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Revision of the family Dolichocybidae (Acari: Heterostigmata) from the collection of V.D. Sevastianov

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**ABSTRACT**

The dolichocybid mites in the collection of V.D. Sevastianov, namely *Pavania riparia* Sevastianov, 1980, *P. tadjikistanica* Sevastianov, 1980, *P. protracta* Sevastianov, 1980, *P. tahanae* Sevastianov and Abo-Korah, 1985 and *Dolichocybe firjusae* Sevastianov and Chydyrov, 1994, are revised and redescribed based on both the type and additional materials. An updated key to species of the genus *Pavania* is provided. The taxonomic position of *Pavania protracta* and *P. tahanae* is discussed.

**Keywords** systematics; redescriptions; *Pavania*; *Dolichocybe*; dung beetles; soil

**Zoobank** http://zoobank.org/3C207D47-8CE2-41A8-89E4-AFEAF392C621

**Introduction**

The family Dolichocybidae is a small group of early-derivative heterostigmatic mites that currently includes 2 subfamilies, 6 genera and 45 species (Hajiqanbar and Khaustov 2010; Rahiminejad et al. 2011; Zhang et al. 2011; Loghmani et al. 2013; Katlav et al. 2014; Brahmanian et al. 2015; Mortazavi et al. 2015; Sobhi et al. 2017; Khaustov and Frolov 2017, 2018a, b; Khaustov and Trach 2017; Khaustov 2017). Little is known about the way of life of dolichocybid mites, but all of them are probably fungivorous (Rack 1967; Magowski 1988; Kaliszewski et al. 1995). Some species are important pests of edible mushrooms (Lan et al. 2017).

The identification of many dolichocybid mites is difficult or even impossible due to their incomplete and inadequate descriptions. All species described by V.D. Sevastianov and his co-authors belong to this “problematic” group. The list of dolichocybids described by V.D. Sevastianov and his co-authors includes 6 species, namely *Formicomotes octipes* Sevastianov, 1980, *Pavania riparia* Sevastianov, 1980, *P. tadjikistanica* Sevastianov, 1980, *P. protracta* Sevastianov, 1980, *P. tahanae* Sevastianov and Abo-Korah, 1985, and *Dolichocybe firjusae* Sevastianov and Chydyrov, 1994 (Sevastianov 1980; Sevastianov & Abo-Korah 1985; Sevastianov et al. 1994). Only *Formicomotes octipes* was recently redescribed (Khaustov and Frolov 2018a), while other species remain unstudied since the times of their original descriptions.

The main aim of this article is to provide redescriptions of dolichocybid mites described by V.D. Sevastianov and co-authors based on type and additional material.

**Materials and methods**

The type materials of dolichocybid mites were loaned from the collection of the Odessa I. I. Mechnikov National University Museum of Zoology, Odessa, Ukraine. Additional material of
Figure 1 *Pavania riparia* Sevastianov, 1980, female: A – dorsum of the body, B – venter of the body. Legs omitted.

*Pavania riparia* was collected by junior author on the dung beetle *Copris lunaris* and mounted in Hoyer’s medium. One non type material slide of *P. riparia* from the collection of the junior author was remounted and several specimens were removed, dusted with gold and scanned with aid of a JEOL–JSM-6510LV SEM microscope.

Mite morphology was studied using a Carl Zeiss AxioImager A2 compound microscope.
with phase contrast and DIC objectives. Photomicrographs were taken with an AxioCam ICc5 digital camera.

The terminology of the idiosoma and legs follows Lindquist (1986); the nomenclature of subcapitular setae follows Grandjean (1944). All measurements are given in micrometers (μm). For leg chaetotaxy the number of solenidia is given in parentheses.

**Taxonomy**

**Family Dolichocybidae Mahunka, 1970a**

**Genus Pavania Lombardini, 1949**

Type species: *Pavania fusiformis* Lombardini, 1949, by original designation.

*Pavania riparia* Sevastianov, 1980

*Pavania riparia* Sevastianov, 1980, p.1457, Figs 1–3. (Figs 1–4)

**Redescription**

**Female (Figs 1–4)**

Body oval, weakly sclerotized. Length of idiosoma 125–130, width 74–86.

**Gnathosoma (Figs 4A–C)** — Gnathosomal capsule, excluding palps, almost round, its length 22, width 22–24. Dorsally with two pairs of weakly barbed and blunt-ended cheliceral setae (cha, chb). Setae cha 13–14 distinctly longer than chb 9–10. Dorsal median apodeme well developed. Postpalpal setae (pp) short, divided distally (Fig. 4C). Venter of gnathosoma with one pair of smooth, pointed subcapitular setae m 12. Palps with smooth setae dFe and dGe dorsolaterally, setae dGe 10–11 pointed, more than two times longer than blunt-ended

![Figure 2 Pavania riparia Sevastianov, 1980, female: A – right leg I in dorsal view, B – right leg II in dorsal view, C – right leg III in dorsal view, D – right leg IV in dorsal view.](image-url)

Palps ventrally with two solenidia (sol). Inner solenidion slightly shorter than outer one. Palp tibiotarsus with short, blunt-ended ventrolateral seta (probably tibial l”) and distal eupathidium-like tiny seta (eup) (Fig. 4B). Palps terminate with well-developed tibial claw (cl) (Fig. 4A, B). Cheliceral styles strong, curved. Pharynx thin-walled, elongate, with weak lateral projections.

**Idiosomal dorsum** (Figs 1A, 3A) — All dorsal shields with small sparsely distributed dimples (Fig. 3A). Prodorsal shield with three pairs of setae (v\(_1\), v\(_2\), sc\(_2\)) and a pair of clavate, barbed trichobothria sc\(_1\) with rounded apex. All dorsal setae blunt-ended. Most of dorsal setae smooth or with very small barbs and only setae h\(_1\) with distinct barbs. Tips of setae h\(_2\) thickened into tiny clubs. Cupules ia on tergite D and ip on tergite EF small, round; other cupules not evident. Posterior margins of tergites C, D, and EF with several weak projections. Lengths of dorsal setae: v\(_1\) 16, v\(_2\) 6, sc\(_2\) 30–32, c\(_1\) 23–27, c\(_2\) 18, d 17, e 10–12, f 17–18, h\(_1\) 13–14, h\(_2\) 54–63. Distances between setae: v\(_1\)–v\(_1\) 16–17, v\(_2\)–v\(_2\) 24–26, sc\(_2\)–sc\(_2\) 28, c\(_1\)–c\(_1\) 24–28, d–d 48–49, e–e 40–41, f–f 28–29, h\(_1\)–h\(_1\) 10, h\(_1\)–h\(_2\) 7–8.

**Idiosomal venter** (Figs 1B, 3B, 4D) — All ventral plates smooth. All ventral setae smooth; setae 2c pointed, other setae blunt-ended. Apodemes 1 (ap1) and apodemes 2 (ap2) well developed; prosternal apodeme not evident; apodemes 3 (ap3) and 4 (ap4) well developed. Coxal fields I-IV each with three pairs of setae. Lengths of ventral setae: 1a 6, 1b 7, 1c 6, 2a 10, 2b 6, 2c 19, 3a 9, 3b 8–9, 3c 10–11, 4a 8, 4b 8–9, 4c 9, ag 9–10, g\(_1\) 4–5, g\(_2\) 4, ps 9.

![DIC photomicrographs of *Pavania riparia* Sevastianov, 1980, female: A – dorsal view, B – ventral view.](image)
Legs (Fig. 2) — Leg I (Fig. 2A). Setal formula: 0–4–2–6(2)–11(2). Tarsus with two small claws and semioval empodium. All leg setae smooth. Setae $l'$ of femur, $l'$; $v'$ of genu, $k$ and $v'$ of tibia blunt-ended; other leg setae (except eupathidia) pointed. Trochanter dorsally with four spine-like projections. Tarsus I with ventrodistal membranous flange. Lengths of solenidia $\omega_1$, $\omega_2$, $\phi_1$, $\phi_2$; Solenidia $\phi_2$ and $\omega_2$ weakly clavate, solenidion $\phi_1$ distinctly clavate, solenidion $\omega_1$ finger-shaped. Leg II (Fig. 2B). Setal formula: 0–2–1–4(1)–6(1). Tarsal claws simple; empodium large. Solenidion $\omega_4$ finger-shaped, solenidion $\phi$ 2–3 clavate. Trochanter dorsally with two spine-like projections. Setae $tc''$ and $u'$ of tarsus with flattened and weakly sclerotized blunt-ended tips. Other leg setae pointed. Setae $v''$ of femur, $l'$, $v''$ of tibia and $tc'$; $pl''$ of tarsus weakly barbed, other setae smooth. Leg III (Fig. 2C). Setal formula: 0–1–1–4–5. Claws and empodium of same shape as on tarsus II. Setae ($tc$) of tarsus with flattened and weakly sclerotized blunt-ended tips, other leg setae pointed. Seta $pl''$ of tarsus weakly barbed; other leg setae smooth. Leg IV (Fig. 2D). Setal formula: 0–1–1–4–5. Claws and empodium of same shape as on tarsus III. Seta $d$ of femur blunt-ended, seta $tc'$ of tarsus weakly blunt-ended, other leg setae pointed. Seta $tc'$ of tarsus smooth; other leg setae weakly barbed.

Male unknown.

Figure 4  SEM images of *Pavania riparia* Sevastianov, 1980, female: A – gnathosoma in ventral view, B – left palp in ventral view, C – postpalpal seta, D – opisthosoma in ventral view.
Figure 5 *Pavania tadjikistanica* Sevastianov, 1980, female (holotype): A – dorsum of the body, B – venter of the body. Legs omitted.

**Material examined**

Female holotype, and 10 female paratypes, slide No. D-T-2, Ukraine, vicinity of Odessa, coast of Kuyalnik Liman, on *Copris lunaris* (Coleoptera, Scarabaeidae), 22 May 1960, Sevastianov V.D. leg.; 10 females, Ukraine, Odessa Prov., Razdelnaya District, vicinity of settlement Kolontaevka (46°43’ N, 30°18’ E), on *C. lunaris*, 20 Sept. 2009, Trach V.A. leg.; 8 females,

**Remarks**

The holotype and paratypes available for study are in poor condition and redescription is based on additional material collected by the junior author.

*Pavania tadjikistanica* Sevastianov, 1980


(Figs 5–7)

**Redescription**

**Female (Figs 5–7)**

The holotype and two paratypes available for this study are in rather bad condition (Fig. 7) and some tiny structures like cupules, dimples of dorsal plates and weak barbs on setae are not discernible. Length of idiosoma 120, width 80.


**Idiosomal dorsum** (Figs 5A, 7A) — Prodorsal shield with three pairs of setae (*v1, v2, sc2*) and a pair of broken trichobothria *sc1*. Setae *sc2* pointed, other dorsal setae blunt-ended. Tips of setae *h2* thickened into tiny clubs. Posterior margins of tergites without projections. Lengths of

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**Figure 6** *Pavania tadjikistanica* Sevastianov, 1980, female (holotype): A – right leg I in dorsal view, B – right leg II in dorsal view, C – left leg III in dorsal view, D – left leg IV in dorsal view.
dorsal setae: v₁ 14, v₂ 6, sc₂ 36, c₁ 20, c₂ 20, d 22, e 16, f 17, h₁ 13, h₂ 53. Distances between setae: v₁–v₁ 22, v₂–v₂ 29, sc₂–sc₂ 34, c₁–c₁ 24, d–d 34, e–e 43, f–f 29, h₁–h₁ 12, h₁–h₂ 6.

**Idiosomal venter (Figs 5B, 7B)** — All ventral setae blunt-ended. Ap1 and ap2 well developed; prosternal apodeme not evident; sejugal apodeme (apsej) weakly developed laterally; ap3 and ap4 well developed. Coxal fields I-IV each with three pairs of setae. Genital setae (g₁, g₂) very small, vestigial. Lengths of ventral setae: 1a 6, 1b 6, 1c 5, 2a 8, 2b 5, 2c 8, 3a 7, 3b 7, 3c 9, 4a 6, 4b 9, 4c 8, ag 7, g₁ 1, g₂ 1, ps 9.

**Legs (Fig. 6)** — Leg setation as in previous species. Leg I (Fig. 6A). Tarsus with two small claws and semioval empodium. Setae l' of femur, l' of genu, k, l' and v' of tibia blunt-ended; other leg setae (except eupathidia) pointed. Trochanter dorsally probably without spine-like projections. Lengths of solenidia ω₁ 6, ω₂ 3, φ₁ 6, φ₂ 5; solenidia ω₁, φ₂ and ω₂ weakly clavate, solenidion φ₁ distinctly clavate. Leg II (Fig. 6B). Tarsal claws simple, hooked; empodium large. Solenidia ω 5 and ϕ 3 weakly clavate. Trochanter probably without spine-like projections. All leg setae pointed. Leg III (Fig. 6C). Claws and empodium of same shape as on tarsus II. Seta d of femur blunt-ended, other leg setae pointed. Leg IV (Fig. 6D). Claws and empodium of same shape.

**Figure 7** DIC photomicrographs of *Pavania tadjikistanica* Sevastianov, 1980, female (holotype): A – dorsal view, B – ventral view.
shape as on tarsus III. Seta $d$ of femur blunt-ended, other leg setae pointed.

**Male unknown.**

**Material examined**

Female holotype, and 2 female paratypes, slide No. T-D-3, Tadjikistan, vicinity of Dushanbe, under elytra of *Onthophagus* sp. (Coleoptera, Scarabaeidae), 25 Aug. 1969, Ilyasov I.N. leg.
**Pavania protracta** Sevastianov, 1980

*Pavania protracta* Sevastianov, 1980, p.1459, Figs 8–10. (Figs 8–10)

**Redescription**

**Female (Figs 8–10)**

Length of idiosoma 150, width 75.


**Idiosomal venter (Figs 8B, 10B)** — All ventral plates smooth. Setae *1a, 1b, 1c, 2h, 2c,* and *g₁* blunt-ended; other ventral setae pointed. Setae *1a, 1b, 1c, 2h,* and *2c* weakly barbed; other ventral setae smooth. Only *ap2* and *ap3* present, weakly developed; other apodemes not evident. Coxal fields I-IV each with three pairs of setae. Lengths of ventral setae: *1a* 5, *1b* 3,
Legs (Fig. 9) — Leg setation as in previous species. Leg I (Fig. 9A). Tarsus with two small claws and very short empodium. Setae $v'$ of genu, $k$ and $v'$ of tibia blunt-ended; other leg setae (except eupathidia) pointed. Setae $v'$, ($l$) of femur, $k$ of tibia, $pl'$, ($u$) and all eupathidia of tarsus smooth; other leg setae weakly barbed. Trochanter dorsally with three spine-like projections; central projection distinctly smaller than lateral ones. Lengths of solenidia $\omega_1 \, 9$, $\omega_2 \, 4$, $\phi_1 \, 8$, $\phi_2 \, 5$; Solenidia $\omega_1$ and $\phi_2$ finger-shaped; solenidion $\omega_2$ weakly clavate, solenidion $\phi_1$ distinctly clavate. Leg II (Fig. 9B). Tarsal claws simple, hooked; empodium small, semi-oval. Solenidia $\omega_5$ finger-shaped and $\phi_3$ weakly clavate. Trochanter with one spine-like projection. All leg setae pointed and weakly barbed. Leg III (Fig. 9C). Claws and empodium of same shape as on tarsus II. Seta $pv'$ of tarsus thickened, spiniform, blunt-ended; other leg setae pointed. Setae ($pv$) and $tc''$ of tarsus smooth; other leg setae weakly barbed. Leg IV (Fig. 9D). Claws and empodium of same shape as on tarsus III. Seta $pv'$ of tarsus thickened, spiniform, blunt-ended; other leg setae pointed. Setae $pv'$ and $tc''$ of tarsus smooth; other leg setae weakly barbed.

Figure 10  DIC photomicrographs of Pavenia protracta Sevastianov, 1980, female (holotype): A – dorsal view, B – ventral view.
Male unknown.

Material examined
Female holotype, and 1 female paratype, slide No. T-D-4, Russia, Tatarstan, vicinity of Kazan, soil under maize, 27 Aug. 1968, Artemjeva T.I. leg.

Remarks
The holotype is in rather bad condition (Fig. 13). One female paratype was remounted and description is based on this paratype specimen.
**Pavania tahanae** Sevastianov and Abo-Korah, 1985
*Pavania tahanae* Sevastianov and Abo-Korah, 1985, p.35, Figs 1–4. (Figs 11–13)

**Redescription**

**Female (Figs 11–13)**

Length of idiosoma 135, width 80.


**Idiosomal dorsum (Figs 11A, 13A)** — All dorsal shields smooth. Prodorsal shield with three pairs of setae (v1, v2, sc2) and a pair of clavate and weakly barbed trichobothria sc1. Setae e weakly barbed, other dorsal setae apparently smooth. Setae v1 and v2 blunt-ended, other dorsal setae pointed. Posterior margins of tergites without projections. Cupules not evident. Lengths of dorsal setae: v1 18, v2 9, sc2 32, c1 22, c2 29, d 23, e 25, f 28, h1 18, h2 35. Distances between setae: v1–v1 11, v2–v2 20, sc2–sc2 28, c1–c1 37, d–d 53, e–e 46, f–f 42, h1–h1 11, h1–h2 9.

**Idiosomal venter (Figs 11B, 13B)** — All ventral plates smooth. All ventral setae smooth. Setae g1 and g2 blunt-ended, other ventral setae pointed. Only ap2 and ap3 clearly discernible; other apodemes not evident. Coxal fields I-V each with three pairs of setae. Lengths of ventral setae: 1a 7, 1b 8, 1c 6, 2a 13, 2b 6, 2c 15, 3a 9, 3b 7, 3c 13, 4a 7, 4b 8, 4c 8, ag 11, g1 4, g2 4, ps 10.

**Figure 12 Pavia tahanae** Sevastianov and Abo-Korah, 1985, female (holotype): A – right leg I in dorsal view, B – right leg II in dorsal view, C – right leg III in dorsal view, D – right leg IV in dorsal view.
Legs (Fig. 12) — Leg setation as in previous species. Leg I (Fig. 12A). Tarsus with two small claws, empodium not evident. All leg setae smooth. Seta $k$ of tibia and all eupathidia of tarsus blunt-ended; other leg setae pointed. Trochanter dorsally without spine-like projections. Lengths of solenidia $\omega_1$, $\omega_2$, $\phi_1$, $\phi_2$; solenidion $\omega_1$ finger-shaped; solenidion $\omega_2$ baculiform, solenidia $\phi_1$ and $\phi_2$ distinctly clavate. Leg II (Fig. 12B). Tarsal claws simple, hooked; empodium very small, semioval. Solenidia $\omega$ 8 finger-shaped and $\phi$ 2 weakly clavate. Trochanter without spine-like projections. All leg setae pointed and smooth. Leg III (Fig. 12C). Claws and empodium of same shape as on tarsus II. Solenidion $\phi$ 2 weakly clavate. All leg setae pointed and smooth. Leg IV (Fig. 12D). Claws and empodium of same shape as on tarsus II. Solenidion $\phi$ 2 weakly clavate. All leg setae pointed and smooth.

Male unknown.

Figure 13  DIC photomicrographs of Pavania tahanae Sevastianov and Abo-Korah, 1985, female (holotype): A – dorsal view, B – ventral view.
Material examined

Female holotype, slide No. 704, Egypt, vicinity of Shibin El Kom, soil under cotton, 1 Sept. 1980, Abo-Korah leg.

Key to world species of *Pavania* (based on Khaustov & Frolov 2018b)

1. Setae *sc*\(_1\) absent ................................................................. 2
   — Setae *sc*\(_1\) present .......................................................... 5

2. Setae 1c and 2c present ............................................................ 3
   — Setae 1c and 2c absent ......................................................... *P. neotropica* Khaustov and Frolov, 2017 (Brazil)

3. Setae *v*\(_1\) shorter than distance between their bases; setae *cha* less than three times longer than *chb*; setae *e* never longer than *f*; setae *h*\(_2\) at most seven times longer than *h*\(_1\) ................. 4
   — Setae *v*\(_1\) longer than distance between their bases; setae *cha* three times longer than *chb*; setae *e* longer than *f*; setae *h*\(_2\) 15 times longer than *h*\(_1\) ...........................................
   ..................................................... *P. gymnopleuri* Hajiqanbar and Khaustov, 2010 (Iran)

4. Genu I with one seta (*v*\(_2\)); dorsal idiosomal setae smooth; setae *c*\(_1\) longer than *c*\(_2\); setae *c*\(_1\) and *d* pointed ........................................ *P. sabzevarensis* Hajiqanbar and Khaustov, 2010 (Iran)
   — Genu I with two setae (*v*\(_2\), *l*\(_1\)*); dorsal idiosomal setae weakly barbed; setae *c*\(_2\) longer than *c*\(_1\); setae *c*\(_1\) and *d* distinctly blunt-ended .... *P. onthophagi* Hajiqanbar and Khaustov, 2010 (Iran)

5. Setae *sc*\(_1\) capitate .............................................................. 6
   — Setae *sc*\(_1\) seta-like .......................................................... *P. setiformis* Loghmani and Hajiqanbar, 2013 (Iran)

6. Setae (*u*) and (*pv*) of tarsus I not lanceolate .................................. 7
   — Setae (*u*) and (*pv*) of tarsus I lanceolate ........................................ *P. lanceolata* Bahramian and Hajiqanbar, 2015 (Iran)

7. Coxal fields II with 3 pairs of setae ........................................... 8
   — Coxal fields II with 2 pairs of setae ....................................... *P. equisetosa* Mahunka, 1975 (Ghana)

8. Empodium on tarsi II-IV small, not reaching beyond tips of claws; seta *pv*\(_2\) on tarsi III and IV simple .................................................. 9
   — Empodium on tarsi II-IV large, reaching beyond tips of claws .......... 10

9. Seta *pv*\(_2\) on tarsi III and IV thickened, spiniform and blunt-ended, solenidia on tibiae III and IV absent ..................................................... *P. rotracta* Sebastianov, 1980 (Russia)
   — Seta *pv*\(_2\) on tarsi III and IV simple, solenidia on tibiae III and IV present ........................................ *P. tahanae* Sebastianov and Abo-Korah, 1985 (Egypt)

10. Setae *h*\(_2\) less than 3.5 times longer than *h*\(_1\) ........................................ 11
    — Setae *h*\(_2\) more than 3.5 times longer than *h*\(_1\) ....................... 15

11. Setae *c*\(_1\) never reaching beyond bases of setae *f*; setae *c*\(_1\) shorter than *h*\(_2\); setae *d* shorter than *h*\(_2\) ........................................ 12
    — Setae *c*\(_1\) reaching beyond bases of setae *f*; setae *c*\(_1\) longer than *h*\(_2\); setae *d* and *h*\(_2\) subequal ........................................ *P. perhirata* Mahunka, 1973 (Ghana)

12. Setae *sc*\(_2\) subequal to distance between their bases .................. 13
    — Setae *sc*\(_2\) distinctly longer than distance between their bases .......
13. Setae $c_1, d, e$ and $f$ blunt-ended ................................................................. 14
   — Setae $c_1, d, e$ and $f$ pointed .................................................... $P. bembidii$ Khaustov, 2005 (Crimea)

14. Setae $h_1$ almost three times longer than $ps$, solenidion $\varphi_2$ with rounded tip .............. $P. carabidophila$ Khaustov, 2005 (Russia: Krasnodarskiy Kray, Primorskiy Kray)
   — Setae $h_1$ almost subequal with $ps$, solenidion $\varphi_2$ with attenuated tip .......................... $P. africana$ Khaustov and Frolov, 2018b (South Africa)

15. Setae $h_2$ more than six times longer than $h_1$ .................................................. 16
   — Setae $h_2$ less than six times longer than $h_1$ ................................................. 19

16. Setae $sc_2$ less than 2.5 times longer than $\nu_1$; setae $f$ less than twice as long as $e$; setae $e$
   shorter than $\nu_1$ ................................................................................................... 17
   — Setae $sc_2$ at least 3.5 times longer than $\nu_1$; setae $f$ more than twice as long as $e$; setae $e$
   longer than $\nu_1$ ................................................................................................... $P. endroedyi$ Mahunka, 1975 (Ghana)

17. Setae $sc_2$ more than twice as long as $\nu_1$; setae $f$ and $d$ subequal; setae $c_1$ never reaching
   beyond posterior border of tergite $C$ ........................................................................... 18
   — Setae $sc_2$ less than twice as long as $\nu_1$; setae $f$ longer than $d$; setae $c_1$ reaching beyond
   posterior border of tergite $C$ ........................................................................... $P. brasiliensis$ Mahunka, 1970b (Brazil)

18. Setae $2a$ as long as $2c$ and both longer than $c_1, d$ and $f$; setae $m$ protruding beyond anterior
   border of gnathosoma ............................................................. $P. elongata$ Hajiqanbar and Khaustov, 2010 (Iran)
   — Setae $2a$ longer than $2c$ and both shorter than $c_1, d$ and $f$; setae $m$ never protruding beyond
   anterior border of gnathosoma ............................................................. $P. simplex$ Mahunka, 1973 (Ghana)

19. Setae $f$ distinctly longer than $e$; setae $e$ and $h_1$ subequal ........................................... 20
   — Setae $e$ and $f$ subequal; setae $e$ longer than $h_1$ ......................................................... $P. tadjikistanica$ Sevastianov, 1980 (Tadjikistan, Iran)

20. Setae $2c$ subequal with $2a$ ................................................................. 21
   — Setae $2c$ about two times longer than $2a$ .... $P. riparia$ Sevastianov, 1980 (Ukraine, Slovakia)

21. Setae $f$ more than two times longer than $e$ ................................................................. 22
   — Setae $f$ less than 1.5 times longer than $e$ ................................................................. $P. khaivensis$ Sobhi and Hajiqanbar, 2017 (in Sobhi et al. 2017) (Iran)

22. 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 $c_1$ ........................................................................ $P. kamalii$ Hajiqanbar and Khaustov, 2010 (Iran)
   — Dorsal idiosomal setae smooth and pointed; setae $c_2$ longer than $c_1$; setae $sc_2$ more than
   twice as long as $c_1$ ........................................................................ $P. justiformis$ Lombardini, 1949 (Italy, Iran)

Genus Dolichocybe Krantz, 1957
Type species: Dolichocybe keiferi Krantz, 1957, by original designation.

Dolichocybe firjusae Sevastianov and Chydyrov, 1994
(Figs 14–16)

Redescription

Female (Figs 14–16)
Figure 14 *Dolichocybe firjusae* Sevastianov and Chydyrov, 1994, female (holotype): A – dorsum of the body, B – venter of the body. Legs omitted.
Figure 15 *Dolichocybe firjusae* Sevastianov and Chydyrov, 1994, female (holotype): A – left leg I in dorsal view, B – left leg II in dorsal view, C – right leg III in dorsal view, D – right leg IV in dorsal view.

Body elongate, weakly sclerotized. Length of idiosoma 180, width 77.

**Gnathosoma** — Gnathosomal capsule, excluding palps, almost oval, its length 20, width 15. Dorsally with two pairs of smooth and pointed cheliceral setae (*cha, chb*). Setae *cha* 12 distinctly longer than *chb* 6. Dorsal median apodeme indistinct. Postpalpal setae (*pp*) rod-like. Venter of gnathosoma with one pair of smooth, pointed subcapitular setae *m* 17. Palps freely articulated to gnathosomal capsule, with smooth and pointed setae *dFe* and *dGe* dorsolaterally, setae *dGe* 12 pointed, more than two times longer than blunt-ended *dFe* 5. Palps ventrally with two subequal solenidia. Palp tibiotarsus with short ventrolateral seta (probably tibial ‘t’). Pharynx thin-walled, elongate, with weak lateral projections.


**Legs (Fig. 15)** — Leg setation as in previous species. Leg I (Fig. 15A). Tarsus with two small claws; empodium indistinct. Setae of femur, `l` of genu, `d` of tibia, `tc` and `pl` of tarsus weakly barbed; over leg setae smooth. Seta `k` and eupathidia blunt-ended, other leg setae pointed. Trochanter dorsally with one large spine-like projection. Lengths of solenidia `ω1`, `ω2`, `φ1`, `φ2`; solenidion `φ2` and `ω2` peg-like, solenidion `φ1` distinctly clavate, solenidion `ω1` finger-shaped. Leg II (Fig. 15B). Tarsal claws simple, hooked; empodium large, flipper-like. Solenidion `ω` finger-shaped, solenidion `φ` 1 very small, peg-like, difficult to discern. Trochanter dorsally without spine-like projections. All leg setae pointed. Setae `tc`, `u` and (pv) of tarsus smooth, other setae weakly barbed. Leg III (Fig. 15C). Claws and empodium of same shape as on tarsus II. All leg setae pointed. Seta `d` of tibia and all tarsal setae smooth, other leg setae weakly barbed. Leg IV (Fig. 15D). Claws and empodium of same shape as on tarsus III.
All leg setae pointed. Seta d of tibia and all tarsal setae smooth, other leg setae weakly barbed. 

**Male unknown.**

**Material examined**

Female holotype, slide No. 908, Turkmenistan, Chardzhou Prov., vicinity of settlement Karabekaul, soil on cotton field, 24 Sept. 1982, Chydyrov P.R. leg.

**Discussion**

The main differences between the genera *Dolichocybe* and *Pavania* according to Cross (1965) are the shape of cheliceral stylets (falcate and well developed in *Pavania* and small, indistinct in *Dolichocybe*) and position of palps (palps arising ventrolaterally in *Pavania* and laterally in *Dolichocybe*). In fact, the position of palps is rather uniform in all dolichocybid mites and can not be used as a generic-level character. The shape and size of stylets are also highly variable. In typical *Pavania* (like most species associated with dung beetles), stylets are really large and falcate. In typical *Dolichocybe* (*D. keiferi*, *D. subcorticalis* Khaustov, 2006, *D. sibiriensis* Khaustov, 2017, *D. firjusae*) styles are small and indistinct. However, at least in *Pavania protracta* and *P. tahanae*, size of the cheliceral stylets is intermediate between typical for *Pavania* and for *Dolichocybe*. Therefore, the shape of cheliceral stylets is a vague character, difficult to use in separation of the genera *Dolichocybe* and *Pavania*. Rahiminejad et al. (2011) redefined the genus *Dolichocybe* and used the following characters to separate *Dolichocybe* from *Pavania*: “gnathosoma apparently longer than wide; chelicerae small and indistinct; tarsus I with 10 or 11 setae; tibiae III and IV with one minute solenidion each; with deep constriction between propodosoma and hysterosoma separated by soft and transversely striated cuticle” (in *Dolichocybe*); “gnathosoma almost as long as wide; chelicerae large and distinct; tarsus I with 11 setae; tibiae III and IV with no solenidia; without deep constrictions between propodosoma and hysterosoma” (in *Pavania*). Based on our study, the number of setae on tarsus I is the same in *Pavania* and *Dolichocybe* and can not be used in separation of these genera. The presence of solenidia on tibiae III and IV in *Dolichocybe* is also problematic character. In fact, solenidia on tibiae III and IV are apparently absent in *D. keiferi* (type species) (Cross 1965), *D. hippocastani* Rack, 1967, *D. picea* Rack, 1967 (Rack 1967), and absent in *D. subcorticalis*, *D. sibiriensis* (Khaustov 2006, 2017) and *D. firjusae* (present study). Potentially solenidia on tibiae III and IV are present in *Pavania brasiliensis* Mahunka, 1970, at least Mahunka (1970) depicted a tiny solenidion on the tibia III. Therefore, the presence of solenidia on tibiae III and IV also can not be used for separation of these genera. It is also difficult to understand the extent of constriction between propodosomal and hysterosomal.

Two redescribed herein species, *Pavania protracta* and *P. tahanae*, have intermediate characters between *Dolichocybe* and *Pavania*: body shape is similar to that in *Pavania* (not strongly elongate), gnathosoma is rather small (as in *Dolichocybe*), cheliceral stylets are of medium size (intermediate), constriction between propodosomal and hysterosoma is not deep (as in *Pavania*). In addition, both of these species have unusually short — considerably shorter than tarsal claws — empodia on tarsi II-IV. *Pavania tahanae* also has solenidia on tibiae III and IV (like some “*Dolichocybe*”). Both species were collected in soil (not phoretic on insects) and potentially could represent a non-phoretic form of *Pavania/Dolichocybe* complex. At present female dimorphism has been evident only in the genus *Formicomotes* Sevastianov, 1980. Non-phoretic form of *F. heteromorphus* Magowski, 1988 has much shorter empodia than phoretic form (Magowski 1988). In this paper, we retain all species in the genera in which they were originally described. The redefinitions of the genera *Dolichocybe* and *Pavania* are necessary based on redescription of their type species and more discoveries of new species in these two close genera (particularly *Dolichocybe*) are required (phoretic or in soil) to see what characters are more variable.
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References


