, located mediadorsally, subequal to *φ*; setae (*p*) of tarsus distinctly widened distally. Soft cuti-
cle separating trochanters and coxae of legs I–IV with distinct pore-like structure (Fig. 14C).


Idiosoma venter. Genital area (Figs 2D, 14B): seven pairs eugenital setae, aedeagus, wide, acuminate and ridged, directed anteriorly.

**Tritonymph** (Figs 5, 6, 16). Idiosomal dorsum as in adults, except presence of dehiscence line on prodorsum (Fig. 16A). Body length 425–470, width 295–335.

Idiosoma venter (Fig. 16B). Genital area: eugenital setae absent; three pairs genital setae.

Legs (Figs 5, 6). Leg I (Fig. 5A): Setal formula: Tr — 1, Fe — 9/5, Ge — 10, Ti — 13 (2φ, 1k), Ta — 27 (2ω, 1ε). Leg II (Fig. 5B): Setal formula: Tr — 1, Fe — 7/5, Ge — 8 (1σ), Ti — 10 (2φ), Ta — 15 (2ω, 1ε). Leg III (Fig. 6A): Setal formula: Tr — 1, Fe — 6/4, Ge — 6 (1σ), Ti — 9 (2φ), Ta — 15. Leg IV (Fig. 6B): Setal formula: Tr — 1, Fe — 4/4, Ge — 7 (1σ), Ti — 9 (1φ), Ta — 14.

**Deuteronymph** (Figs, 7, 8, 17) Idiosomal dorsum (Fig. 17A) as in tritonymph. Body length 320–345, width 235–240.

Idiosoma venter (Figs 17B–D). Podosoma: coxa IV lacks seta 4c. Genital area (Figs 17C, D): two pairs genital and aggenital setae, sometimes one genital seta absent (Fig. 17D).

Legs (Figs 7, 8). Leg I (Fig. 7A): Setal formula: Tr — 1, Fe — 6/5, Ge — 7 (1σ), Ti — 10 (2φ, 1k), Ta — 23 (2ω, 1c). Leg II (Fig. 7B): Setal formula: Tr — 1, Fe — 2/5, Ge — 4 (1σ), Ti — 5 (2φ), Ta — 13(2ω, 1c). Leg III (Fig. 8A): Setal formula: Tr — 1, Fe — 2/4, Ge — 4 (1σ), Ti — 5 (2φ), Ta — 13. Leg IV (Fig. 8B): Setal formula: Tr — 0, Fe — 1/4, Ge — 5 (1σ), Ti — 5 (1φ), Ta — 11.

**Protonymph** (Figs 9, 10, 18) Body length 235–250, width 175–190; idiosoma narrows be-
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Idiosoma venter (Figs 18D–F). Podosoma: coxa III lacks setae (3c), coxa IV without setae. Genital area: one pair genital papillae and genital setae, aggenitals absent.

Legs (Figs 9, 10). Leg I (Fig. 9A): Setal formula: Tr — 0, Fe — 6, Ge — 4(1σ), Ti — 5(2φ, 1k), Ta — 18 (1ω, 1ε). Leg II (Fig. 9B): Setal formula: Tr — 0, Fe — 7, Ge — 4(1σ), Ti — 5 (2φ), Ta — 11(1ω, 1ε). Leg III (Fig. 10A): Setal formula: Tr — 0, Fe — 5, Ge — 4(1σ), Ti — 5(2φ), Ta — 8. Leg IV (Fig. 10B): Setal formula: Tr — 0, Fe — 5, Ge — 0, Ti — 0, Ta — 7. Femora I–IV undivided. Genu and tibia IV without erect solenidia.

**Larva** (Figs 11, 19). Body length 190–200, width 130–150. Idiosomal dorsum (Figs 19A, C) similar with that of protonymph.

Idiosoma renter (Figs 19B, D). Podosoma: (1c) absent; Claparrde organs between coxae I and II, integument of cap smooth on upper and lower surfaces. Genital area: external evidence of genitalia absent.

Legs (Figs 11A–C). Leg I (Fig. 11A): Setal formula: Tr — 0, Fe — 6, Ge — 4 (1σ), Ti — 5 (2φ, 1k), Ta — 14 (1ω, 1ε). Leg II (Fig. 11B): Setal formula: Tr — 0, Fe — 6, Ge — 4 (1σ), Ti — 5 (2φ), Ta — 9 (1ω, 1ε). Leg III (Fig. 11C): Setal formula: Tr — 0, Fe — 5, Ge — 4 (1σ), Ti — 5 (2φ), Ta — 8.

**Type material.** Holotype female, slide No. AK310794, Crimea: Yalta mountain-forest Nature Reserve, wet moss on soil near the stream, 31 July 1994, coll. A.A. Khaustov. Paratypes: 8 females, 7 males, 5 tritonymphs, 2 deutonymphs, 7 protonymphs, 4 larvae, same data as holotype; 2 females, 1 tritonymph, Crimea: Yalta, wet moss on

**Etymology.** The name of the new species refers to the presence of the weak reticulate subcuticular pattern in adults.

**Differential diagnosis.** The new species differs from *P. coniunctus* Jesionowska, 1989 by the presence of the weak subcuticular idiosomal reticulate pattern (absent in *P. coniunctus*), by the presence of five pairs of aggenital setae (6 in *P. coniunctus*), famulus on tarsus I situated basally to rhagidial solenidion $\omega_1$ (vs. laterally to $\omega_1$ in *P. coniunctus*) and by much more rich setation on the leg segments.

**DISCUSSION**

Mites of the genus *Protopenthalodes* are very similar to species of the genus *Halotydeus* Berlese, 1891. Both genera are characterized by the following synapomorphies: 1) setae $ps_1$ and $ps_2$ are absent, 2) lens-like eyes present near setae $sc_2$, 3) the naso very small, with short setae $v_1$, 4) sejugal furrow is absent, 5) rhagidial solenidia in rhagidial organs I and II are fused, 6) the body is soft, cuticle is striate-spiculate, 7) there is at least one pair of genital setae situated laterally to other genital setae. *Protopenthalodes* differs from *Halotydeus* by the ventral anal opening (vs. terminal in *Halotydeus*), the presence of prodorsal apodemes (vs. absent in *Halotydeus*), the ventral idiosoma with orthotrichous setation (vs. neotrichous in *Halotydeus*). At present the genus *Halotydeus* is placed in the family Penthalidae based on single character state — the terminal anal opening, while in other genera of Penthalidae, the anal opening is dorsal, and in the remaining families of Eupodoidea, the anal opening ventral. Qin and Halliday (1997), after a cladistic analysis of Australian and New Zealand Eupodoidea, also noted that *Halotydeus* could not be considered as a genus in the family Penthalidae and a new family should be created for this genus. In my opinion, *Halotydeus* mites should be removed from Penthalidae to Penthalodidae based on synapomorphic characters 1–4 and 7 (see the second senetence of this paragraph), which are also characteristic for the type genus of Penthalodidae.

During my study of the morphology of *Protopenthalodes reticulatus* sp. n. I found pore-like structures of unknown homology situated on the soft cuticle between coxae and trochanters of legs I–IV (Fig. 14C). These pore-like structures were recently discovered in the genus *Pseudoeupodes* Khaustov, 2014 of the family Eupodidae (Khaus-
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Probably these pore-like structures are presented in other genera of eupodoid mites and additional studies are required for understanding of their distribution within Eupodoidea.

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Fig. 16. *Protopenthalodes reticulatus*, sp. n., phase contrast photos, tritonymph: A — prodorsum and anterior part of hysterosoma, dl — dehiscence line, B — anogenital area.

Fig. 17. *Protopenthalodes reticulatus*, sp. n., phase contrast photos, deutonymph: A — idiosomal dorsum, B — idiosomal venter, C — genital acetabulae, D — genital area.


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Fig. 19. *Protopenthalodes reticulatus*, sp. n., phase contrast photos, larva: A — prodorsum and anterior part of hysterosoma, B — podosoma in ventral view C — cap of Claparede organ, CO — Claparede organ, C — posterior part of hysterosoma, D — anal area.