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THREE NEW SPECIES OF MITE FAMILY PYGMEPHORIDAE (ACARI: HETEROSTIGMATA) ASSOCIATED WITH SCARAB BEETLES (COLEOPTERA: SCARABAEIDAE) FROM UKRAINE

ТРИ НОВЫХ ВИДА КЛЕЩЕЙ СЕМЕЙСТВА PYGMEPHORIDAE (ACARI: HETEROSTIGMATA), СВЯЗАННЫЕ С НАВОЗНИКАМИ (COLEOPTERA: SCARABASIDAE) ИЗ УКРАИНЫ

A. A. Khaustov
А. А. Хаустов

Nikita Botanical Gardens — National Scientific Center, Yalta, Crimea 98648, Ukraine; e-mail: alkhaustov@mail.ru
Никитский ботанический сад — Национальный научный центр, Ялта, АР Крым 98648, Украина; e-mail: alkhaustov@mail.ru

Key words: Pygmephoridae, *Pygmephorellus*, *Spatulaphorus*, new species, Scarabaeidae, *Geotrupes*, Ukraine
Ключевые слова: Pygmephoridae, *Pygmephorellus*, *Spatulaphorus*, новые виды, Scarabaeidae, *Geotrupes*, Украина

ABSTRACT

Three new species of mites: *Pygmephorellus punctatus* **sp. n.**, *Spatulaphorus geotruporum* **sp. n.**, and *S. vladimiri* **sp. n.** (Acari: Pygmephoridae) are described from the dung beetle *Geotrupes stercorarius* (L.) (Coleoptera: Scarabaeidae) from Ukraine. *Pediculaster geotrupi* Mahunka, 1970 is transferred to the genus *Spatulaphorus* Rack, 1993.

РЕЗЮМЕ

Приводится описание трех новых видов клещей:*Pygmephorellus punctatus* **sp. n.**, *Spatulaphorus geotruporum* **sp. n.** и *S. vladimiri* **sp. n.** (Acari: Pygmephoridae), собранных на жуках-навозниках *Geotrupes stercorarius* L. (Coleoptera: Scarabaeidae) из Украины. Ранее описанный вид *Pediculaster geotrupi* Mahunka, 1970 переведен в род *Spatulaphorus* Rack, 1993.

The family Pygmephoridae is one of the largest group among the cohort Heterostigmata and common in dung. However to present only three species were reported phoretic on dung beetles of the genus *Geotrupes* (Coleoptera: Scarabaeidae): *Geotrupophorus gozmanyi* Mahunka, 1970 from *Geotrupes stercorosus* Scr., *Pediculaster geotrupi* Mahunka, 1970 from *G.* sp. from Hungary [Mahunka, 1970], and *Pygmephorellus szekessyi* (Mahunka, 1970) from *Geotrupes vernalis* L. from Slovakia [Kaluz, 1992].

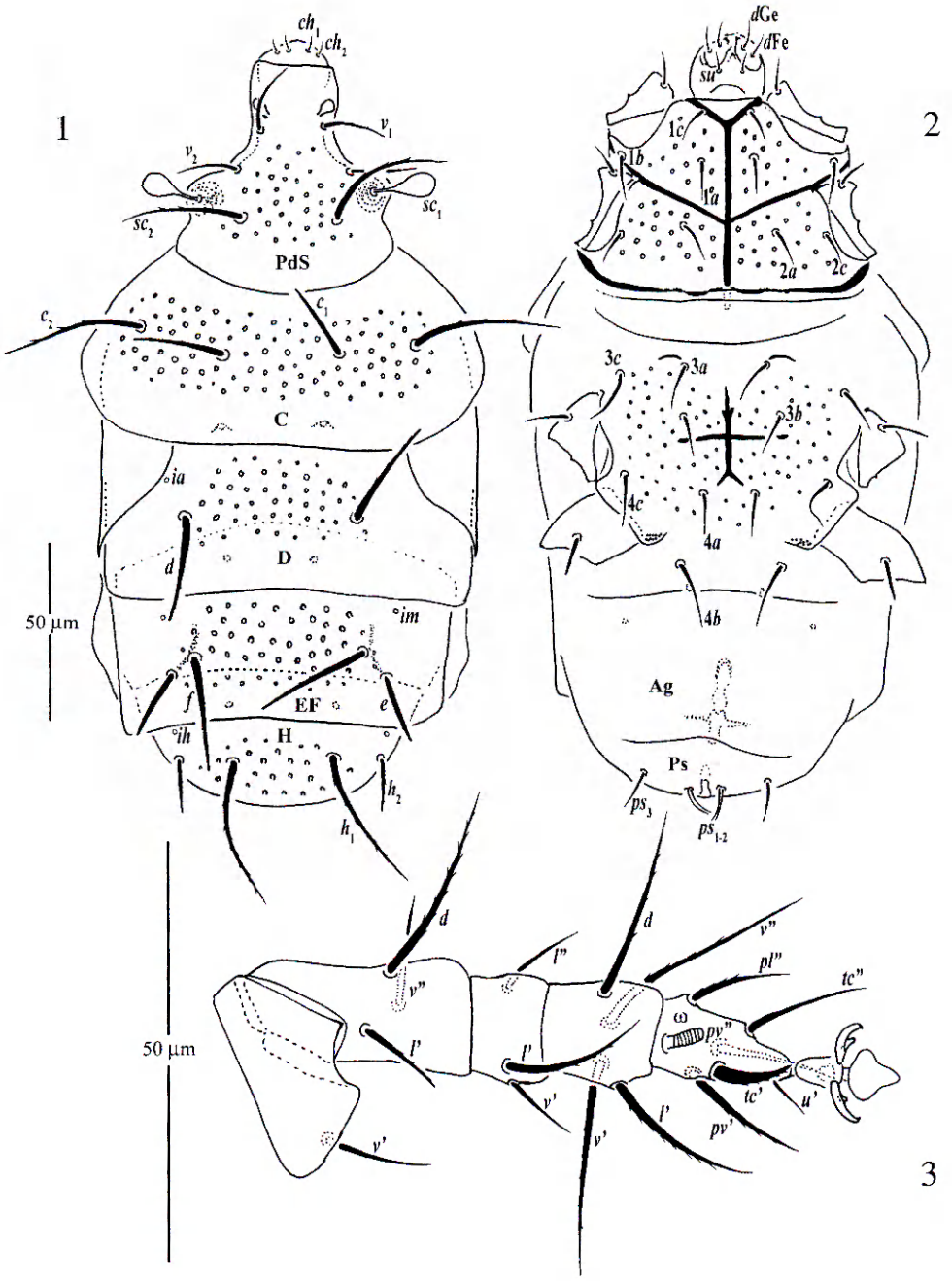
The purpose of this paper is to describe three new species of Pygmephoridae collected from dung beetles *Geotrupes stercorarius* L. from Ukraine. The description based on phoretic females. The presence of female dimorphism in the genera *Pygmephorellus* and *Spatulaphorus* is not clear. Moser and Cross [1975] discovered female dimorphism (presence of phoretic and non-phoretic or "normal" forms) in the genera *Pediculaster* Vitzthum, 1931 and *Pygmephorellus* Cross & Moser, 1971, collected from galleries of bark beetles. But subsequent description of *Pygmephorellus*-like *Siteroptes trichoderma* Smiley & Moser, 1976 shows that it has three pairs of setae on epimeres II in both formsand does not belong to the genus *Pygmephorellus*, which has two pairs of setae on epimeres II. The study of the life history of *Elattoma bennetti* [Cross, Moser, 1971], the sister genus of *Spatulaphorus* and *Pygmephorellus* shows the absence of "normal" females in this genus [Cross, Moser, 1971]. A study of the life histories of *Pygmephorellus* and *Spatulaphorus* is necessary to clarify this problem.

The terminology follows that of Lindquist [1986]. All measurements are given in micrometers (μm) for the holotype and for 5 paratypes (in parenthesis). Type material is deposited in the collection of Department of Acarology, Shmalgausen Institute of Zoology, Kiev, Ukraine.

Pygmephorellus punctatus Khaustov sp. n.

Figs. 1–6

Phoretic female. Idiosomal length 215 (197–220), maximum width 112 (101–114).

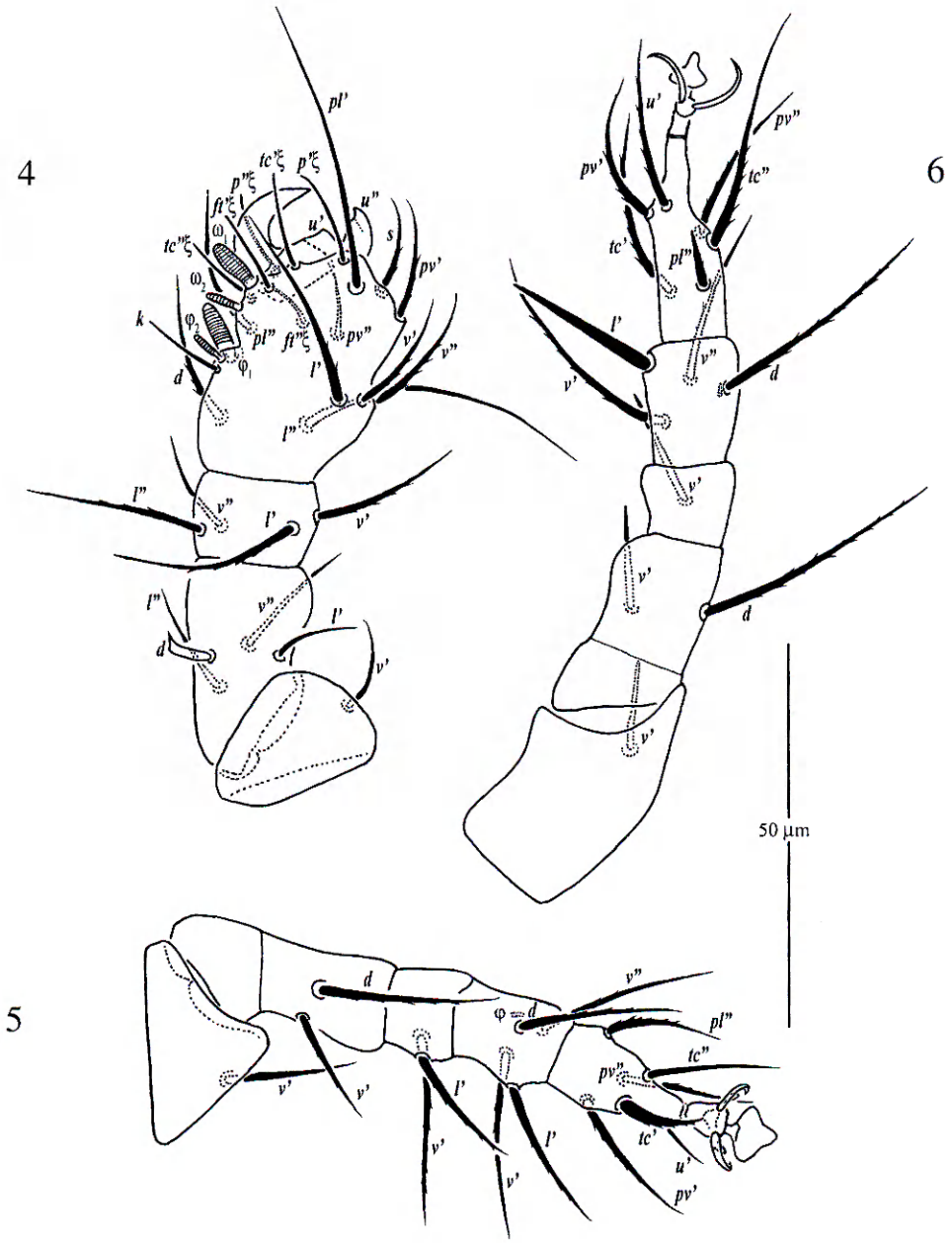


Figs. 1–3. *Pygmephorellus punctatus* sp. n., phoretic female: 1 — dorsum, 2 — venter, 3 — leg II.

Gnathosoma (Figs. 1–2). Two pairs of dorsal setae, ch_1 and ch_2 present; ch_1 slightly anterior to ch_2. Pair of ventral setae *su* present. Palp with 2 pairs of setae *d*Ge and *d*Fe, small ventral solenidion, and accessory setigenous structure. Dorsal medial apodeme well developed.

Idiosomal dorsum (Fig. 1). Tergites strongly punctate. Cupuli *ia*, *im*, and *ih* small, round. Dorsal setae strong, barbed, and blunt-ended, except for pointed sc_2, c_2, h_1. Tergite EF with pair of longitudinal subcuticular apodemes medially to setae *e*. Setae *e* posterior to setae *f*. Length of dorsal setae: v_1 18 (17–19), v_2 18 (17–19), sc_2 43 (41–43), c_1 27 (24–30), c_2 44 (41–44), *d* 31 (29–31), *e* 19 (17–19), *f* 37 (36–39), h_1 45 (40–46), h_2 16 (16–20). Distances between setae: v_1–v_1 22 (21–22), v_2–v_2 34 (30–34), sc_2–sc_2 30 (28–31), c_1–c_1 36 (33–39), c_1–c_2 23 (21–24), *d*–*d* 50 (43–50), *e*–*f* 8 (6–8), *f*–*f* 51 (45–52), h_1–h_1 31 (24–31), h_1–h_2 16 (13–16). Trichobothrium with thin stem, distally spherical.

Idiosomal venter (Fig. 2). All ventral setae smooth. Apodemes 1 (ap1), 2 (ap2), and sejugal apodeme (apsej) well developed and joined with presternal apodeme (appr), Apodemes 3(ap3) weak-



Figs. 4–6. *Pygmephorellus punctatus* sp. n., phoretict female: 4–6 — legs I, III and IV, respectively.

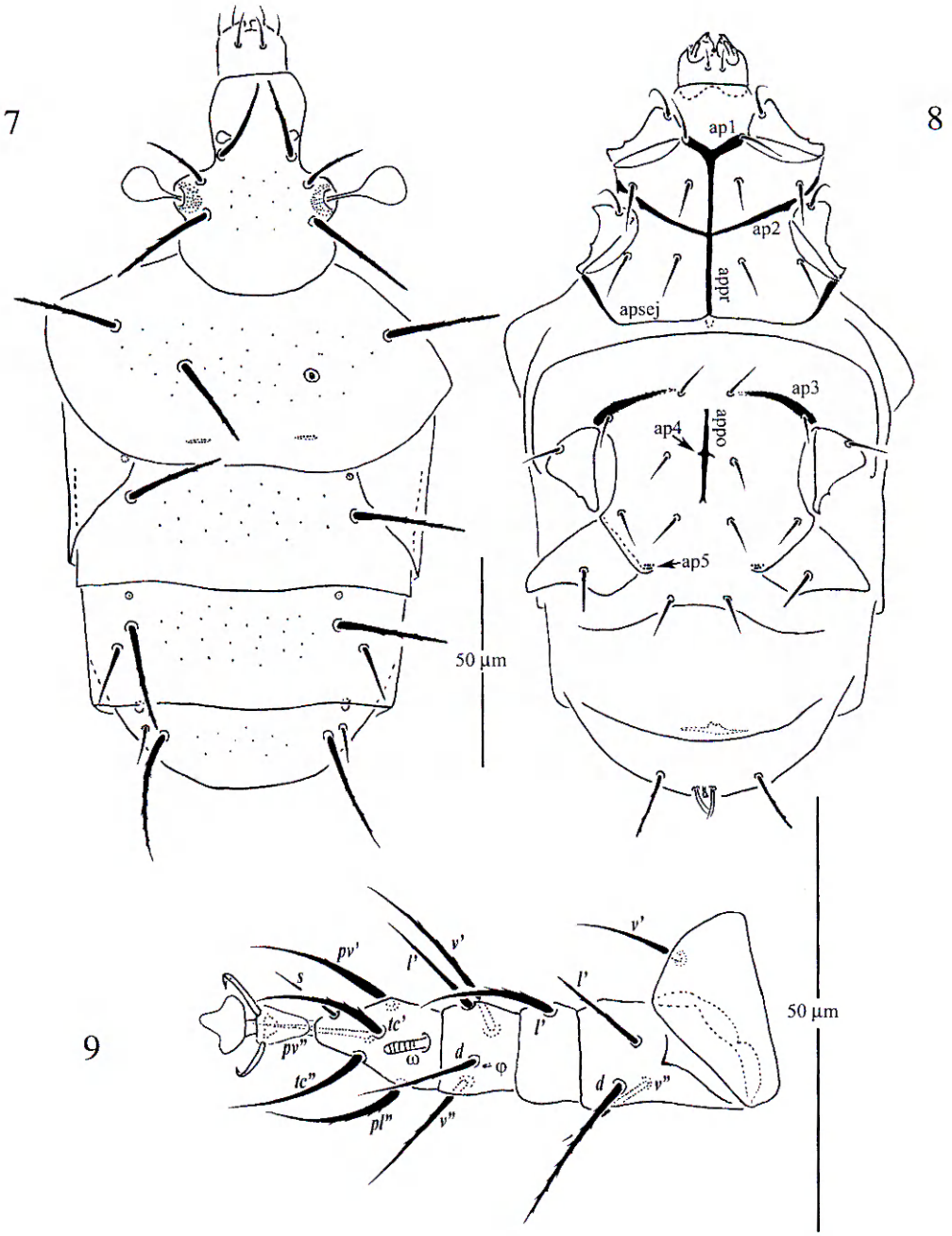
ly developed, apodemes 4 (ap4) well developed and joined with poststernal apodeme (appo), which bifurcate posteriorly. Apodemes 5 (ap5) vestigial. Length of ventral setae: 1*a* 20 (19–20), 1*b* 15 (15–22), 1*c* 12 (11–12), 2*a* 13 (13–15), 2*c* 11 (10–11), 3*a* 13 (13–14), 3*b* 13 (12–14), 3*c* 17 (16–19), 4*a* 13 (11–13), 4*b* 22 (19–23), 4*c* 16 (15–17), ps_1 15 (12–15), ps_2 15 (13–15), ps_3 17 (15–17).

Legs (Figs. 3–6). Leg I (Fig. 4): setal formulas (number of solenidia in parenthesis): Tr 1 – Fe 4 – Ge 4 – Ti+Ta 17 (4). Tibiotarsus thickened, with massive claw. Solenidia ω_1 8 (7–8) = φ_1 8 (7–8) > ω_2 4 (4) = φ_2 4 (4–5); ω_1 and φ_1 finger-shaped, distinctly thicker than φ_2 and ω_2. Setae *d*Fe broadened, hook-like. Leg II (Fig. 3): Tr 1 – Fe 3 – Ge 3 – Ti 4 (1) – Ta 6 (1). Tarsus with sickle-like padded claws. Solenidion ω 6 (5–6) finger-shaped, solenidion φ depressed, weakly visible. Leg III (Fig. 5): Tr 1 – Fe 2 – Ge 2 – Ti 4 (1) – Ta 6. Claws of same shape as on tarsus II. Solenidion φ depressed, weakly visible. Leg IV (Fig. 6): Tr 1 – Fe 2 – Ge 1 – Ti 4 (1) – Ta 6. Tarsus with two well developed non-padded claws. Solenidion φ not observed.

Male, non-phoretic female and **larva**: unknown.

DIFFERENTIAL DIAGNOSYS

The new species is similar to *Pygmephorellus artemjevi* Sevastianov, 1981, but differs from it by



Figs. 7–9. *Spatulaphorus geotruporum* sp. n., phoretic female: 7 — dorsum, 8 — venter, 9 — leg II.

the subequal solenidia ω_1 and φ_1 on tibiotarsus I (ω_1 (9) >φ_1 (6) in *P. artemjevi*), by the position of setae *e* posteriorly to *f* (*e* and *f* on the same level in *P. artemjevi*), and by the longer setae sc_2 (41–43) and c_2 (41–44) (37 and 36, respectively in *P. artemjevi*).

Type material. Holotype: female, Ukraine, Donetsk distr., Slavyansk reg., settl. Bogorodichnoe, on *Geotrupes stercorarius*, 20.06.1973 (leg. Sklyar); paratype: 50 females, same data as holotype.

ETYMOLOGY

The new species named "*punctatus*" referring to the well developed dimples on tergites and epimeres.

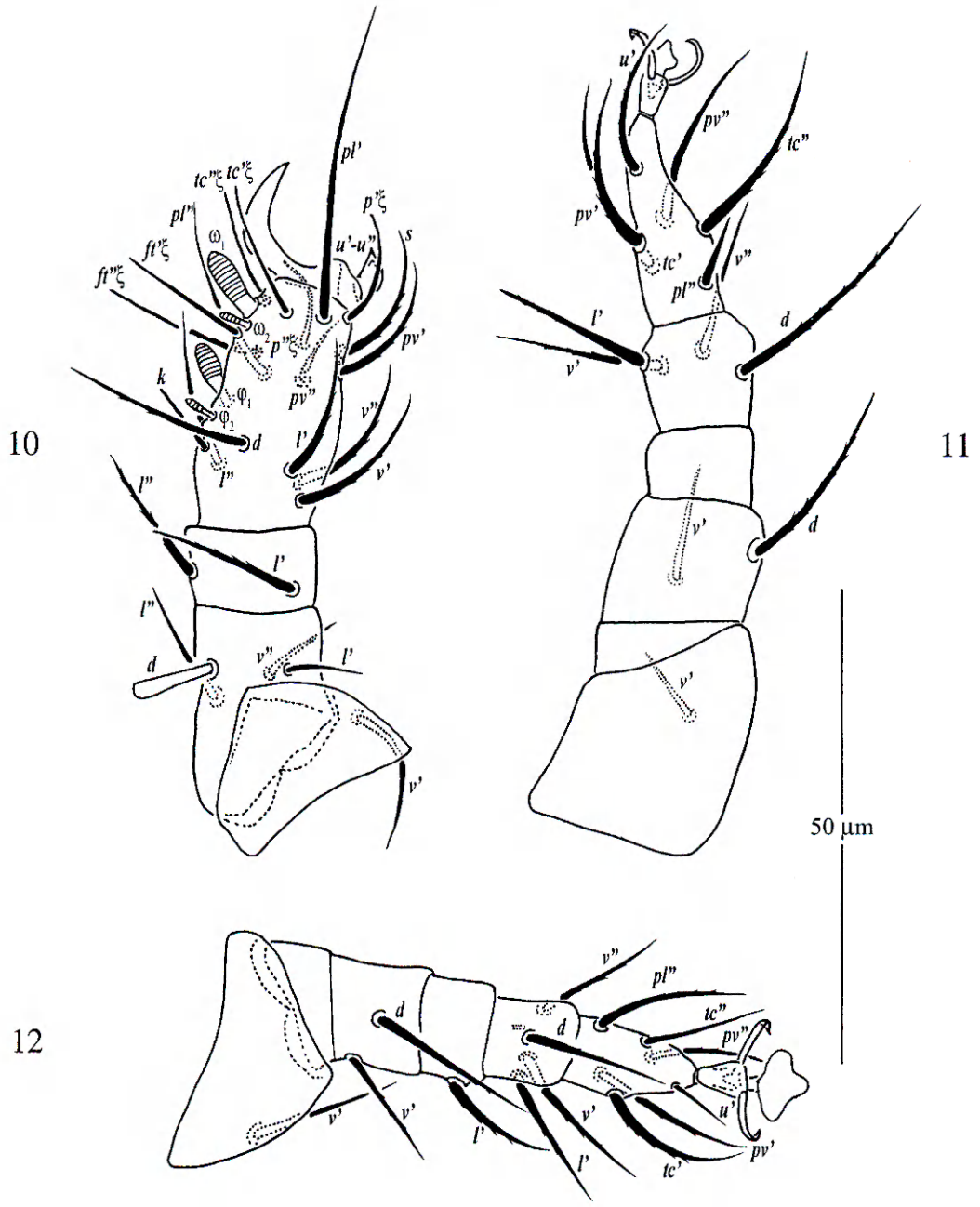
Spatulaphorus geotruporum sp. n.

Figs. 7–12

Phoretic female. Idiosomal length: 172(157-174), maximum width 100(96–100).

Gnathosoma (Figs. 7–8). Pair of dorsal setae ch_1 present. Pair of ventral setae *su* present. Palp with 2 pairs of setae *d*Ge and *d*Fe, small ventral solenidion, and accessory setigenous structure. Dorsal medial apodeme well developed.

Idiosomal dorsum (Fig. 7). Tergites finely punctate. Cupuli *ia*, *im*, and *ih* small, round. Dorsal setae strong, barbed and blunt-ended, except for



Figs. 10–12. *Spatulaphorus geotruporum* sp. n., phoretic female: 10–12 — legs I, III and IV, respectively.

pointed h_1. Setae *e* posterior to setae *f*. Length of dorsal setae: v_1 19 (17–19), v_2 11 (11–12), sc_2 29 (28–30), c_1 22 (21–22), c_2 24 (24–26), *d* 24 (24–26), *e* 13 (12–14), *f* 27 (27–28), h_1 34 (34–35), h_2 8 (8). Distances between dorsal setae: v_1–v_1 13 (13–14), v_2–v_2 26 (26–27), sc_2–sc_2 30 (28–30), c_1–c_1 31 (30–31), c_1–c_2 20 (19–20), *d*–*d* 56 (53–57), *e*–*f* 6 (6), *f*–*f* 53 (52–54), h_1–h_1 43 (41–43), h_1–h_2 3 (3–5). Trichobothrium with thin stem, distally spherical.

Idiosomal venter (Fig. 8). All ventral setae smooth, except ps_3, which serrated and blunt-ended. Ap1 and ap2 well developed and joined with appr; apsej weakly developed in medial part and strong laterally; ap3 well developed and reach bases of setae 3*a*. Apodemes 4 and ap5 vestigial. Length of ventral setae: 1*a* 14 (11–14), 1*b* 12 (10–12), 1*c* 10 (9–10), 2*a* 9 (9–10), 2*c* 9 (9–10), 3*a* 10 (10–11), 3*b* 9 (8–9), 3*c* 9 (9–10), 4*a* 9 (8–9), 4*b* 12 (11–12), 4*c* 10 (9–10), ps_1, ps_2 8 (8), ps_3 14 (13–15).

Legs (Figs. 9–12). Leg I (Fig. 10): Tr 1 – Fe 4 – Ge 2 – Ti+Ta 17 (4). Tibiotarsus thickened, with massive claw. Solenidia ω_1 6(6) = φ_1 6(6–7) > ω_2 5(5) = φ_2 5(4–5); ω_1 and φ_1 finger-shaped, distinctly thicker than φ_2 and ω_2. Setae *d*Fe broadened, spathu-

late. Leg II (Fig. 9): Tr 1 – Fe 3 – Ge 1 – Ti 4 (1) – Ta6(1). Tarsus with sickle-like non-padded claws. Solenidion ω 5 (5) finger-shaped, solenidion φ depressed, weakly visible. Leg III (Fig. 11): Tr 1 – Fe 2 – Ge 1 – Ti 4 (1) – Ta 6. Claws of same shape as on tarsus II. Solenidion φ depressed, weakly visible. Leg IV (Fig. 12): Tr 1 – Fe 2 – Ge 0 – Ti 4 (1) – Ta 6. Tarsus with two well developed simple claws. Solenidion φ not observed.

Male and **larva**: unknown.

DIFFERENTIAL DIAGNOSYS

The new species is similar to *Spatulaphorus geotrupi* (Mahunka, 1970) comb. nov., but differs by the reduced apodemes 4 (well developed and reaching to bases of setae 3*b* in *S. geotrupi*) and by the subequal setae c_1 and c_2 (c_2 almost two times longer than c_1 in *S. geotrupi*).

Type material. Holotype: 1 female, Ukraine, Donetsk distr., Slavyansk reg., settl. Bogorodichnoe, on *Geotrupes stercorarius*, 20.06.1973 (leg. Sklyar); paratype: 40 females, with same data as holotype.

ETYMOLOGY

The new species named "*geotruporum*" referring to its association with beetles of the genus *Geotrupes*.

REMARKS

The genus *Spatulaphorus* Rack, 1993 contains four species, described from different scarab beetles in Botswana, Vietnam, and South Africa [Dastych, Rack, 1993, Dastych et al., 1997]. Mahunka [1970] described *Pediculaster geotrupi* Mahunka, 1970 from *Geotrupes* sp. from Hungary. An analysis of the morphology of *S. geotruporum* sp. n. and the description, drawings, and numerous specimens from Crimea of *P. geotrupi* shows that both species very close to each other and belong to genus *Spatulaphorus*.

Spatulaphorus vladimiri Khaustov sp. n.

Figs. 13–18

Phoretic female. Idiosomal length: 151(150–164), maximum width 93(93–97).

Gnathosoma (Figs. 13–14). Pair of dorsal setae ch_1 present. Pair of ventral setae *su* present. Palp with 2 pairs of setae *d*Ge and *d*Fe, small ventral solenidion, and accessory setigenous structure. Dorsal medial apodeme well developed.

Idiosomal dorsum (Fig. 13). Tergites smooth. Cupuli *ia*, *im*, and *ih* small, round. Dorsal setae of two types: strong and flattened or cone-like and barbed sc_2, c_2, *d*, *f*, h_1, and very small and thin other setae. Setae *e* posterior to setae *f*. Length of dorsal setae: v_1 4 (4), v_2 4 (4–6), sc_2 20 (17–20), c_1 7 (7–8), c_2 16 (14–16), *d* 13 (12–13), *e* 5 (5–6), *f* 14 (14–17), h_1 13 (13–16), h_2 4 (4–5). Distances between dorsal setae: v_1–v_1 17 (17–19), v_2–v_2 31 (31–33), sc_2–sc_2 40 (40–43), c_1–c_1 33 (29–33), c_1–c_2 18 (18–23), *d*–*d* 46 (46–50), *e*–*f* 5 (3–5), *f*–*f* 47 (47–48), h_1–h_1 36 (36–39), h_1–h_2 5 (5–6). Trichobothrium with thin stem, distally spherical.

Idiosomal venter (Fig. 14). All ventral setae short and smooth. Ap1, ap2, and apsej well developed and joined with appr; ap3 weakly developed, ap4 well developed and joined with appo. Ap5 vestigial. Length of ventral setae: 1*a* 4 (4), 1*c* 3 (3), 1*b*, 2*a*, 2*c*, 3*b*, 3*c*, 4*a*, 4*c* 5 (5), 3*a* 6 (6), 4*b* 7 (7–8), ps_1, ps_2 6 (6), ps_3 8 (8–9).

Legs (Figs. 15–18). Leg chaetotaxy as in *S. geotruporum* sp. n. Leg I (Fig. 15): tibiotarsus robust, with massive claw. Solenidia ω_1 4(4) = φ_1 4(4) > ω_2 2(2) = φ_2 2(2); ω_1 and φ_1 finger-shaped, distinctly thicker than knob-like φ_2 and ω_2. Setae *d*Fe broadened, spathulate. Leg II (Fig. 16): tarsus with simple sickle-like claws. Solenidion ω 3 (3) finger-shaped, solenidion φ depressed, hardly visible. Setae *pl*″ and *tc*′ spine-like. Leg III (Fig. 17): claws of same shape as on tarsus II. Solenidion φ depressed, hardly visible. Setae *pl*″ and *tc*′ spine-like. Leg IV (Fig. 18): tarsus with two well developed simple claws. Solenidion φ not evident. Setae *pl*″ spine-like, setae *l*′, *v*′, *v*″ thickened basally.

Male and **larva**: unknown.

DIFFERENTIAL DIAGNOSYS

The new species considerably differs from al congeners by unusually thick dorsal setae sc_2, c_2, *d*, *f*, h_1 and by spine-like setae *pl*″ and *tc*′ on tarsi II an III. But the shape of setae *d*Fe of leg I and le chaetotaxy, as well as association with scarab bee tles as in the genus *Spatulaphorus*.

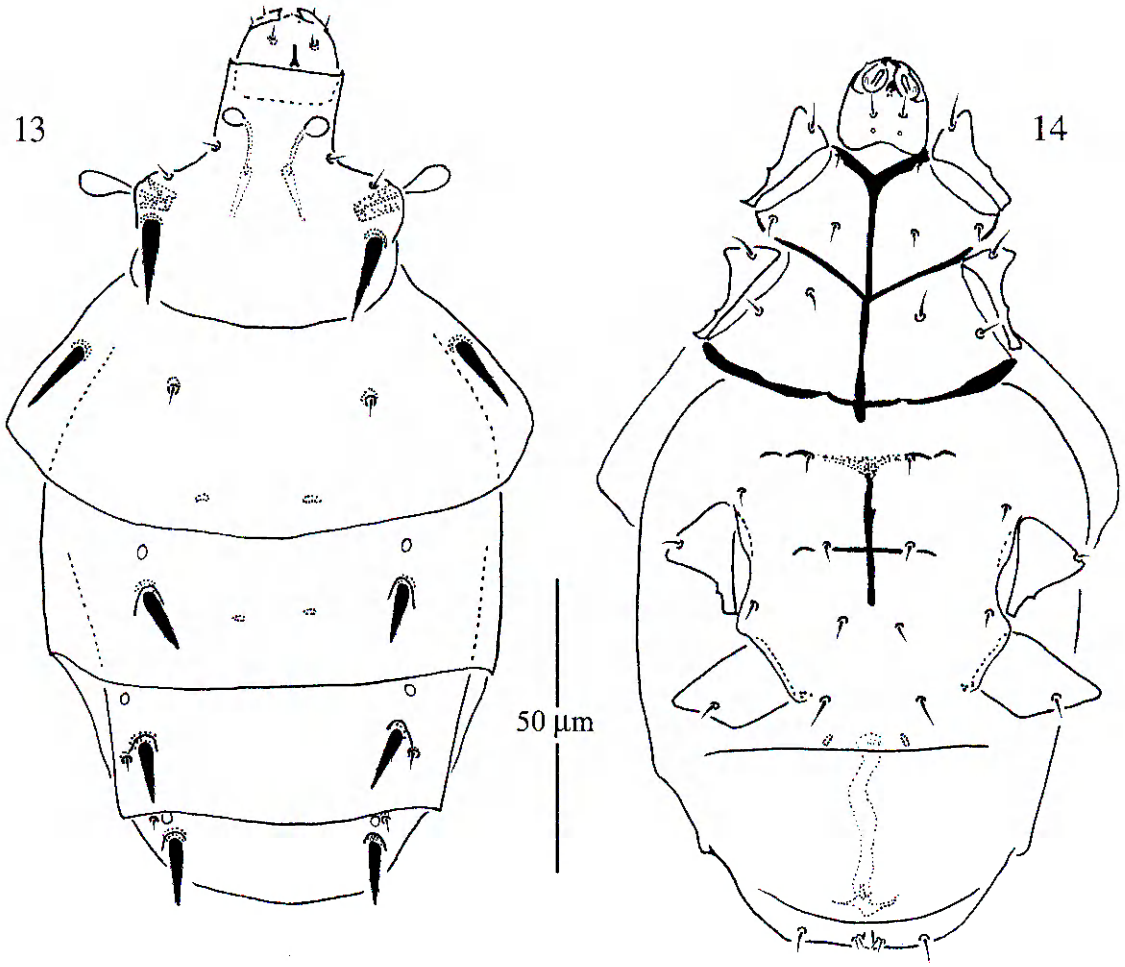
Type material. Holotype: 1 female, Ukraine Kharkov distr., Lozovaya reg., settl. Novoiva novka, on *Geotrupes stercorarius*, July 2002 (leg V. Khaustov); paratype: 13 females, with sam data as holotype.

ETYMOLOGY

The new species is named "*vladimiri*" for my son Vladimir who collected beetles with phoretic mites of the new species.

ACKNOWLEDGEMENTS

I thank Prof. V.D. Sevastianov, Odessa National University, Ukraine for providing me with



Figs. 13–14. *Spatulaphorus vladimiri* sp. n., phoretic female: 13 — dorsum, 14 — venter.

the paratypes of *Pygmephorellus artemjevi*; Dr. V.E. Sklyar, Poltava, Ukraine for the materials of mites from dung beetles; Dr. A.M. Camerik, Republic of South Africa, for reviewing the manuscript and helpful suggestions.

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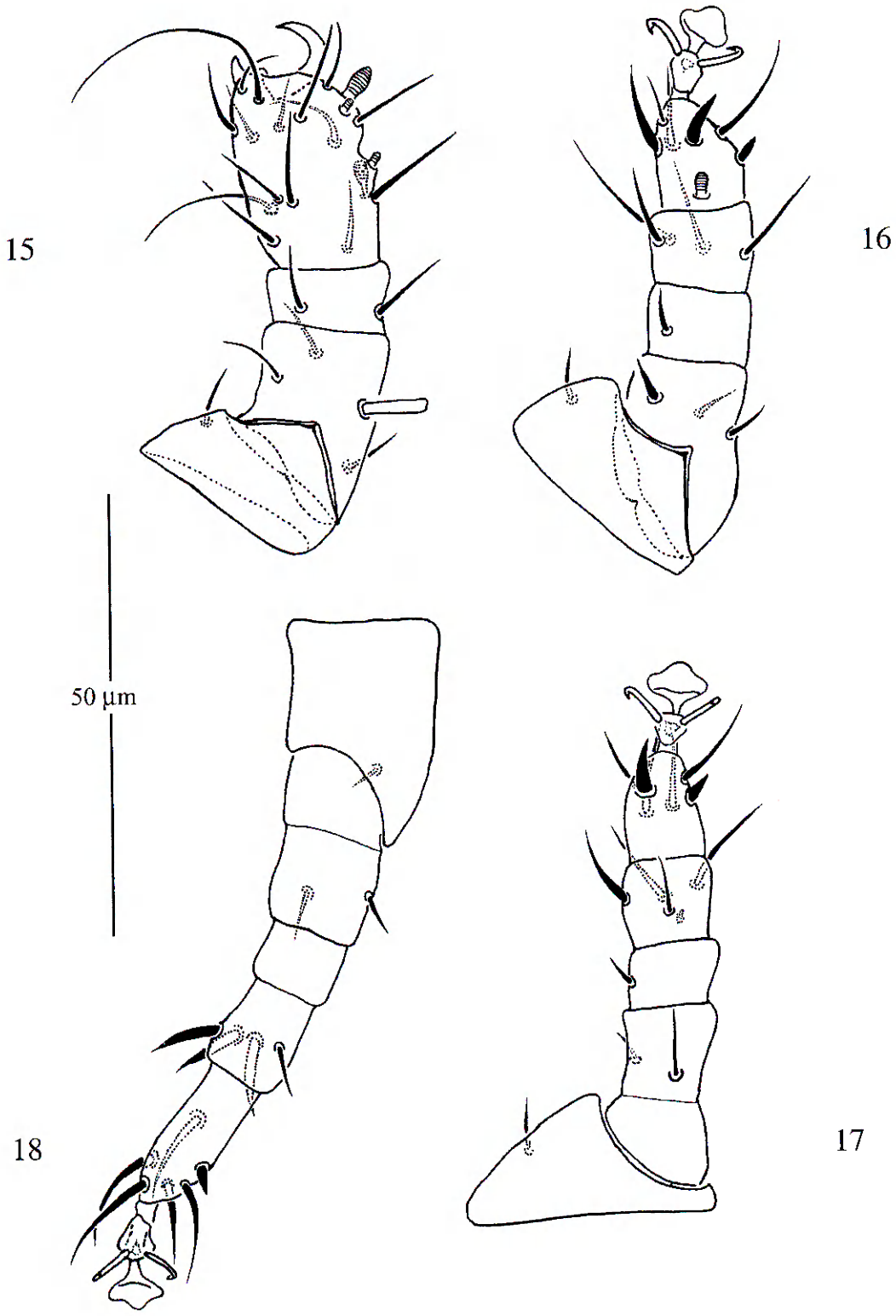

Figs. 15–18. *Spatulaphorus vladimiri* sp. n., phoretic female: 15–18 — legs I – IV, respectively.