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A new species group and five new species of the genus *Pavania* (Acari: Dolichocybidae) associated with insects, with notes on leg chaetotaxy and the distribution of genera

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Key words. Acari, Prostigmata, Heterostigmata, Dolichocybidae, *Pavania*, taxonomy, new species, chaetotaxy, Coleoptera, Scarabaeidae, Carabidae, Iran

Abstract. A new species group and five new species of mites of the genus *Pavania* Lombardini, 1949 belonging to the family Dolichocybidae (Acari: Heterostigmata) are described from Iran. *Pavania gymnopleuri* Hajiqanbar & Khaustov sp. n., *P. sabzevarensis* Hajiqanbar & Khaustov sp. n. and *P. onthophagi* Hajiqanbar & Khaustov sp. n., represent a new *gymnopleuri* species group. Two new species are also described in the *fusiformis* group: *P. kamalii* Hajiqanbar & Khaustov sp. n. and *P. elongata* Hajiqanbar & Khaustov sp. n. All new species are associated with scarabaeid and carabid beetles (Coleoptera: Scarabaeidae, Carabidae). This is the first record of the family Dolichocybidae from Iran. The leg setation and geographic distribution of all genera of this family are discussed and keys to genera and species of the genus *Pavania* are provided.

INTRODUCTION

In the section Heterostigmata, according to Mironov & Bochkov (2009), the basal superfamily Dolichocyboidea includes the families Dolichocybidae Mahunka, 1970 and Crotalomorphidae Lindquist & Krantz, 2002 (Lindquist & Krantz, 2002). Despite this, these mites are morphologically and biologically specialized. Mites of the family Dolichocybidae are associated with different insects, especially beetles and ants with which the female mites have a phoretic relationship. Parasitic associations are not recorded in this family. The adult females are fungivorous and demonstrate the phenomenon of neosomy (Kaliszewski et al., 1995) in which the larvae and males live within the body of the physogastric females; males are therefore poorly known.

Hitherto, this family consisted of two subfamilies, six genera and 30 species and was not recorded in Iran. During an extensive survey of the insect-associated heterostigmatic mites in northeastern Iran, five new species of the genus *Pavania,* belonging to the family Dolichocybidae, were recorded and are described here. In this paper, we establish a new *gymnopleuri* species group containing 3 new species within the genus *Pavania*. *Pavania* is thus divided into two species groups: the *fusiformis* group (based on the name for the type species) containing 15 species including two additional new species described below, and the *gymnopleuri* group containing 3 species.

MATERIAL AND METHODS

Mites were collected from different species of the beetle families Scarabaeidae and Carabidae (Insecta: Coleoptera). Of the host beetles, some were captured in a light trap but most were collected directly in their habitats, i.e., livestock dung pads.

The mites were cleared in lactophenol and mounted in Hoyer's medium. Morphology of the mites was studied using a light microscope with phase contrast. All measurements in the descriptions are given in micrometers for the holotype and (when available) for five paratypes (in parentheses). Terminology follows that of Lindquist (1986). Details of geographical coordinates were recorded using a GPS mobile device. The scarabaeid beetle hosts were identified by V. Martynov (Donetsk National University, Donetsk, Ukraine).

Holotypes of new taxa are deposited in the Acarological Collection, Department of Entomology, Faculty of Agriculture, Tarbiat Modares University, Tehran, Iran. One paratype of each species is deposited in the following collections: Zoological Institute, University of Hamburg, Hamburg, Germany; U.S. National Museum of Natural History, Washington D.C., U.S.A.; Collection of Nikita Botanical Gardens, Yalta, Ukraine; Department of Animal Taxonomy and Ecology, A. Mickiewicz University, Poznan, Poland; and Acarological Collection, Zoological Museum, College of Agriculture, University of Tehran, Karaj, Iran. Most paratypes are retained with the holotype.

SYSTEMATICS

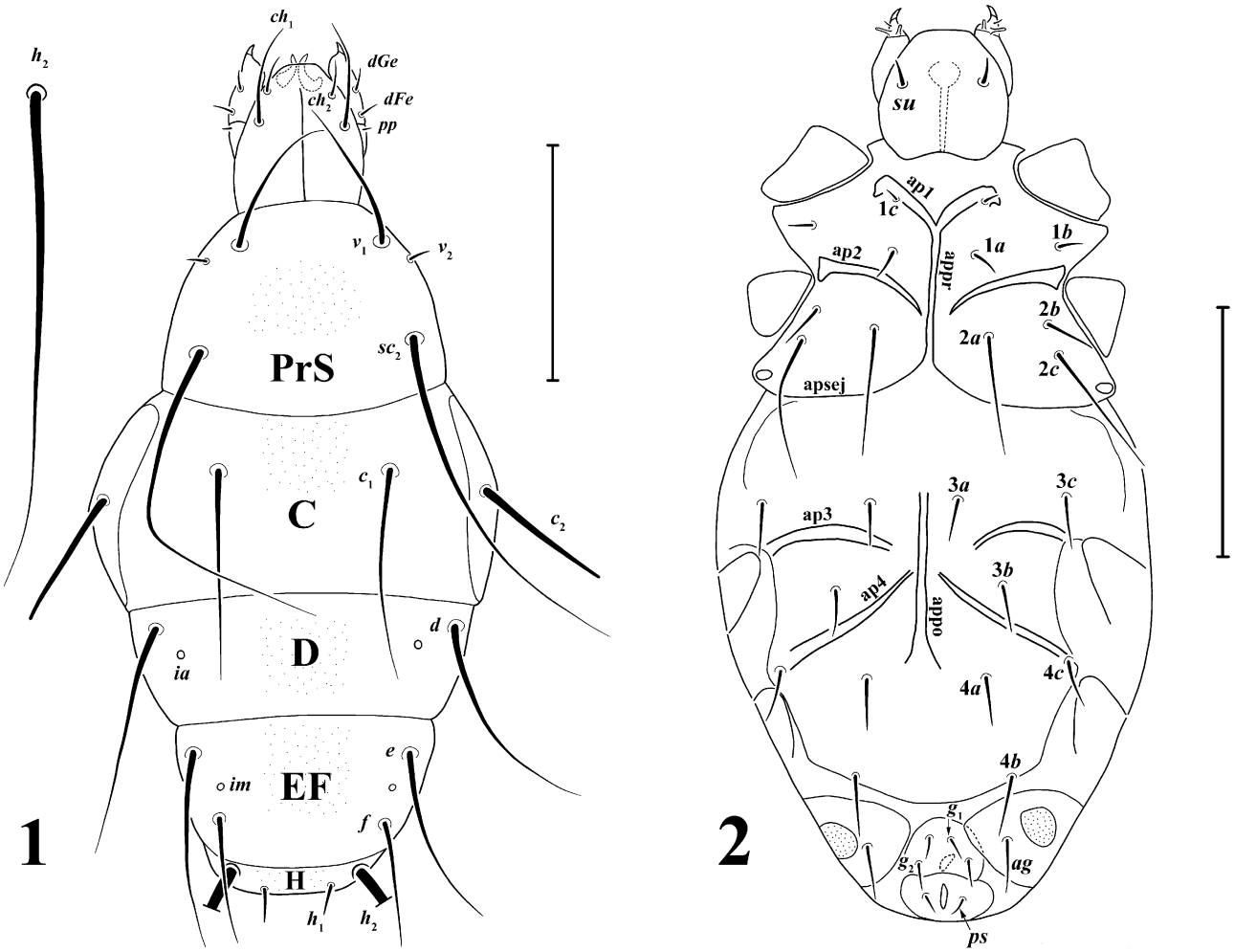
Family Dolichocybidae Mahunka, 1970

Genus *Pavania* Lombardini, 1949

Type species: *Pavania fusiformis* Lombardini, 1949

Diagnosis of adult female

Gnathosoma. Gnathosoma rounded subquadrangular, usually longer than wide; dorsally with 2 pairs of cheliceral setae (ch_1 and ch_2) and ventrally with 1 pair of subcapitular setae (*su*). Cheliceral stylets large and sickle-shaped. Pharynx hardly visible, rounded. Palpi originated ventrolaterally from gnathosoma, 2-segmented.



Figs 1–2. *Pavania gymnopleuri* sp. n., female. 1 – body in dorsal view; 2 – body in ventral view. Scale bars 50 μm.

Palpal tibiotarsus with 2 solenidia and a small seta, terminated in a distinct claw. Palpal femurogenu with 2 dorsolateral setae (*dGe* and *dFe*). Small palpcoxal seta (*pp*) evident at palp bases.

Idiosoma. Sometimes with tiny dimples on dorsal surface. Prodorsum with 3 pairs of setae (v_1, v_2 and sc_2), setae v_2 shorter than sc_2 and v_1; trichobothridia (sc_1) present or absent. Posterior edges of tergites undulated in some species. Cupuli *ia* and *im* obvious on tergites D and EF, respectively. Ventral apodemes usually well-developed; apodeme I (ap1) joined to the presternal apodeme (appr) forming a Y-shaped structure. Each coxisternal plate with 3 pairs of setae; setae 3*a* and 3*c* situated out of third coxisternal plate and inserted above apodemes III. Genital plate with 2 pairs of setae (g_1 and g_2) and genital aperture. Aggenital plates spaced and flanking genital plate, and each bearing one seta (*ag*) and a small porous area. Pseudanal plate with one pair of setae (*ps*) and anal slit. **Legs.** Leg I thicker than other legs, legs II–IV similar in shape, 5-segmented, all with empodium and paired claws, without spine-like setae and all solenidia emergent. Number of setae and solenidia on each leg: Leg I: Fe 4 (*d*, *v"*, *l'*, *l"*); Ge 2 (*v'*, *l'*); Ti 6 (*d*, *k*, *v'*, *v"*, *l'*, *l"*, φ_1, φ_2); Ta 11 (*p'*, *p"*, *tc'*, *tc"*, *ft'*, *ft"*, *pl"*, *pv'*, *pv"*, *u'*, *u"*, ω_1, ω_2). Leg II: Fe 2 (*d*, *v"*); Ge 1 (*l'*); Ti 4 (*d*, *v'*, *v"*, *l'*, φ); Ta 6 (*tc'*, *tc"*, *pv'*, *pv"*, *pl"*, *u'*, ω). Leg III: Fe 1 (*d*); Ge 1 (*v'*); Ti 4 (*d*, *v'*, *v"*, *l'*); Ta 5 (*tc'*, *tc"*, *pv'*, *pv"*, *pl"*). Leg IV: Fe 1 (*d*); Ge 1 (*v'*); Ti 4 (*d*, *v'*, *v"*, *l'*); Ta 5 (*tc'*, *tc"*, *pv'*, *pv"*, *pl"*).

Male unknown.

The genus *Pavania* is here divided in two species groups:

Pavania gymnopleuri species group (Figs 1–18): Prodorsum only with 3 pairs of setae (v_1, v_2 and sc_2), trichobothridia (sc_1) absent.

Pavania fusiformis species group (Figs 19–30): Prodorsum with 3 pairs of setae (v_1, v_2 and sc_2) and one pair of capitate trichobothridia (sc_1).

Pavania gymnopleuri species group

Pavania gymnopleuri Hajiqanbar & Khaustov sp. n.

(Figs 1–6)

Differential diagnosis. The new species resembles two other species of this species group: *P. sabzevarensis* and *P. onthophagi*. Readily recognizable from these two species by the following characters: gnathosoma with chelicera setae ch_1 nearly 3 times longer than ch_2 (1.7 times in *P. sabzevarensis* and 1.5 times in *P. onthophagi*); dorsal idiosomal setae smooth and pointed except c_2 which is blunt-ended (c_2, *e* and *f* blunt-ended in *P. sabzevarensis*

and most dorsal idiosomal setae weakly barbed and distinctly blunt-ended in *P. onthophagi*); seta *e* longer than *f* (*e* shorter than *f* in *P. sabzevarensis* and *e* almost as long as *f* in *P. onthophagi*); seta h_2 almost 15 times longer than h_1 (7 times in *P. sabzevarensis* and nearly 3.5 times in *P. onthophagi*); ventral idiosomal setae smooth, attenuated and pointed, setae 2*a* and 2*c* longest on ventral aspect (ventral idiosomal setae smooth and needle-like, setae 2*a* longest on the ventral aspect of both *P. sabzevarensis* and *P. onthophagi*).

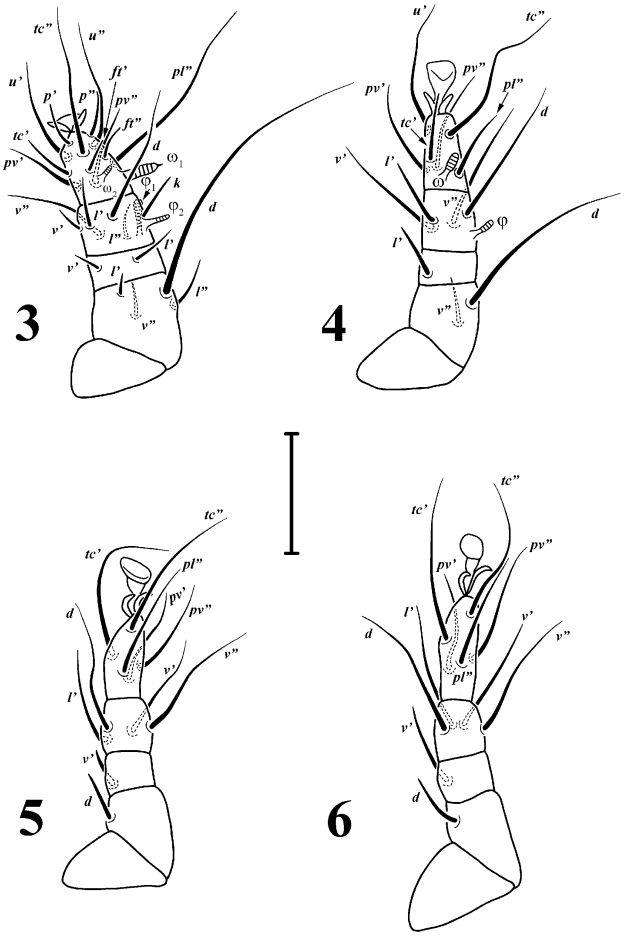
Description

Female (holotype). Length of idiosoma 144 (140–147 in 5 paratypes), width 86 (85–91).

Gnathosoma (Figs 1–2). Length of gnathosoma 31 (28–31), width 28 (27–28). Gnathosomal capsule rounded subquadrangular in dorsal aspect, slightly longer than wide; cheliceral setae ch_1 25 (21–23) and ch_2 9 (9–12) pointed and smooth. Dorsomedian apodeme evident and forming the longitudinal division in dorsal view of gnathosomal capsule. Cheliceral stylets 10 (9–11) long, curved and sickle-shaped. Subcapitulum with subcapitular setae *su* 7 (6–7) stiff, located on anterior half. Pharynx situated between subcapitular setae. Palpi conspicuous, exceeding apex of gnathosomal capsule, femorogena with setae *dGe* 5 (5–7) and *dFe* 4 (4–5), tibiotarsus with 2 solenidia, one longer than the other; minute palpcoxal setae *pp* inserted near to articulation of each palp with gnathosomal capsule.

Idiosomal dorsum (Fig. 1). Ovoid in shape. All dorsal shields with smooth posterior margins, ornamented with sparse dimples, without backward undulating projections. All dorsal idiosomal setae smooth. Prodorsal shield (PrS) subtrapezoid, anterior margin approximately straight, posterior margin concave, with setae v_1 35 (31–37), v_2 5 (4–5), sc_2 78 (77–84), setae v_1 longer than distance between their bases, both v_1 and sc_2 tapered and pointed, v_2 very short and located posterolaterally to v_1. Median shield of tergite C bearing setae c_1 47 (45–46) tapered and pointed and each lateral shield with 1 distinctly blunt-ended seta c_2 29 (28–33), c_1 almost 1.6 times longer than c_2. Tergite D with setae *d* 50 (48–55) tapered and pointed and cupuli *ia* situated posterolaterally to setae *d* on each side, setae c_1 and *d* subequal in length. Tergite EF with setae *e* 45 (38–43), *f* 27 (28–30) tapered and pointed, and 1 pair of cupuli *im* placed between insertion of setae *e* and *f*, seta *e* nearly 1.7 times longer than *f*. Tergite H with setae h_1 7 (6–8) needle-like and h_2 108 (106–111) ultralong, attenuated and pointed; seta h_2 approximately 15 times longer than h_1. Distances between dorsal idiosomal setae: v_1–v_1 30 (29–30), v_2–v_2 43 (40–41), v_1–v_2 6 (6–6), sc_2–sc_2 49 (47–47), c_1–c_1 34 (33–36), *d*–*d* 62 (59–66), *e*–*e* 46 (45–48), *f*–*f* 35 (36–38), *e*–*f* 16 (13–17), h_1–h_1 13 (11–13), h_2–h_2 28 (28–29), h_1–h_2 7 (6–8).

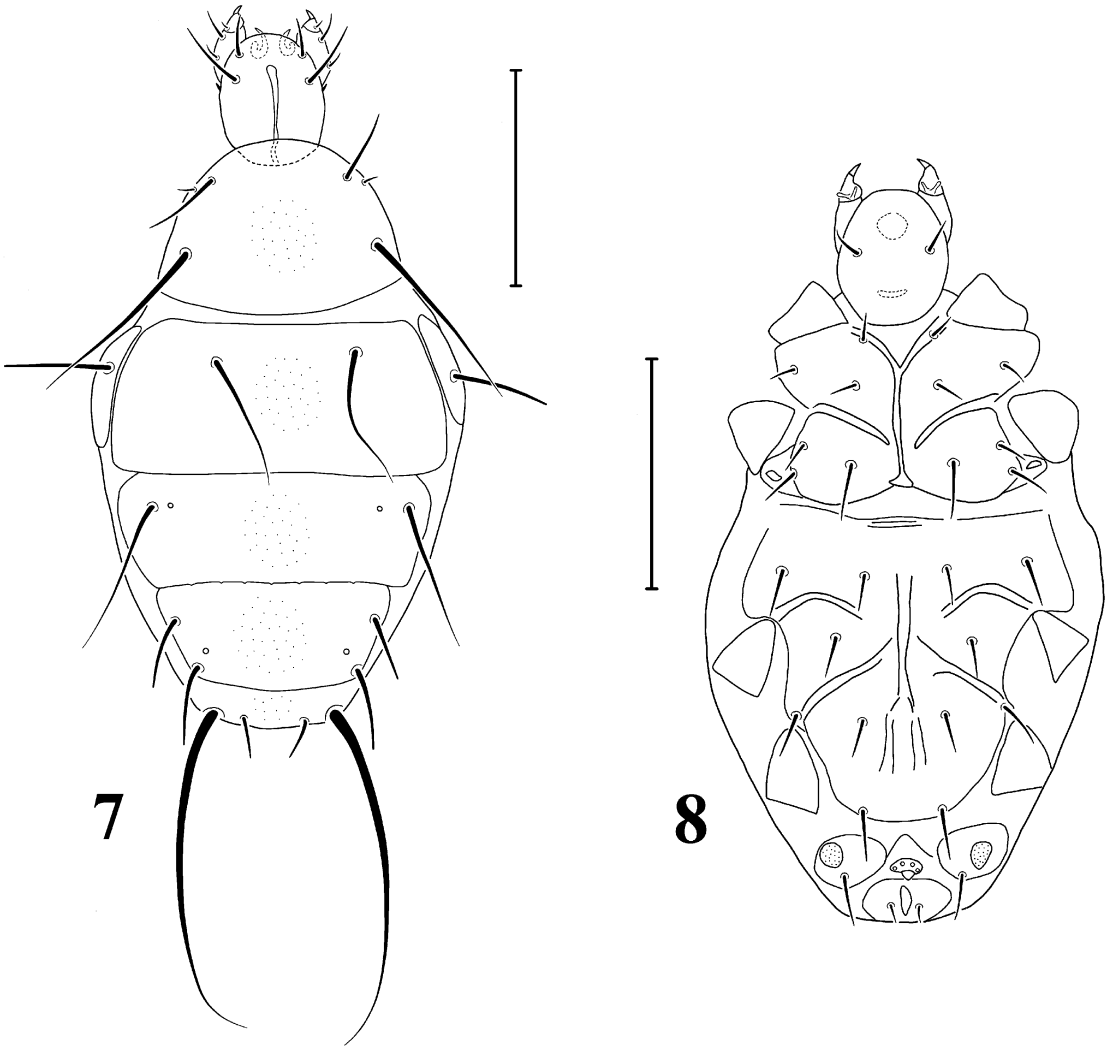
Idiosomal venter (Fig. 2). Ventral idiosomal setae smooth, attenuated and pointed, setae 2*a* and 2*c* longest on ventral aspect. Apodemes II (ap2) not reaching to presternal apodeme (appr); both apodemes III (ap3) and IV (ap4) not joined to poststernal apodeme (appo). Coxal field I: 1*a* 5 (5–5), 1*b* 5 (5–5), 1*c* 4 (4–5), 1*a* and 1*b* subequal in size and slightly longer than 1*c*. Coxal field II: 2*a* 27 (23–25), 2*b* 11 (9–10), 2*c* 30 (27–29), seta 2*c* longer than 2*a* and both more than 2 times longer than 2*b*. Coxal field III: 3*a* 10 (8–9), 3*b* 10 (9–10), 3*c* 11 (10–11), all subequal in size. Coxal field IV: 4*a* 10 (9–11), 4*b* 12 (11–13), 4*c* 10 (10–12), setae 4*a* and 4*c* of the same length and shorter than 4*b*. Genital plate with setae g_1 4 (4–5), g_2 5 (4–6). Aggenital plates each bearing seta *ag* 10 (9–11) and 1 small porous area. Pseudanal plate with setae *ps* 5 (5–6).



Figs 3–6. *Pavania gymnopleuri* sp. n., female: legs I–IV in dorsal view, respectively. Scale bar 20 μm.

Legs (Figs 3–6). Leg I (Fig. 3): setal formula (number of solenidia in parentheses): 4-2-6(2)-11(2). Tarsus with 4 slightly blunt-ended eupathidial setae *p'*, *p"*, *ft'* and *ft"*, rest of setae on the leg I seta-like and pointed; *pl"* longest seta on tarsus; solenidion ω_1 6 (5-6) prominent, finger shaped and stalked with a fine apical spine; solenidion ω_2 3 (3-3) finger shaped. Tibia with eupathidium *k* stiff, thicker than other setae; solenidion φ_1 6 (6–7) fairly clubbed and stalked, longer than finger shaped φ_2 4 (3–4). Genu with 2 setae (*l'* and *v'*), *l'* approximately twice as long as *v'*. Seta *d* on femur longer than leg I; seta *l"* longer than *v"*.

Leg II (Fig. 4). Setal formula: 2-1-4(1)-6(1). Setae of leg attenuated and pointed except setae *l'* on the genu and *v"* on femur, which are needle-like, *tc'* and *tc"* shortest and longest setae on tarsus, respectively, solenidion ω 5



Figs 7–8. *Pavania sabzevarensis* sp. n., female. 7 – body in dorsal view; 8 – body in ventral view. Scale bars 50 μm.

(4–5) finger shaped, stalked and striated; solenidion φ 4 (4–4) similar to ω but thinner; seta *d* on femur longest seta of the leg II and 4 times as long as seta *v"*.

Leg III (Fig. 5). Setal formula: 1-1-4-5. Setae of leg attenuated and pointed except setae *v'* on genu and *d* on femur, which are needle-like; seta *d* of femur longer than seta *v'* of genu; setae *d* and *v"* subequal in length and seta *d* longer than *l'* on tibia.

Leg IV (Fig. 6). Setal formula: 1-1-4-5. Setae of leg attenuated and pointed except setae *v'* on genu and *d* on femur, which are needle-like; seta *v'* of genu longer than seta *d* of femur; on tibia setae *d* and *v"* subequal in length and seta *d* more than twice as long as this segment.

Male unknown.

Type material. Holotype ♀ (Sab-2-I) and 14♀ paratypes, phoretic on *Gymnopleurus mopsus persianus* Reitter, 1893 (Coleoptera: Scarabaeidae) collected in dung pads of livestock: Northeastern Iran, Razawi Khorasan province, Mehr village in the vicinity of Sabzevar town, 36.30°N, 57.80°E, altitude 1,024 m, 4.vi.2007, coll. H. Hajiqanbar.

Etymology. The name *gymnopleuri* refers to the generic name of the scarab host – *Gymnopleurus*.

***Pavania sabzevarensis* Hajiqanbar & Khaustov sp. n.**

(Figs 7–12)

Differential diagnosis. The new species differs from two other species of this species group in its cheliceral setae ch_1, which are nearly 1.7 times longer than ch_2 (3 times in *P. gymnopleuri* and 1.5 times in *P. onthophagi*); dorsal idiosomal setae smooth and pointed except c_2, *e* and *f*, which are blunt-ended (c_2 blunt-ended in *P. gymnopleuri* and most dorsal idiosomal setae weakly barbed and distinctly blunt-ended in *P. onthophagi*); seta *e* shorter than *f* (*e* longer than *f* in *P. gymnopleuri* and *e* almost as long as *f* in *P. onthophagi*); seta h_2 7 times longer than h_1 (almost 15 times in *P. gymnopleuri* and nearly 3.5 times in *P. onthophagi*); ventral idiosomal setae smooth and needle-like, setae 2*a* the longest ones on the ventral aspect (the same in *P. onthophagi* but ventral idiosomal setae smooth, attenuated and pointed, setae 2*a* and 2*c* the longest on ventral aspect in *P. gymnopleuri*); genu I with one seta *v'* (with two setae *v'* and *l'* in both *P. gymnopleuri* and *P. onthophagi*).

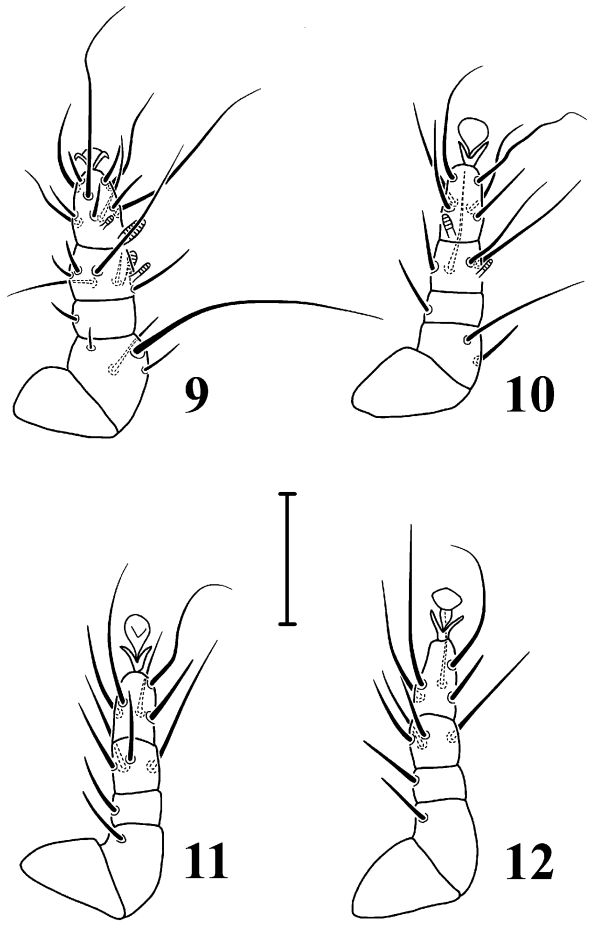
Description

Female (holotype). Length of idiosoma 126 (114–122 in 5 paratypes), width 83 (78–81).

Gnathosoma (Figs 7–8). Length of gnathosoma 29 (29–30), width 25 (23–25). Gnathosomal capsule rounded subquadrangular in dorsal aspect, longer than wide; cheliceral setae ch_1 15 (13–17) and ch_2 9 (9–11) needle-like. Dorsomedian apodeme evident. Cheliceral stylets 9 (7–9) curved and falcate. Subcapitulum with subcapitular setae *su* 7 (6–7) stiff and located on anterior half. Palpi conspicuous, exceeding apex of gnathosomal capsule, femorogenu with setae *dGe* 6 (6–7) and *dFe* 4 (4–5), tibiotarsus with 2 solenidia, subequal in size; minute palp-coxal setae *pp* inserted near to articulation of each palp on gnathosomal capsule.

Idiosomal dorsum (Fig. 7). Ovoid in shape. All dorsal shields ornamented with sparse dimples; some specimens with deep and large dimples limited to margins of prodorsum and tergites C and D; in some specimens posterior margins of some shields with backward undulating projections. All dorsal idiosomal setae smooth. Prodorsal shield subtrapezoid, with anterior margin curved and concave posterior margin, with setae v_1 17 (15–17), v_2 4 (4–5), sc_2 45 (45–50), setae v_1 shorter than distance between their bases, both v_1 and sc_2 tapered and pointed, v_2 very short and located posterolaterally to v_1. Median shield of tergite C including setae c_1 32 (30–33) tapered and pointed and each lateral shield with 1 blunt-ended seta c_2 25 (22–23), c_1 approximately 1.3 times longer than c_2. Tergite D bearing setae *d* 33 (30–34) tapered and pointed, and cupuli *ia* situated laterally to seta *d*, setae c_1 and *d* subequal in length, posterior margin of tergite D with seven equally spaced tiny projections. Tergite EF with blunt-ended setae *e* 16 (15–17), *f* 18 (17–20) and 1 pair of cupuli *im* placed anterolaterally to setae *f*, seta *f* slightly longer than *e*. Tergite H with setae h_1 10 (10–11) needle-like and h_2 72 (72–77) ultra-long, attenuated and pointed; seta h_2 almost 7 times as long as h_1. Distances between dorsal idiosomal setae: v_1–v_1 29 (26–29), v_2–v_2 37 (35–38), v_1–v_2 4 (4–5), sc_2–sc_2 43 (40–43), c_1–c_1 30 (30–33), *d*–*d* 57 (57–58), *e*–*e* 44 (44–46), *f*–*f* 34 (33–36), *e*–*f* 10 (11–12), h_1–h_1 13 (11–12), h_2–h_2 26 (25–26), h_1–h_2 6 (5–7).

Idiosomal venter (Fig. 8). All ventral idiosomal setae smooth and needle-like; some specimens with deep and large dimples limited to margins of coxal fields. Apodemes II not reaching to presternal apodeme; both apodemes III and IV not joined to the poststernal apodeme. Coxal field I with 1*a* 6 (6–7), 1*b* 5 (5–7), 1*c* 5 (5–6), both latter subequal in size and slightly shorter than 1*a*. Coxal field II with 2*a* 12 (10–12), 2*b* 7 (6–7), 2*c* 10 (9–11), seta 2*a* approximately 2 times as long as 2*b*. Coxal field III with 3*a* 9 (9–10), 3*b* 9 (8–10), 3*c* 11 (10–11), setae 3*a* and 3*b* sub-equal in length and both shorter than 3*c*. Coxal field IV with 4*a* 8 (8–9), 4*b* 11 (10–11), 4*c* 9 (9–10), 4*b* longer than 4*a* and 4*c*. Genital plate without setae g_1 and g_2 (only their alveoli remain) but genital aperture visible. Aggenital plates each bearing 1 seta *ag* 11 (10–11) and 1 small porous area. Pseudanal plate with setae *ps* 5 (5–6).



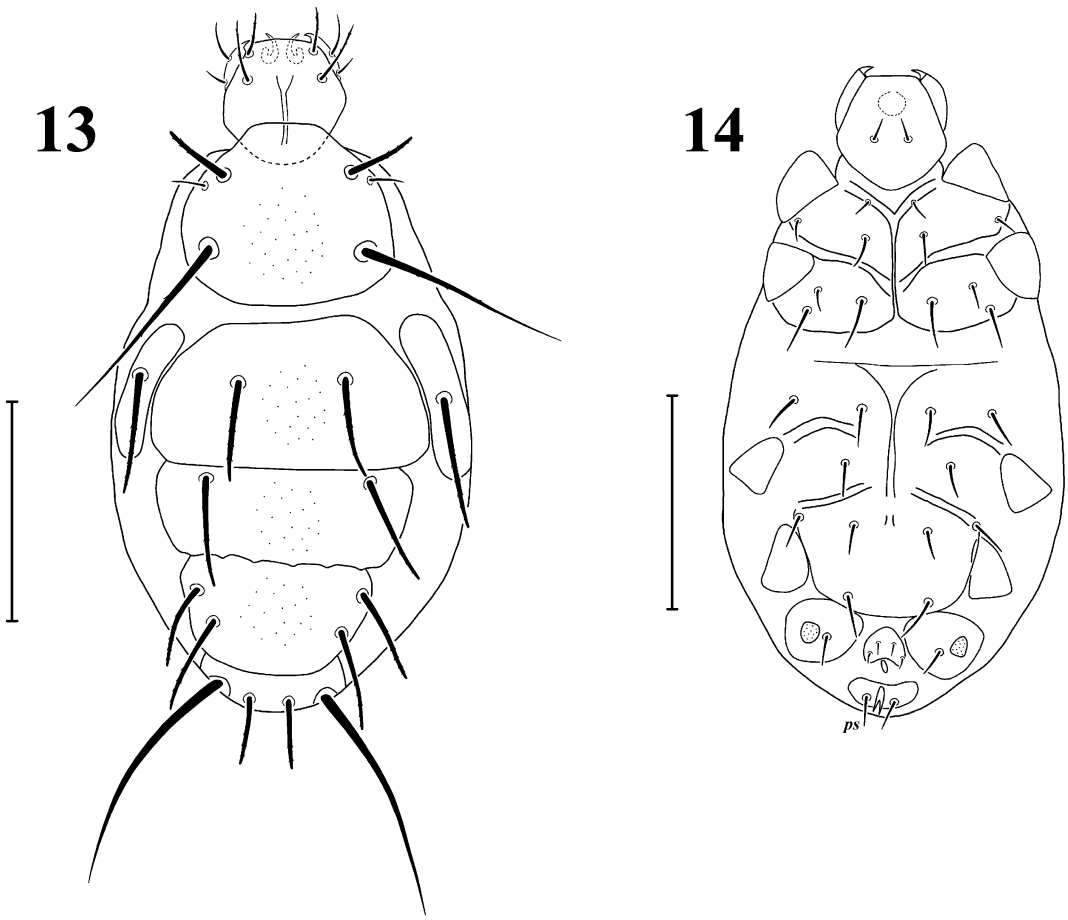
Figs 9–12. *Pavania sabzevarensis* sp. n., female: legs I–IV in dorsal view, respectively. Scale bar 20 μm.

Legs (Figs 9–12). Leg I (Fig. 9): setal formula: 4-1-6(2)-11(2). Tarsus with 4 slightly blunt-ended eupathidial setae *p'*, *p"*, *ft'* and *ft"*, rest of setae on leg I slender and pointed; both *tc"* and *pl"* subequal in length and the longest on tarsus; solenidion ω_1 5 (5–5) prominent, approximately spindle shaped; solenidion ω_2 3 (3–4) finger shaped. Tibia with eupathidium *k* stiff; solenidion φ_1 6 (7–8) stalked and slightly clubbed, longer than φ_2 4 (3–4) finger shaped. Genu with 1 seta (*v'*). Seta *d* on femur equal in length to whole leg I; seta *v"* longer than *l"*.

Leg II (Fig. 10). Setal formula: 2-1-4(1)-6(1). Setae of leg attenuated and pointed except setae *l'* on genu and *v"* on femur, which are needle-like, *pl"* and *tc"* shortest and longest setae on tarsus, respectively, solenidion ω 4 (3–4) finger shaped; solenidion φ 3 (3–4) similar to ω but thinner; seta *d* on femur 2.5 times as long as seta *v"*.

Leg III (Fig. 11). Setal formula: 1-1-4-5. Setae of leg attenuated and pointed except setae *pl"* on the tarsus, *v'* on genu and *d* on femur, which are needle-like; seta *pl"* shortest on tarsus; seta *d* of femur as long as seta *v'* of genu; seta *v'* shorter than *v"* and *d* subequal to *l'* on tibia.

Leg IV (Fig. 12). Setal formula: 1-1-4-5. Setae of leg attenuated and pointed except setae *pl"* on the tarsus, *v'*



Figs 13–14. *Pavania onthophagi* sp. n., female. 13 – body in dorsal view; 14 – body in ventral view. Scale bars 50 μm.

on genu and *d* on femur, which are needle-like; seta *v'* of genu slightly longer than seta *d* on femur; on tibia setae *d* shorter than *v"* and slightly longer than its segment.

Male unknown.

Type material. Holotype ♀ (Sab-2-II) and 21♀ paratypes phoretic on *Gymnopleurus mopsus persianus* collected in dung pads of livestock: Northeastern Iran, Razawi Khorasan province, Mehr village in the vicinity of Sabzevar town, 36.30°N, 57.80°E, altitude 1,024 m, 4.vi.2007, coll. H. Hajiqanbar.

Etymology. The specific epithet refers to the name of city Sabzevar in Northeastern Iran.

Pavania onthophagi Hajiqanbar & Khaustov sp. n.

(Figs 13–18)

Differential diagnosis. The new species is distinguishable from two other species of this species group by the following features: cheliceral setae ch_1 approximately 1.5 times longer than ch_2 (3 times in *P. gymnopleuri* and 1.7 times in *P. sabzevarensis*); dorsal idiosomal setae weakly barbed and distinctly blunt-ended, except v_2, sc_2 and h_2 being pointed (smooth in both other species, c_2 blunt-ended in *P. gymnopleuri* and c_2, *e* and *f* blunt-ended in *P. sabzevarensis*); seta *e* almost as long as *f* (*e* longer than *f* in *P. gymnopleuri* but shorter in *P. sabzevarensis*); seta h_2 nearly 3.5 times longer than h_1 (almost 15 times in *P. gymnopleuri* and 7 times in *P. sabzevarensis*); ventral idiosomal setae smooth and needle-like, setae 2*a* the longest in ventral aspect (the same in *P. sabzevarensis* but in *P. gymnopleuri* ventral idiosomal setae smooth, attenuated and pointed, setae 2*a* and 2*c* the longest in ventral aspect).

Description

Female (holotype). Length of idiosoma 136 (115–122 in 5 paratypes), width 81 (74–77).

Gnathosoma (Figs 13–14). Length of gnathosoma 28 (28–30), width 28 (26–29). Gnathosomal capsule rounded subhexagonal in dorsal aspect, as long as wide with cheliceral setae ch_1 18 (19–20) and ch_2 12 (11–13) weakly barbed. Dorsomedian apodeme evident. Cheliceral stylets 8 (7–8) curved and falcate. Subcapitulum with subcapitular setae *su* 5 (5–5) stiff, located on posterior half. Palpi somewhat appressed to gnathosoma (for this reason accessories of tibiotarsus not visible), exceeding apex of gnathosomal capsule, femorogenu with setae *dGe* 9 (7–9) and *dFe* 5 (5–6) smooth and pointed; palpcoxal setae *pp* not visible.

Idiosomal dorsum (Fig. 13). Ovoid in shape. All dorsal shields ornamented with sparse and fairly deep dimples; in some specimens posterior margins of dorsal shields with backward pointing and equally spaced projections. Dorsal idiosomal setae weakly barbed and distinctly blunt-ended except v_2, sc_2 and h_2 which are pointed. Prodorsal shield subtrapezoid, its anterior margin straight and posterior margin slightly concave, with setae v_1 17 (17–18), v_2 7 (5–7), sc_2 50 (47–52), setae v_1 shorter

than distance between their bases, v_2 short and located posterolaterally to v_1, sc_2 weakly barbed, tapered and pointed. Median shield of tergite C with setae c_1 25 (23–25) and each lateral shield with seta c_2 30 (28–30), c_1 approximately 0.8 times longer than c_2. Tergite D with setae *d* 27 (24–27) and cupuli *ia* situated posterior to seta *d*, seta *d* slightly longer than c_1, posterior margin of tergite D usually undulated. Tergite EF with setae *e* 23 (21–23), *f* 23 (22–23) and 1 pair of cupuli *im* placed closer to setae *e* on its inner posterolateral side, seta *f* as long as *e*. Tergite H with setae h_1 16 (15–17) and h_2 57 (61–62), the latter long, attenuated and pointed, seta h_2 almost 3.5 times longer than h_1. Distances between dorsal idiosomal setae: v_1–v_1 28 (27–28), v_2–v_2 38 (35–36), v_1–v_2 4 (4–5), sc_2–sc_2 34 (33–35), c_1–c_1 25 (25–27), *d*–*d* 36 (36–39), *e*–*e* 35 (35–38), *f*–*f* 28 (27–29), *e*–*f* 8 (8–9), h_1–h_1 9 (10–10), h_2–h_2 22 (21–23), h_1–h_2 6 (5–6).

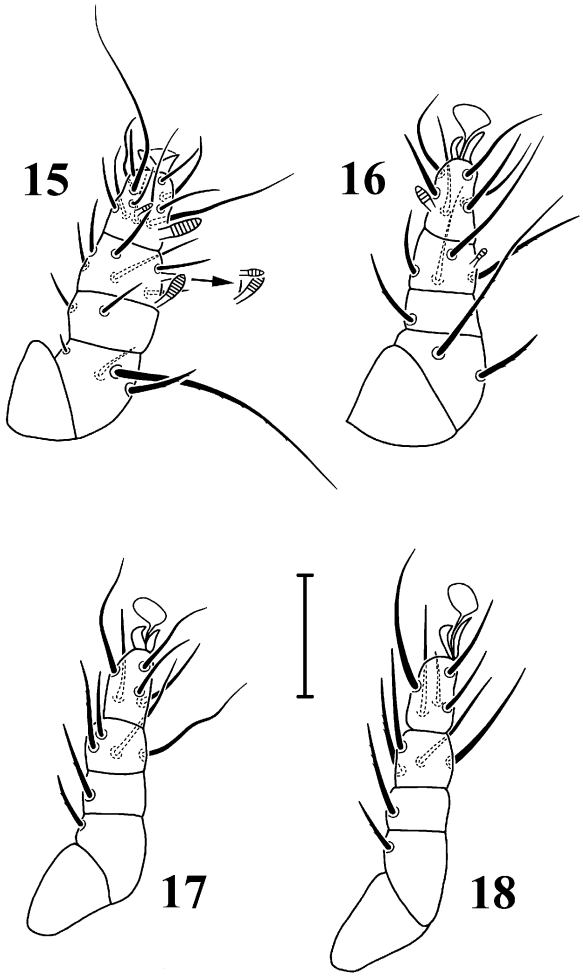
Idiosomal venter (Fig. 14). All ventral idiosomal setae smooth and needle-like. Apodemes II almost reaching to presternal apodeme; both apodemes III and IV not joined with poststernal apodeme. Coxal field I: 1*a* 7 (6–7), 1*b* 5 (5–5), 1*c* 5 (5–5), 1*c* and 1*b* subequal in size and shorter than 1*a*. Coxal field II: 2*a* 12 (11–12), 2*b* 5 (5–6), 2*c* 11 (10–11), seta 2*a* 2.4 times as long as 2*b*. Coxal field III: 3*a* 9 (8–9), 3*b* 8 (8–9), 3*c* 8 (9–9), all setae in coxal field III almost subequal in length. Coxal field IV: setae 4*a* 7 (7–9), 4*b* 10 (9–10), 4*c* 9 (8–9), setae 4*b* longer than 4*a* and 4*c*. Genital plate with setae g_1 3 (3–3) and g_2 3 (3–3). Aggenital plates each bearing 1 seta *ag* 6 (6–7) and 1 small porous area. Pseudanal plate with setae *ps* 8 (8–9) and bifurcate anal slit.

Legs (Figs 15–18). Leg I (Fig. 15): setal formula: 4-2-6(2)-11(2). Tarsus with 4 slightly blunt-ended eupathidial setae *p'*, *p"*, *ft'* and *ft"*, rest of setae on the leg I seta-like and pointed; seta *tc"* longest on the tarsus and longer than *pl"*; solenidion ω_1 6 (6–6) prominent and finger shaped; solenidion ω_2 3 (3–3) finger shaped. Tibia with eupathidium *k* stiff; solenidion φ_1 7 (6–7) stalked and fairly clubbed, longer than φ_2 4 (4–5) finger shaped. Genu with 2 setae (*v'* and *l'*). Seta *d* on femur weakly barbed, shorter than leg I; seta *l"* longer than *v"*.

Leg II (Fig. 16). Setal formula: 2-1-4(1)-6(1). Setae of leg attenuated and pointed except setae *l'* on genu and *v"* on femur which are needle-like; setae *v"* on tibia, *l'* on genu, *d* and *v"* on femur weakly barbed; seta *tc'* shortest on tarsus, solenidion ω 4 (4–5) finger shaped; solenidion φ 4 (4–5) similar to ω but thinner; seta *d* on femur 2.8 times as long as seta *v"*.

Leg III (Fig. 17). Setal formula: 1-1-4-5. Setae of leg attenuated and pointed except setae *v'* on genu and *d* on femur which are needle-like; setae *l'* on tibia, *v'* on genu and *d* on femur weakly barbed; seta *pl"* shortest on tarsus; seta *d* of femur shorter than seta *v'* of genu; setae *d* shorter than *v"* and *l'* on tibia.

Leg IV (Fig. 18). Setal formula: 1-1-4-5. Setae of leg attenuated and pointed except *v'* on genu and *d* on femur which are needle-like; setae *l'* on tibia, *v'* on genu and *d* on femur weakly barbed; seta *v'* of genu longer than seta *d* of femur; on tibia setae *d* shorter than *v"* and longer than its segment.



Figs 15–18. *Pavania onthophagi* sp. n., female: legs I–IV in dorsal view, respectively. Scale bar 20 μm.

Male unknown.

Type material. Holotype ♀ (Bo-1) and 15♀ paratypes phoretic on *Onthophagus* (*Euonthophagus*) *gibbosus gibbosus* (Scriba, 1970) (Coleoptera: Scarabaeidae) collected in dung pads of livestock: Northeastern Iran, North Khorasan province, Esfidan village in the vicinity of Bojnord town, 37.31°N, 57.57°E, altitude 1,611 m, 28.vi.2007, coll. H. Hajiqanbar.

Additional material. 11♀ (Es-1), phoretic on *Onthophagus* (s. str.) *taurus* (Schreber, 1959) (Coleoptera: Scarabaeidae) collected in dung pads of livestock: Northeastern Iran, North Khorasan province, vicinity of Esfarayen town, 36.93°N, 57.74°E, altitude 1,471 m, 26.vi.2007, coll. H. Hajiqanbar.

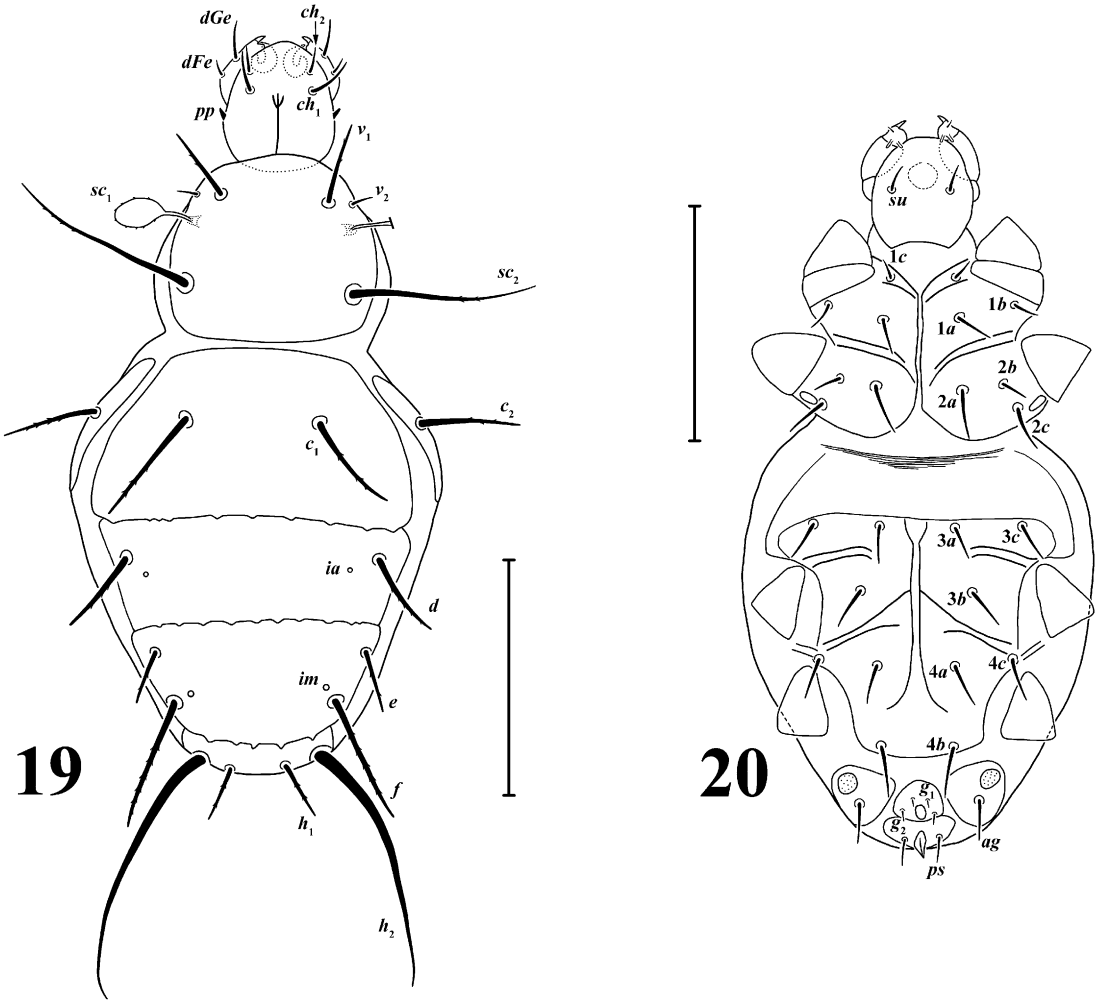
Etymology. The specific epithet is derived from the generic name of the host scarab beetle – *Onthophagus*.

Pavania fusiformis species group

Pavania kamalii Hajiqanbar & Khaustov sp. n.

(Figs 19–24)

Differential diagnosis. This new species is similar to *Pavania fusiformis* Lombardini, 1949 but differs from it by seta c_1 longer than c_2 (c_2 longer than c_1 in *P. fusiformis*); seta c_1 longer than *d* (c_1 and *d* subequal in *P.*



Figs 19–20. *Pavania kamalii* sp. n., female. 19 – body in dorsal view; 20 – body in ventral view. Scale bars 50 μm.

fusiformis) and seta sc_2 less than twice length of c_1 (sc_2 more than twice length of c_1 in *P. fusiformis*).

Description

Female (holotype). Length of idiosoma 130 (121–134 in 5 paratypes), width 78 (71–75).

Gnathosoma (Figs 19–20). Length of gnathosoma 27 (26–29), width 25 (22–25). Gnathosomal capsule rounded subquadrangular in dorsal aspect, longer than wide; dorsally with cheliceral setae ch_1 10 (11–14) and ch_2 6 (7–8) smooth. Dorsomedian apodeme evident. Cheliceral stylets 9 (8–9) curved and falciform. Subcapitulum with subcapitular setae *su* 6 (6–7) needle-like. Pharynx rounded. Palpi conspicuous, exceeding apex of gnathosomal capsule, femurogena with 2 setae *dGe* 7 (6–7) and *dFe* 4 (4–5), tibiotarsus with 2 solenidia subequal in size and 1 small seta; minute palpcoxal setae *pp* visible and inserted near to articulation of each palp with the gnathosomal capsule.

Idiosomal dorsum (Fig. 19). Almost ovoid in shape. All dorsal shields smooth and their posterior margins with several backward pointing and more or less equally spaced projections. Dorsal idiosomal setae weakly barbed and blunt–ended except v_2 and h_2, which are smooth and pointed. Prodorsal shield subquadrangular, its anterior margin curved and posterior margin slightly concave, with setae v_1 17 (17–19), v_2 4 (4–5), sc_2 39 (39–44) and 1 pair of barbed capitate trichobothridia sc_1, setae v_1 shorter than distance between their bases, v_2 short and located laterally of v_1, sc_2 weakly barbed, tapered and pointed. Median shield of tergite C with setae c_1 28 (28–32) and each lateral shield with seta c_2 22 (22–25), c_1 almost 1.3 times longer than c_2. Tergite D with setae *d* 21 (21–22) and cupuli *ia* situated posterolaterally to seta *d*, seta c_1 longer than *d*. Tergite EF with setae *e* 13 (13–15) and *f* 30 (29–31), and 1 pair of cupuli *im* placed closer to setae *f* on its inner anterolateral side, seta *f* 2.3 times as long as *e*. Tergite H with setae h_1 12 (11–13) and h_2 58 (61–65), the latter long, attenuated and pointed, seta h_2 almost 4.8 times longer than h_1. Distances between dorsal idiosomal setae: v_1–v_1 22 (20–21), v_2–v_2 32 (30–32), v_1–v_2 5 (4–5), sc_2–sc_2 34 (32–34), c_1–c_1 28 (25–28), *d*–*d* 52 (50–55), *e*–*e* 44 (43–45), *f*–*f* 33 (31–33), *e*–*f* 10 (10–11), h_1–h_1 11 (11–12), h_2–h_2 23 (23–25), h_1–h_2 6 (5–6).

Idiosomal venter (Fig. 20). All ventral idiosomal setae smooth and needle-like. Ventral apodemes well-developed; apodemes I joined with presternal apodeme; apodemes II not reaching to presternal apodeme; both apodemes III and IV not joined to poststernal apodeme. Coxal field I with setae 1*a* 7 (6–7), 1*b* 5 (5–6), 1*c* 5 (5–5), 1*c* and 1*b* subequal in length and shorter than 1*a*.

Coxal field II with setae 2*a* 11 (11–13), 2*b* 5 (5–6), 2*c* 10 (11–12), seta 2*a* 2.2 times longer than 2*b*. Coxal field III with setae 3*a* 8 (9–10), 3*b* 9 (9–10), 3*c* 9 (10–11), all setae of coxal field III subequal in length. Coxal field IV with setae 4*a* 9 (9–10), 4*b* 11 (11–12), 4*c* 10 (9–10), setae 4*b* longer than 4*a* and 4*c*. Genital plate with setae g_1 2 (2–2), g_2 3 (3–3) short. Aggenital plates including 1 seta *ag* 9 (9–11) and 1 small porous area each. Pseudanal plate with setae *ps* 6 (6–7).

Legs (Fig. 21–24). Leg I almost thicker than leg II (Fig. 21): setal formula: 4-2-6(2)-11(2). Tarsus with 4 slightly blunt-ended eupathidial setae *p'*, *p"*, *ft'* and *ft"*, rest of setae on leg I seta-like and pointed; seta *tc"* longest on tarsus and longer than *pl"*; solenidion ω_1 6 (5–5) prominent and finger shaped; solenidion ω_2 3 (3–3) finger shaped. Tibia with eupathidium *k* stiff; solenidion φ_1 7 (6–7) stalked and fairly clubbed, longer than φ_2 3 (3–4) finger shaped. seta *d* 4 times as long as *l"* on femur.

Leg II (Fig. 22). Setal formula: 2-1-4(1)-6(1). Setae of leg attenuated and pointed; seta *pl"* shortest on tarsus, solenidion ω 4 (4–4) finger shaped; solenidion φ 3 (3–3) similar to ω; on femur and genu, setae *d* and *l'* subequal and both longer than seta *v"*.

Leg III (Fig. 23). Setal formula: 1-1-4-5. Setae of leg attenuated and pointed; on the tarsus seta *tc'* longer than its segment length; seta *d* of femur shorter than seta *v'* of the genu.

Leg IV (Fig. 24). Setal formula: 1-1-4-5. Setae of leg attenuated and pointed; on tarsus seta *pl"* shortest of all tarsals and shorter than its segment length; on tibia, seta *l'* longer than *d*; seta *v'* of genu longer than seta *d* on the femur.

Male unknown.

Type material. Holotype ♀ (Es-3) and 11♀ paratypes phoretic on *Scarabaeus* spp. (Coleoptera: Scarabaeidae) collected in dung pads of livestock or caught by a light trap: Northeastern Iran, North Khorasan province, vicinity of Esfarayen town, 36.94°N, 57.73°E, altitude 1,483 m, 26. and 27.vi.2007, coll. H. Hajiqanbar.

Etymology. The new species is named in honour of Prof. Karim Kamali, supervisor of the senior author, in recognition of his encouragement for the study of mites in Iran.

Pavania elongata Hajiqanbar & Khaustov sp. n.

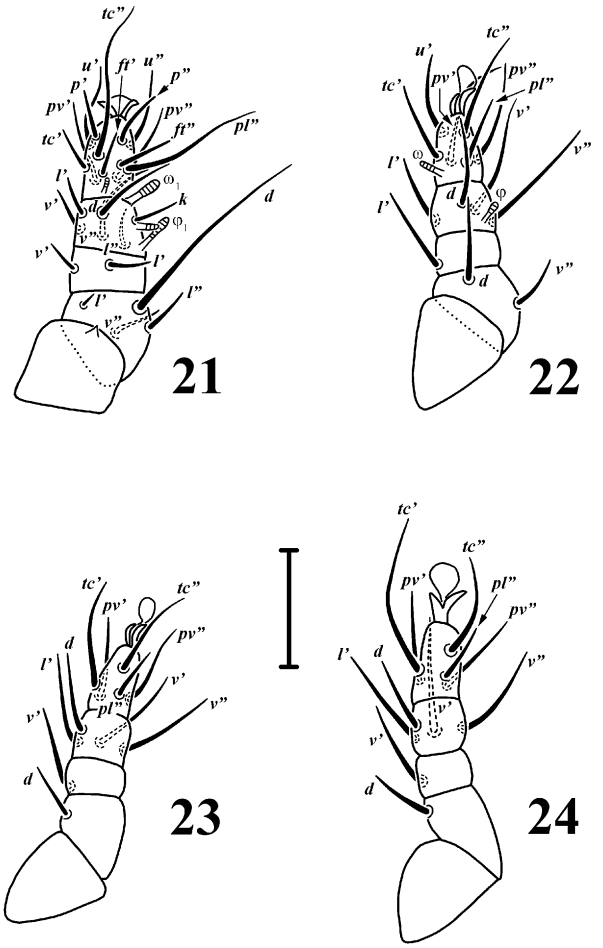
(Figs 25–30)

Differential diagnosis. The new species differs from other species of the species group by subequal coxal setae 2*a* and 2*c* (28) which are more than twice as long as 2*b* (13); seta c_1 shorter than c_2 but longer than *d*; seta *f* nearly 1.2 times as long as *e*. This species is also characterized by having an elongate idiosoma (mites of the genus *Pavania* usually have fusiform idiosoma).

Description

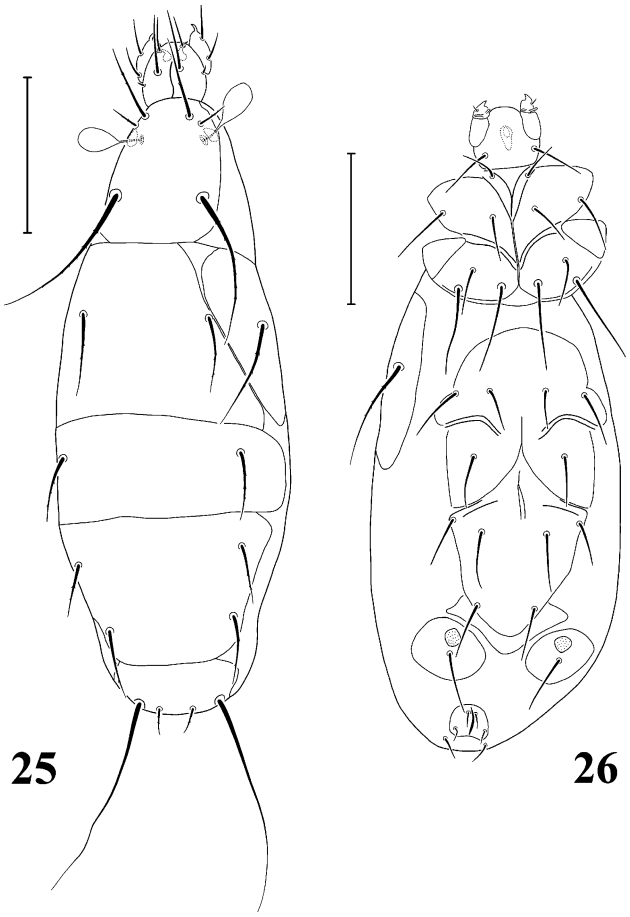
Female (holotype). Length and width of idiosoma 200 and 85, respectively.

Gnathosoma (Fig. 25–26). Length of gnathosoma 28 and 23, respectively. Gnathosomal capsule rounded subquadrangular in dorsal aspect, longer than wide; cheliceral setae ch_1 21 and ch_2 10 smooth. Dorsomedian apodeme evident. Cheliceral stylets curved and falciform, 6 long. Subcapitulum with subcapitular setae *su* 17 located on posterior half. Pharynx rounded. Palpi conspicuous, exceeding apex of gnathosomal capsule, femurogenu with setae *dGe* 11 and *dFe* 10, tibiotarsus with 2 solenidia, one longer than the other, and 1 small seta; minute palpcoxal setae *pp* inserted near to articulation of each palp with gnathosomal capsule.

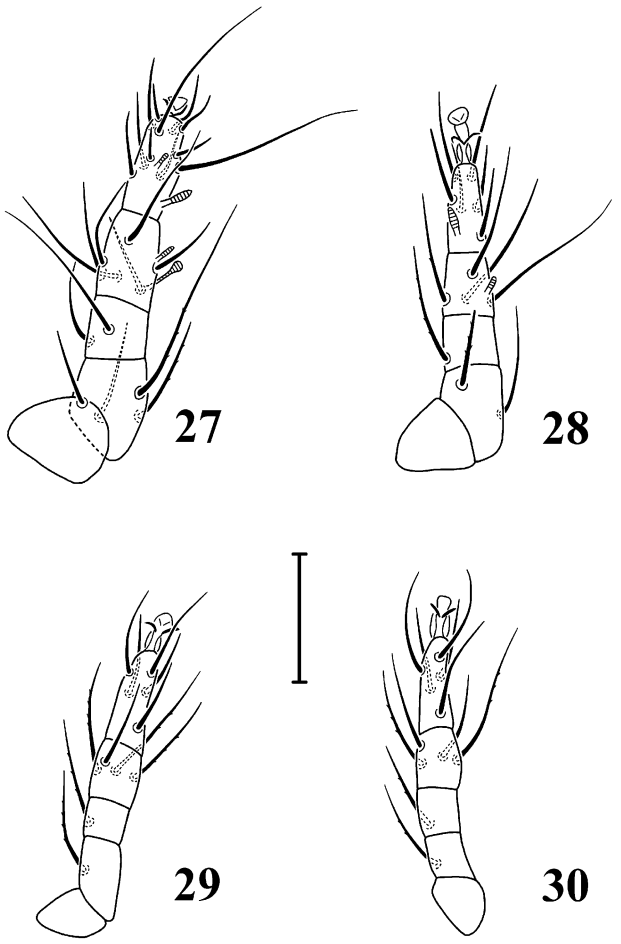


Figs 21–24. *Pavania kamalii* sp. n., female: legs I–IV in dorsal view, respectively. Scale bar 20 μm.

Idiosomal dorsum (Fig. 25). Cylindrical in shape. All dorsal shields smooth and their posterior margins without small projections. Dorsal idiosomal setae weakly barbed, attenuated and pointed except h_2 which is smooth. Prodorsal shield subquadrangular, its anterior margin slightly curved and posterior margin concave, with setae v_1 28, v_2 9, sc_2 59 and 1 pair of smooth capitate trichobothridia sc_1, setae v_1 longer than distance between their bases, v_2 short and located posterolaterally of v_1. Median shield of tergite C with setae c_1 26 and each lateral shield with seta c_2 36 [one of the lateral shields is drawn from below due to rotation of the specimen during slide preparation], c_2 almost 1.4 times longer than c_1. Tergite D with setae *d* 23 and cupuli *ia* situated posterolaterally to seta *d*, seta c_2 longer than *d*. Tergite EF with setae *e* 20 and *f* 23, and 1 pair of cupuli *im* placed close to setae *f* on its inner anterolateral side, seta *f* approximately 1.2 times as long as *e*.



Figs 25–26. *Pavania elongata* sp. n., female. 25 – body in dorsal view; 26 – body in ventral view. Scale bars 50 μm.



Figs 27–30. *Pavania elongata* sp. n., female: legs I–IV in dorsal view, respectively. Scale bar 20 μm.

Tergite H with setae h_1 9 and h_2 67 long, seta h_2 almost 7.4 times longer than h_1. Distances between dorsal idiosomal setae: v_1–v_1 14, v_2–v_2 21, v_1–v_2 4, sc_2–sc_2 28, c_1–c_1 40, *d*–*d* 55, *e*–*e* 52, *f*–*f* 38, *e*–*f* 23, h_1–h_1 11, h_2–h_2 27, h_1–h_2 7.

Idiosomal venter (Fig. 26). All ventral idiosomal setae smooth, tapered and pointed. Apodemes I joined to thin presternal apodeme; apodemes II reaching presternal apodeme; both apodemes III and IV not joined to poststernal apodeme. Coxal field I: 1*a* 14, 1*b* 16, 1*c* 12, 1*b* longer than1*c* and 1*a*. Coxal field II: 2*a* 28, 2*b* 13, 2*c* 28, setae 2*a* and 2*c* equal in length and the longest on ventral side. Coxal field III: 3*a* 13, 3*b* 17, 3*c* 17, setae 3*b* and 3*c* equal in length and longer than 3*a*. Coxal field IV: setae 4*a* 18, 4*b* 18, 4*c* 16, setae 4*a* and 4*b* subequal in length and longer than 4*c*. Genital plate with subequal short setae g_1 5, g_2 5. Aggenital plates including 1 seta *ag* 19 and 1 small porous area each. Pseudanal plate with setae *ps* 9.

Legs (Figs 27–30). Leg I thicker and longer than other legs (Fig. 27): setal formula: 4-2-6(2)-11(2). Tarsus with 4 slightly blunt-ended eupathidial setae *p'*, *p"*, *ft'* and *ft"*, rest of setae on leg I slender and pointed; seta *pl"* longest on tarsus and longer than *tc"*; solenidion ω_1 5 prominent, slightly stalked and finger shaped; solenidion ω_2 4, finger shaped. Tibia with eupathidium *k*; solenidion φ_1 6 stalked and distinctly clubbed, longer than φ_2 4 finger shaped. Seta *d* 2 times as long as *l"* on femur; both *d* and *l"* weakly barbed.

Leg II (Fig. 28). Setal formula: 2-1-4(1)-6(1). Setae of leg attenuated and pointed except *d* on femur which is blunt-ended; setae *l'* on tibia and genu and seta *d* on femur weakly barbed; setae *pv"* and *pl"* subequal in length and both the shortest setae on tarsus, solenidion ω 4 finger shaped and fairly stalked; solenidion φ 3 finger shaped; on femur seta *v"* longer than *d*.

Leg III (Fig. 29). Setal formula: 1-1-4-5. Setae of leg attenuated and pointed; setae *l'*, *v'* and *v"* on tibia, *v'* on genu and *d* on femur weakly barbed; seta *tc'* on tarsus shorter than its segment length; seta *d* of femur almost as long as seta *v'* of genu.

Leg IV (Fig. 30). Setal formula: 1-1-4-5. Setae on leg attenuated and pointed; setae *l'* and *v"* on tibia, *v'* on the genu and *d* on femur weakly barbed; seta *pl"* on tarsus longer than its segment length; seta *l'* on tibia approximately as long as *d*; seta *v'* of genu and seta *d* of femur subequal in length.

Male unknown.

Type material. Holotype ♀ (Ms-6) phoretic on an unidentified carabid beetle (Coleoptera: Carabidae) collected on surface of the ground: Northeastern Iran, North Khorasan province, Haver village, elevations of Maneh and Samalghan town,

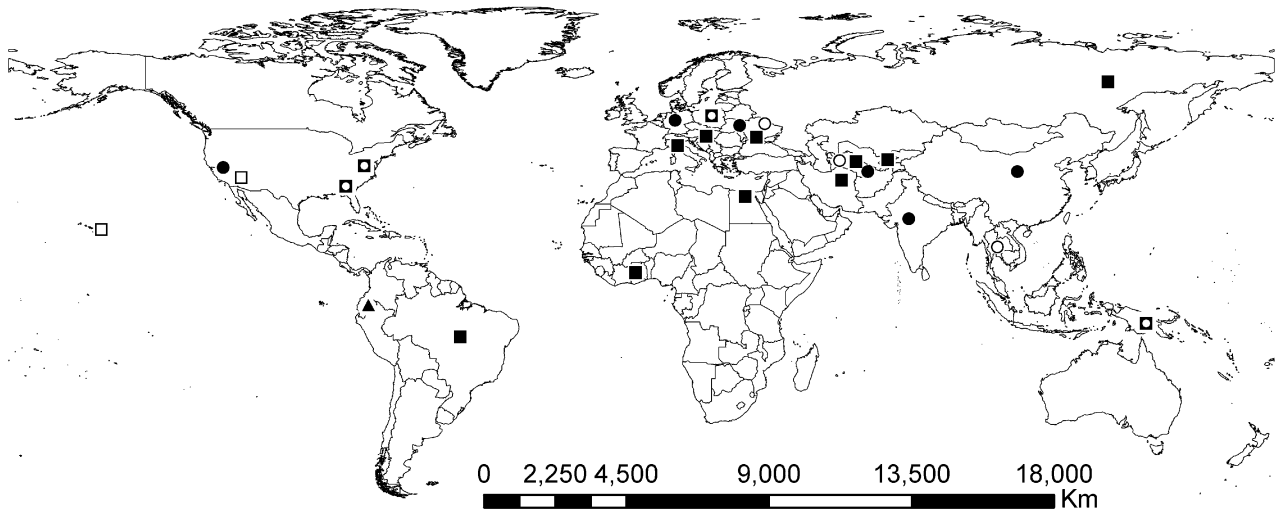


Fig. 31. Distribution of the dolichocybid genera in the world. ■ – *Pavania*; ● – *Dolichocybe*; ▲ – *Rafamastix*; ◘ – *Acanthomastix*; □ – *Dolichomotes*; ○ – *Formicomotes*.

37.7°N, 56.4°E, altitude 2,365 m, 30.vi.2006, coll. H. Hajiqanbar.

Etymology. The specific epithet is derived from the Latin root of "elongatus" meaning prolonged, which refers to the elongate idiosoma of this species.

DISCUSSION

Sevastianov (1980) classified five genera of the family Dolichocybidae in the two subfamilies Formicomotinae and Dolichocybinae, based on the presence or absence of trichobothridia and numbers of setae on the coxal fields. He considered absence of trichobothridia and presence of one pair of setae on each coxal field as features defining the subfamily Formicomotinae, which included the genera *Dolichomotes* Smiley, 1967, *Acanthomastix* Mahunka, 1970 and *Formicomotes* Sevastianov, 1980. He placed the genera *Pavania* Lombardini, 1947 and *Dolichocybe* Krantz, 1957 in the subfamily Dolichocybinae, characterized by the presence of the trichobothridia and more than one and up to four pairs of setae on the coxal fields.

Later on, Magowski (1997) described the genus *Rafamastix* and placed it in the subfamily Formicomotinae. In mites of this genus, however, coxal fields III and IV each bear two pairs of setae.

The *gymnopleuri* species group of genus *Pavania* described above is morphologically and ecologically very similar to the *fusiformis* group. Even the leg setation in these two groups is identical (Figs 3–6 and 21–24). Likewise, we recorded species of the *gymnopleuri* group phoretic on scarab beetles, which are also recorded as hosts of the *fusiformis* species group. The new species group differs from the *fusiformis* group by a single probably apomorphic feature – loss of trichobothridia. The *fusiformis* group is not defined by a distinct apomorphy and may be a paraphyletic stem group. Thus, the genus *Pavania* belongs obviously to the subfamily Dolichocybinae regardless of the lack of trichobothridia (being one of Sevastianov's criteria for diagnosis of the subfamily Formicomotinae) in the newly defined *gymnopleuri* group.

Features of the recently discovered taxa (after 1980) suggest that the previously defined characters of these subfamilies are not convenient and constant. On the one hand, *Rafamastix* contravenes the number of setae on coxal fields III and IV in the subfamily Formicomotinae, and on the other, the new *Pavania gymnopleuri* species group invalidates the presence of trichobothridia as a constant character of the subfamily Dolichocybinae. Therefore, additional characters are needed to define the subfamilies. Leg setation of all genera of the family Dolichocybidae were studied (see Table 1). This revealed some useful characters that were ignored in the past owing to the often imperfect description of leg setation at the generic level.

It should be noted that the solenidia in genera *Dolichomotes* and *Formicomotes* are attached in a somewhat unusual way. All solenidia in these genera are inserted into the surface of the leg segments, except φ_1 on first tibia, which has a normal structure, emergent and stalked. In this regard, *Dolichomotes crossi* is an exception in that solenidion ω_2 is not pustulate but rather emergent and stick-like.

According to the summarized data in Table 1, some additional features (putative apomorphies), originating from leg setation, can be proposed for improving the diagnoses of the two subfamilies.

Dolichocybinae: solenidion φ on tibia III absent (i), solenidion φ on tibia IV absent (ii).

Formicomotinae: setae *v"* and *l'* on femur I absent (i), seta *v'* on genu I absent (ii), setae *u'* and *u"* on tarsus I absent (iii), seta *u'* on tarsus II absent (iv), seta *tc'* on tarsus IV absent (v).

The family now includes six genera and 35 species. The genus *Pavania*, including the five new species described, includes 18 species and constitutes the largest genus of the family. The remaining 17 species are distributed as follows: *Dolichocybe* (8 species), *Acanthomastix* (4), *Dolichomotes* (2), *Formicomotes* (2) and *Rafamastix* (1).

TABLE 1. Leg setation of the family Dolichocybidae (females).

	Pavania	*Dolichocybe*	*Rafamastix*	*Acanthomastix*	*Dolichomotes**	*Formicomotes*
Leg I						
Femur	*d*	*d*	*d*	–	–	–
	l"	*l"*	*l"*	*l"*	*l"*	*l"*
	v"	*v"*	–	–	–	–
	l'	*l'*	–	–	–	–
Genu	*v'*	*v'*	–	–	–	–
	*l'***	*l'*	*l'*	*l'*	*l'*	*l'*
Tibia	φ_1	φ_1	φ_1	φ_1	φ_1	φ_1
	φ_2	φ_2	φ_2	φ_2	φ_2	φ_2
	k	*k*	*k*	*k*	*k*	*k*
	d	*d*	*d*	*d*	*d*	*d*
	l"	*l"*	*l"*	*l"*	*l"*	*l"*
	v"	*v"*	*v"*	*v"*	*v"*	*v"*
	v'	*v'*	*v'*	–	–	–
	l'	*l'*	*l'*	*l'*	*l'*	*l'*
Tarsus	ω_1	ω_1	ω_1	ω_1	ω_1	ω_1
	ω_2	ω_2	ω_2	ω_2	ω_2	ω_2
	p'	*p'*	–	*p'*	*p'*	*p'*
	p"	*p"*	–	–	–	*p"*
	tc'	*tc'*	*tc'*	*tc'*	*tc'*	*tc'*
	tc"	*tc"*	*tc"*	*tc"*	*tc"*	*tc"*
	ft'	*ft'*	*ft'*	*ft'*	–	–
	ft"	*ft"*	*ft"*	*ft"*	–	–
	pv'	*pv'*	*pv'*	*pv'*	*pv'*	*pv'*
	pv"	*pv"*	*pv"*	*pv"*	*pv"*	*pv"*
	pl"	–	–	*pl"*	*pl"*	*pl"*
	u'	*u'*	–	–	–	–
	u"	*u"*	–	–	–	–
Leg II						
Femur	*d*	*d*	*d*	–	–	–
	v"	*v"*	*l"*	*l"*	*l"*	*l"*
Genu	*l'*	*l'*	*l'*	*l'*	*l'*	*l'*
Tibia	φ	φ	φ	φ	φ	φ
	d	*d*	*d*	*d*	*d*	*d*
	v"	*v"*	*v"*	*v"*	*v"*	*v"*
	v'	*v'*	*v'*	–	–	–
	l'	*l'*	*l'*	*l'*	*l'*	*l'*
Tarsus	ω	ω	ω	ω	ω	ω
	tc'	*tc'*	*tc'*	*tc'*	*tc'*	*tc'*
	tc"	*tc"*	*tc"*	*tc"*	*tc"*	*tc"*
	pv'	*pv'*	*pv'*	*pv'*	*pv'*	*pv'*
	pv"	*pv"*	*pv"*	*pv"*	*pv"*	*pv"*
	pl"	*pl"*	*pl"*	*pl"*	*pl"*	*pl"*
	u'	*u'*	–	–	–	–
Leg III						
Femur	*d*	*d*	*l'* (?)	*l"*	–	–
Genu	*v'*	*v'*	*l'*	*l'*	*l'*	*l'*
Tibia	–	–	φ	φ	φ	φ
	d	*d*	*d*	*d*	*d*	*d*
	v"	*v"*	*v"*	*v"*	*v"*	*v"*
	v'	*v'*	*v'*	–	–	–
	l'	*l'*	*l'*	*l'*	*l'*	*l'*
Tarsus	*tc'*	*tc'*	*tc'*	*tc'*	–	*tc'*
	tc"	*tc"*	*tc"*	*tc"*	*tc"*	*tc"*
	pv'	*pv'*	*pv'*	*pv'*	*pv'*	*pv'*
	pv"	*pv"*	*pv"*	*pv"*	*pv"*	*pv"*
	pl"	*pl"*	*pl"*	*pl"*	*pl"*	*pl"*
Leg IV						
Femur	*d*	*d*	*l'* (?)	*l"*	–	–
Genu	*v'*	*v'*	*l'*	*l'*	*l'*	*l'*
Tibia	–	–	φ	φ	φ	φ
	d	*d*	*d*	*d*	*d*	*d*
	v"	*v"*	*v"*	*v"*	*v"*	*v"*
	v'	*v'*	*v'*	–	–	–
	l'	*l'*	*l'*	*l'*	*l'*	*l'*
Tarsus	*tc'*	*tc'*	–	–	–	–
	tc"	*tc"*	*tc"*	*tc"*	*tc"*	*tc"*
	pv'	*pv'*	*pv'*	*pv'*	*pv'*	*pv'*
	pv"	*pv"*	*pv"*	*pv"*	*pv"*	*pv"*
	pl"	*pl"*	*pl"*	*pl"*	*pl"*	*pl"*

* based on *D. crossi*; ** lacking in *P. sabzevarensis* sp. n.

The newly described taxa expanded the geographical distribution of the dolichocybid mites in the Palaearctic Region. Fig. 31 shows map of the distribution of the genera of the family. All six zoogeographic realms harbour at least one dolichocybid genus. There is only one genus in each of the Afrotropical and Australasian realms, *Pavania* and *Acanthomastix*, respectively. There are two genera in the Neotropical realm, *Pavania* and *Rafamastix*, the latter being restricted to that realm. There are three genera in both the Oriental and Nearctic realms; *Dolichocybe*, *Dolichomotes* and *Formicomotes* in the Oriental, *Formicomotes* is replaced by *Acanthomastix* in the Nearctic. Finally, four genera and most of the dolichocybid mites occur in the Palaearctic realm.

Key to world genera of the family Dolichocybidae (females)

1 Each coxal field with 3 pairs of setae; solenidion on tibiae III–IV absent (subfamily Dolichocybinae). 2
– Each coxal field with less than 3 pairs of setae; solenidion on tibiae III–IV present (subfamily Formicomotinae). 3
2 Gnathosoma longer than wide; chelicerae small and indistinct; tarsus I with 10 setae (*pl"* absent); with deep constriction between propodosoma and hysterosoma which are separated by soft and transversely striated cuticle. . . . . *Dolichocybe*
– Gnathosoma hardly as long as wide; chelicerae large and distinct; tarsus I with 11 setae (*pl"* present); without deep constriction between propodosoma and hysterosoma. . . . . *Pavania*
3 Coxal fields III–IV with 2 pairs of setae each. . . *Rafamastix*
– Coxal fields III–IV with 1 pair of setae each. 4
4 All solenidia emergent; femora III–IV each with one seta (*l"*); tarsus I with both fastigial setae (*ft'*, *ft"*). . . . . *Acanthomastix*
– Most solenidia joined to surface of leg and pustulate; femora III–IV without seta; tarsus I without fastigial setae. 5
5 Tarsus III with 4 setae (*tc'* absent); tarsus I with 6 setae (*p"* absent). . . . . *Dolichomotes*
– Tarsus III with 5 setae (*tc'* present); tarsus I with 7 setae (*p"* present). . . . . *Formicomotes*

Key to world species of the genus *Pavania* (females)

1 Trichobothridia absent (*gymnopleuri* species group). 2
– Trichobothridia present (*fusiformis* species group). 4
2 Setae v_1 longer than distance between their bases; setae ch_1 3 times longer than ch_2; setae *e* longer than *f*; setae h_2 15 times longer than h_1 (Iran). . . . . *P. gymnopleuri* Hajiqanbar & Khaustov sp. n.
– Setae v_1 shorter than distance between their bases; setae ch_1 less than 3 times longer than ch_2; setae *e* never longer than *f*; setae h_2 at most 7 times longer than h_1. 3
3 Genu I with one seta (*v'*); dorsal idiosomal setae smooth; setae c_1 longer than c_2; setae c_1 and *d* pointed (Iran). . . . . *P. sabzevarensis* Hajiqanbar & Khaustov sp. n.
– Genu I with two setae (*v'*, *l'*); dorsal idiosomal setae weakly barbed; setae c_2 longer than c_1; setae c_1 and *d* distinctly blunt-ended (Iran). . . . . *P. onthophagi* Hajiqanbar & Khaustov sp. n.
4 Setae h_2 less than 3.5 times longer than h_1. 5
– Setae h_2 more than 3.5 times longer than h_1. 12
5 Setae c_1 reaching beyond bases of setae *f*; setae c_1 longer than h_2; setae *d* and h_2 subequal (Ghana). . . . . *P. perhirsuta* Mahunka, 1973

– Setae c_1 never reaching beyond bases of setae *f*; setae c_1 shorter than h_2; setae *d* shorter than h_2. 6
6 Setae h_1 longer than or subequal to *d*, *e* and *f* 7
– Setae h_1 shorter than *d*, *e* and *f* 11
7 Setae h_1 longer than sc_2; setae sc_2 distinctly shorter than distance between their bases; seta *e* inserted at the same level as seta *f* (Ghana). . . . . *P. equisetosa* Mahunka, 1975
– Setae h_1 shorter than sc_2; setae sc_2 longer than or subequal to distance between their bases; seta *f* inserted posteriorly to seta *e*. 8
8 Setae sc_2 distinctly longer than distance between their bases; setae sc_2 reaching beyond bases of setae c_1. 9
– Setae sc_2 subequal to distance between their bases; setae sc_2 never reaching beyond bases of setae c_1. 10
9 Setae c_1 longer than c_2; setae h_1 longer than *e*; setae h_1 and v_1 subequal (Ukraine, Slovakia). . *P. riparia* Sevastianov, 1980
– Setae c_2 longer than c_1; setae h_1 and *e* subequal; setae h_1 longer than v_1 (Ghana). . . . . *P. luisiae* Mahunka, 1974
10 Setae c_1, *d*, *e* and *f* blunt-ended; setae v_1 reaching beyond bases of setae ch_1 (Russia). . . . . *P. carabidophila* Khaustov, 2005
– Setae c_1, *d*, *e* and *f* pointed; setae v_1 never reaching beyond bases of setae ch_1 (Ukraine). . . . *P. bembidii* Khaustov, 2005
11 Setae h_2 more than twice as long as h_1; setae *e* and *f* subequal and both longer than *d*; setae *f* distinctly longer than c_1 (Egypt). . . . . *P. tahanae* Sevastianov and Abo-Korah, 1985
– Setae h_2 less than twice as long as h_1; setae *e* and *d* subequal and both longer than *f*; setae c_1 and *f* subequal (Russia, Turkmenistan, Iran). . . . . *P. protracta* Sevastianov, 1980
12 Setae h_2 more than 6 times longer than h_1. 13
– Setae h_2 less than 6 times longer than h_1. 16
13 Setae sc_2 at least 3.5 times longer than v_1; setae *f* more than twice as long as *e*; setae *e* longer than v_1 (Ghana). . . . . *P. endroedyi* Mahunka, 1975
– Setae sc_2 less than 2.5 times longer than v_1; setae *f* less than twice as long as *e*; setae *e* shorter than v_1. 14
14 Setae sc_2 less than twice as long as v_1; setae *f* longer than *d*; setae c_1 reaching beyond posterior border of tergite C (Brazil). . . . . *P. brasiliensis* Mahunka, 1970
– Setae sc_2 more than twice as long as v_1; setae *f* and *d* subequal; setae c_1 never reaching beyond posterior border of tergite C. 15
15 Setae 2*a* as long as 2*c* and both longer than c_1, *d* and *f*; setae *su* protruding beyond anterior border of gnathosoma (Iran). . . . . *P. elongata* Hajiqanbar & Khaustov sp. n.
– Setae 2*a* longer than 2*c* and both shorter than c_1, *d* and *f*; setae *su* never protruding beyond anterior border of gnathosoma (Ghana). . . . . *P. simplex* Mahunka, 1973
16 Setae *e* and *f* subequal; setae *e* longer than h_1; setae on epimeres II subequal (Tajikistan). . . . . *P. tadjikistanica* Sevastianov, 1980
– Setae *f* more than twice as long as *e*; setae *e* and h_1 subequal; setae on epimeres II not subequal. 17
17 Most dorsal idiosomal setae weakly barbed and blunt-ended; setae c_1 longer than c_2; setae sc_2 less than twice as long as c_1 (Iran). . . . . *P. kamalii* Hajiqanbar & Khaustov sp. n.
– Dorsal idiosomal setae smooth and pointed; setae c_2 longer than c_1; setae sc_2 more than twice as long as c_1 (Italy). . . . . *P. fusiformis* Lombardini, 1949

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