

FIRST RECORD OF THE FAMILY TARSOCHYLIDAE FROM IRAN WITH THE DESCRIPTION OF A NEW SPECIES (ACARI: TROMBIDIFORMES)

M. R. Amin¹, M. Khanjani^{*1} and E. A. Ueckermann^{2,3}

¹ Department of Plant Protection, College of Agriculture, Bu-Ali Sina University, Hamedan, Iran; e-mails: mkhanjani@gmail.com; amin13681@yahoo.com

² ARC-Plant Protection Research Institute, Private Bag X134, Queenswood, Pretoria, 0121 South Africa

³ School of Environmental Sciences and Development, North-West University, Potchefstroom Campus 2520, South Africa; e-mail: UeckermannE@arc.agric.za

ABSTRACT: A new species of the genus *Hoplocheylus* Berlese, *H. fereshtae* sp. nov. is described and figured based on females collected from soil under *Phragmites australis* (Cav.) Trin. (Poaceae), Amirabad, Mahallat, Markazi province, Iran. This is the first record of this family from Iran.

KEY WORDS: Tarsochylidae, *Hoplocheylus*, new species, predatory mites, Iran

INTRODUCTION

The family Tarsochylidae (Acariformes: Heterostigmata) was erected by Atyeo and Baker (1964) based on two genera, *Tarsocheylus* Berlese, 1904 and *Hoplocheylus* Atyeo and Baker, 1964. Members of this family are soil dwellers and often turn up in pitfall traps or leaf litter extractions. They have also been collected from the tunnels of bark beetles, as well as from rotting wood (Lindquist 1976). Family Tarsochylidae differs from other families belonging to the cohort Heterostigmata (Aty eo and Baker 1964) by having the reduced palpal tarsus, the divided leg femora, the absence of the genital papillae, a pair of capitated bothridial sensillae, tarsi II–IV with paired claws and a stalked empodium, tarsus I with paired claws and no empodium. The genus *Tarsocheylus* differs from *Hoplocheylus* by the papilliform palpal tarsus (vs indistinguishable in *Hoplocheylus*) and tarsus I with empodium (vs without empodium). Up to the present, eight species of the genus *Hoplocheylus* have been described: *H. atomarius* Berlese, 1913 (synonymy: *H. canadensis* Marshal, 1966 [Lindquist 1976]; *H. aethiopus* Atyeo et Baker, 1964; *H. jonnstoni* Atyeo et Baker, 1964; *H. logispinus* Atyeo and Baker, 1964; *H. pickardi* Smiley and Moser, 1968 (synonymy: *H. similiss* Delfinado and Baker, 1974) [Lindquist 1976]; *H. amricanus* Delfinado and Baker, 1974; *H. arnoidii* Livshitz and Mitrofanov, 1973; and *H. sogdianicus* Barilo and Shari-pov, 1987. In this study we described a new species of the genus *Hoplocheylus* from Iran.

MATERIALS AND METHODS

The specimens were collected from soil and litter under common reed, *Phragmites australis*

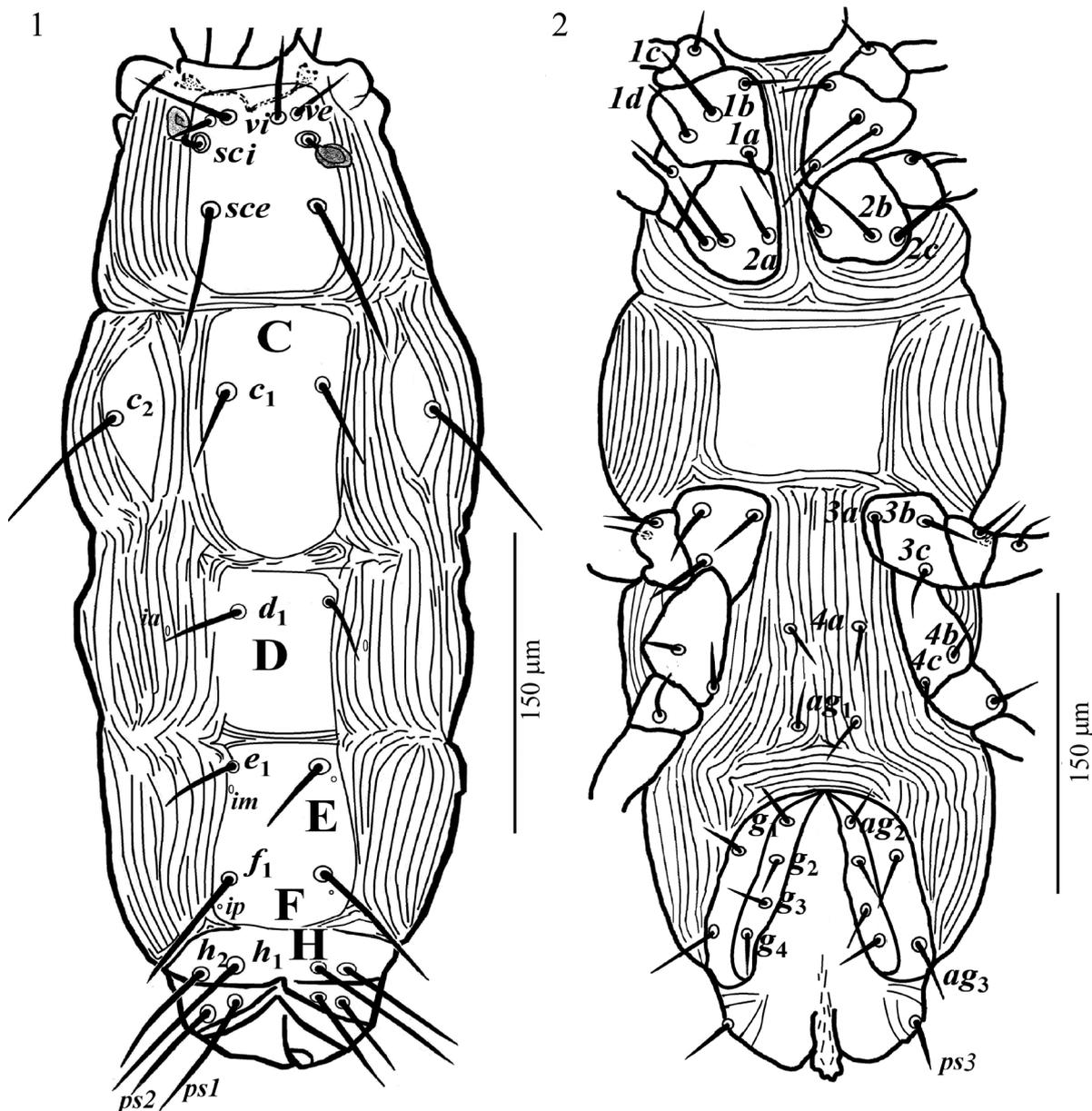
(Cav.) Trin. (Poaceae), Amirabad village, Mahallat vicinity, Markazi province which is located in the wester-center part of Iran. All mites were extracted by Berlese funnel and mounted on microscopic slides in Hoyer's medium. The specimens were examined under an Olympus BX51 differential interference contrast microscope (DIC). A Camera Lucida was used for illustrations.

Measurements: Body length is the distance between the base of the gnathosoma and the posterior end of the idiosoma; width was measured at the broadest part of the idiosoma, immediately anterior to legs III. Length of legs was measured from the proximal base of coxa to the tip of the pretarsus. The terminology, setal notations and leg setation follows that of Kethley (1990) and Lindquist (1976, 1987) extensively discussed the morphology and leg chaetotaxy of tarsochylid mites. All measurements are given in micrometers (µm).

Family Tarsochylidae, Berlese, 1904 Genus *Hoplocheylus* Atyeo and Baker, 1964

Type species: *Tarsocheylus atomarius* Berlese, 1913: 79

Diagnosis. The members of the genus *Hoplocheylus* can be recognized by the following combinations of characters (definitions are compatible with Lindquist, 1976): Propodorsal shield with four pairs of setae, *vi*, *ve*, *sci*, *sce*, setae *sci* capitate sensillae; eyes absent. Hysterosoma with four longitudinal dorsocentral shields, setae *c2* situated dorsolaterally, genital discs absent, ventral surface with distinct quadrate smooth shield between coxa II and III, leg I with subterminal claws and no empodium, legs II–IV with well-developed two claws and empodia, palp tarsus with two solenidia, palp coxa with seta (pcx).



Figs 1–2. *Hoplocheylus fereshtae* sp. nov. Female: 1 — dorsal view; 2 — ventral view.

Key to the genera and species of the Tarsocheylidae

(Updated from Atyeo and Baker 1964)

- 1. Palpal tarsus papilliform, legs I with empodium *Tarsocheylus* *T. paradoxus* (Berlese, 1904)
- Palpal tarsus indistinguishable; legs I without empodium *Hoplocheylus* 2
- 2. All dorsal idiosomal setae long and extending beyond anterior margin of next shield *H. atomarius* (Berlese, 1913)
- Some dorsal idiosomal setae short and not extending beyond anterior margin of next shield ... 3
- 3. Hysterosoma with 1 anteroventral plate 4

- Hysterosoma with 3 anteroventral plates *H. johnstoni* (Aty eo and Baker, 1964)
- 4. Setae *4a* and *ag1* on smooth integument 5
- Setae *4a* and *ag1* on plates 6
- 5. Tibia IV with solenidion, setation of tarsi I–IV (solenidia in parentheses) 14(2)–8(1)–8–7 *H. logispinus* (Aty eo et Baker, 1964)
- Tibia IV without solenidion, setation of tarsi I–IV (solenidia in parentheses) 15(2)–7(1)–7–6 *H. fereshtae* sp. nov.
- 6. Trochanter I with 1 seta 7
- Trochanter I without seta *H. sogdianicus* (Barilo and Sharipov, 1987)

Table 1.
Chaetotaxy of legs segments, habitat and locality of known species of the genus *Hoplocheyletus*

Characters	Tr I-IV	Fl I-IV	Ge I-IV	Ti I-IV	Ta I-IV	F. P. P.	Host	Locality
<i>H. atomarius</i>	1-1-2-1	4-3-2-2	5-4-4-5	6(2)-5(1)-5(1)-5(1)	14(2)-8(1)-8-7	?	Hay humus	Italy
<i>H. aethiopicus</i>	1-1-2-1	4-3-2-2	5-4-4-5	6(2)-5(1)-5(1)-5(1)	14(2)-8(1)-8-7	5+1σ(X)+2 approximate	Under the elytra of <i>Pentalobus barbatus</i> (Coleoptera, Passalidae)	Congo
<i>H. jonnstoni</i>	1-1-2-1	4-3-2-2	5-4-4-5	6(2)-5(1)-5(1)-5(1)	14(2)-8(1)-8-7	5+1σ(X)+2 approximate	Rotting stump	Canada
<i>H. logispinus</i>	1-1-2-1	4-3-2-2	5-4-4-5	6(2)-5(1)-5(1)-5(1)	14(2)-8(1)-8-7	6+1σ(X)+2 approximate	Moss and rotten wood	America
<i>H. pickardi</i>	1-1-2-1	4-3-2-2	5-4-4-5	6(2)-5(1)-5(1)-5	13(2)-8(1)-8-7	5+1σ(P)+2 approximate	Forest soil, litter and debris	America
<i>H. americanus</i>	1-1-2-1	4-3-2-2	5-4-4-5	6(2)-5(1)-5(1)-5(1)	14(2)-7(1)-8-7	5+1σ(P)+2 approximate	Forest soil, litter and debris	America
<i>H. arnoidii</i>	1-1-2-1	5-3-2-2	4-3-3-2	6(2)-4(1)-4(1)-3	15(2)-7(1)-5-5	6+1σ+2 approximate	Outer bark of <i>Pinus taeda</i> L.	
<i>H. sogdianicus</i>	0-1-2-1	4-3-2-2	5-4-4-5	8(2)-5-6(1)-5(1)	15(2)-8(1)-8-6	6+1σ(X)+2 approximate	Trunk tree	Tajikistan
<i>H. fereshtae</i> sp. n.	1-1-2-1	4-3-2-2	5-4-4-5	6(2)-5(1)-5(1)-5	15(2)-7(1)-7-6	6+1σ(P)+2 approximate	Soil under <i>Phragmites australis</i>	Iran

F. P. P. — Formulae of palptarsus, C. — Clavate solenidion, R. — Rodlike solenidion

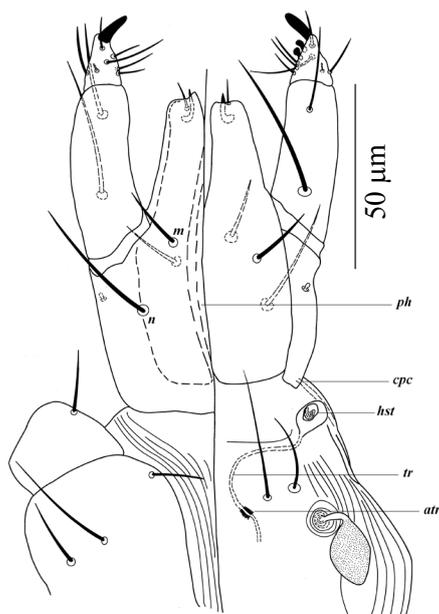


Fig. 3. *Hoplocheylus fereshtae* sp. nov. Female: heterostigma; dorsal seta *sci*; chelicera and palp; subcapitulum.

7. Genua I–IV with 5–4–4–5 setae 8
 — Genua I–IV with 4–3–3–2 setae *H. ornaldii*
 (Livshitz and Mitrofanov, 1973)
8. Tibia IV with solenidion, tarsus I with 14 setae
 9
 — Tibia IV without solenidion, tarsus I with 13
 setae *H. pickardi* (Smiley and Moser, 1968)
9. Tarsus II with 8 setae, palp tarsus with clavate-
 like solenidion *H. aethiopicus*
 (Atyeo and Baker, 1964)
- Tarsus II with 7(1) setae, palp tarsus with rod
 like solenidion *H. amricanus*
 (Delfinado and Baker, 1974)

***Hoplocheylus fereshtae* sp. nov.**

Figs 1–8

Diagnosis. Tarsi III with 7 setae; tibiotarsus with 6 simple setae + one rod-like solenidion + 1 developed claw + 2 short and bluntly rounded, setae *4a* and *ag1* on smooth integument.

Female (holotype). Body 545 (505) long (measurements of paratype in parenthesis); 165 (138) wide; idiosoma 475 (435) long.

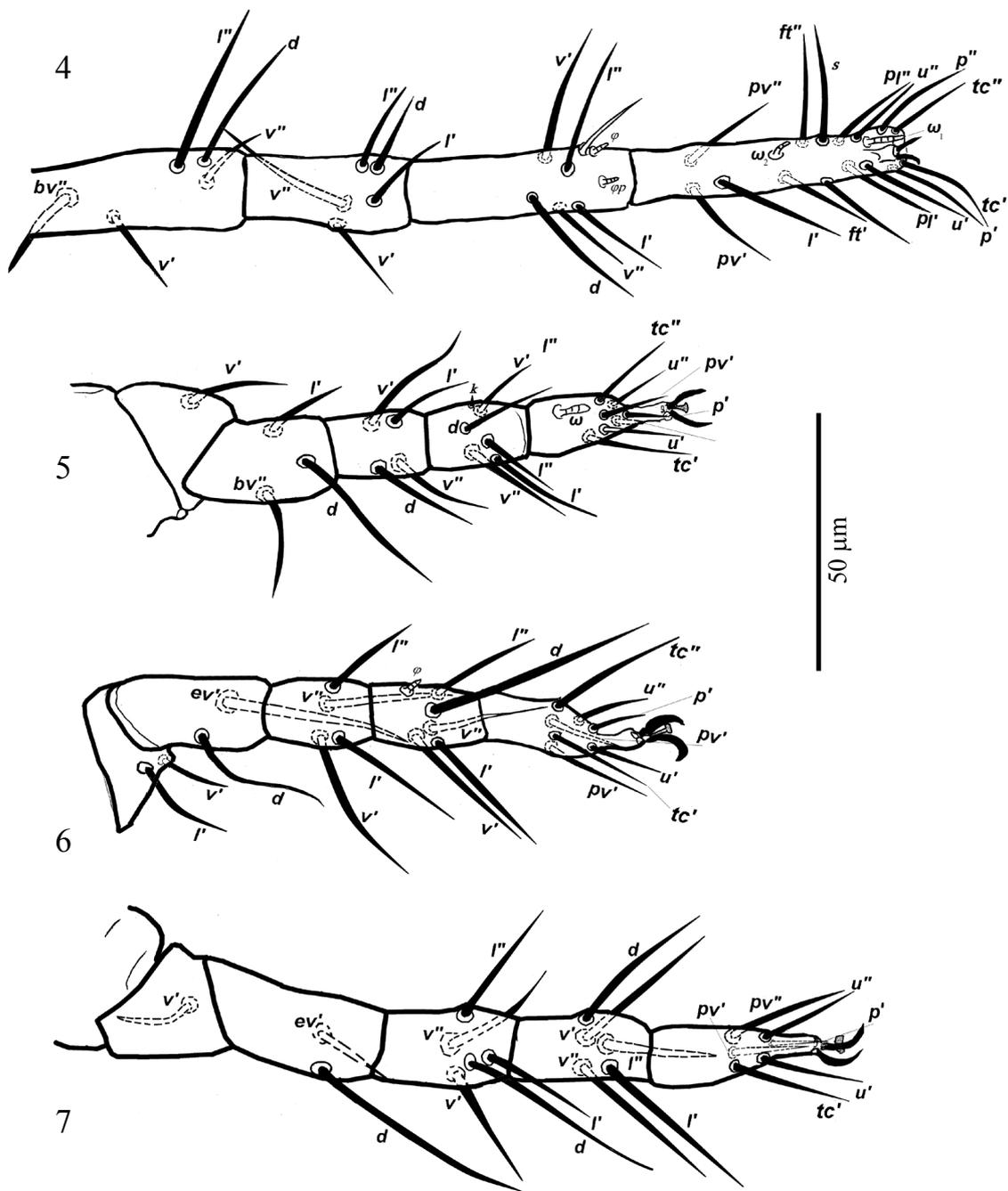
Dorsum (Figs. 1–3). Dorsum covered by 5 smooth dorso-central (propodonotal, 3 hysteronotal and 1 suranal) and 2 lateral shields bearing setae *c2*. Propodonotal shield bearing 4 pairs of setae (*vi*, *ve*, *sci*, *sce*), setae *sci* bulb-shaped and heterostigma capitates distally (Figs 1, 3). Shields C, D, E+F with 1 pair of setae each. Suranal shield

(H) with 2 pairs of setae (*h1*–*2*). Peritremes located on shoulders of propodonotum (Fig. 3). All dorsal setae smooth (Fig. 1). Lengths of dorsal setae: *vi* 45 (37), *ve* 20 (19), *sci* 20 (22), *sce* 67 (65), *c1* 36 (33), *c2* 78 (70), *d1* 34, *e1* 35 (33), *f1* 65 (63), *h1* 64 (60), *h2* 55 (50); distances between dorsal setae as follows: *vi*–*vi* 26 (33), *ve*–*ve* 16 (19), *vi*–*ve* 10 (7), *sci*–*sci* 46 (42), *sce*–*sce* 41 (39), *sci*–*sce* 31 (33), *vi*–*sci* 12 (11), *sce*–*c2* 97 (84), *sci*–*c1* 106 (98), *c1*–*c1* 39 (37), *c1*–*c2* 41 (35), *c2*–*c2* 124 (107), *c1*–*d1* 106 (88), *d1*–*d1* 33 (31), *d1*–*e1* 72 (66), *e1*–*e1* 35 (33), *e1*–*f1* 50 (42), *f1*–*f1* 42 (42), *f1*–*h1* 40 (42), *h1*–*h1* 28, *h1*–*h2* 16 (14), *f1*–*h2* 43 (43), *h2*–*h2* 60 (55), *vi*/*vi*–*vi* 1.73 (1.12), *ve*/*ve*–*ve* 0.77 (0.58), *c1*/*c1*–*c1* 0.91 (0.91), *d1*/*d1*–*d1* 1.03 (1.08), *e1*/*e1*–*e1* 1 (0.97), *f1*/*f1*–*f1* 1.55 (1.49), *h1*/*h1*–*h1* 2.29 (2.14), *h2*/*h2*–*h2* 0.92 (0.91).

Venter (Fig. 2). Hystrosomal plate quadrated and smooth (between coxae II and III); coxal fields I–II and III–IV separated and surrounded by longitudinal striae, endopodal shield absent (Fig. 2). Length of ventral setae: *la* 16, *lb* 16, *lc* 41 (34), *2b* 36 (33), *2c* 28 (26), *3a* 23 (22), *3b* 27 (23), *3c* 29 (25), *4a* 22, *4b* 17 (16) and *4c* 19 (15). Three pairs of aggenital setae (*ag1*–*3*) present; 4 pairs of genital setae (*gl*–*4*) present. Three pairs of pseudoanal setae (*ps1*–*3*) of which *ps3* in ventral position and two others in dorsal position. Length of setae: *ag1* 23 (21), *ag2* 30 (24), *ag3* 31 (27); *ps1* 45 (50), *ps2* 50 (48), *ps3* 25 (24) (Figs. 1–2). Distances between aggenital, genital and pseudoanal setae: *ag1*–*ag1* 24 (22), *ag2*–*ag2* 63 (55), *ag3*–*ag3* 84 (66); *ps1*–*ps1* 36 (30), *ps2*–*ps2* 55 (41), *ps3*–*ps3* 74 (50).

Gnathosoma (Fig. 3). Length of gnathosoma 91 (90). All gnathosomal setae smooth. Palps 3-segmented (Fig. 3). Palp femorogenu with 2 setae, palp tibiotarsus with 6 simple setae, 1 developed terminal claw 9, 1 undulated and rod-like solenidion 4 (5), and 2 subterminal claws subequal in length, 3–4. Subcapitular setae *m* 23 (21) and *n* 34 (35). Distance between subcapitular setae: *m*–*m* 16 (14), *n*–*n* 36 (30); *m*–*n* 18.

Legs (Figs 4–7). Lengths of legs: I 265 (255); II 160 (145), III 160 (150); IV 225 (205). Setae of legs (solenidia in parenthesis): coxae 4–3–3–2; trochanters 1–1–2–1; femora 4–3–2–2; genua 5–4–4–5; tibiae 6(2φ)–5(1φ)–5(1φ)–5; tarsi 15(2ω)–7(1ω)–7–6. Tarsus I with 2 subterminal claws and without empodium (Fig. 4) and legs II–IV with two terminal claws and T-shaped empodium (Figs 5–7). All setae on legs I–IV smooth. Lengths of solenidia: I ω1 8(9), I ω2 3, I κ1 3(4), I κ2 3, II φ 20, II ω 6, III κ 3(2).



Figs 4–7. *Hoplocheylus fereshtae* sp. nov. Female: 4 — leg I; 5 — leg II; 6 — leg III; 7 — leg IV.

Etymology. The new species is named in honor of Mrs. Fereshteh Issai, mother of the senior author.

Remarks. *Hoplocheylus fereshtae* sp. nov. is closest to *H. longispinus* Atyo et Baker, 1964 in having the dorsal shields reduced and most of dorso-central setae shorter than the distances between their bases and bases of the next posterior setae. It differs from *H. longispinus* by setae *fl* reaching the level of seta *h1* and *h2* bases (vs. not reaching in *H. longispinus*), the lateral shields are shorter than median shield C (vs. subequal in length), the palp tib-

iotarsus is rod-like (vs. bluntly rounded), and setation of tarsi I–IV is 15(2 ω)–7(1 ω)–7–6 (vs. 14(2 ω)–8(1 ω)–8–7). *H. fereshtae* sp. nov. is also similar to *H. sogdianicus* (Barilo et Sharipov, 1987). In both these species, the palpal tarsus is very small, tarsi I are without empodia, some dorsal idiosomal setae are short and not extending beyond the anterior margin of the shield, only a single the antero-ventral plate is present on hysterosoma. It differs from *H. sogdianicus* by the presence of one seta on trochanter I (vs. without setae in *H. sogdianicus*), tibiae I–IV 6(2 ϕ)–5(1 ϕ)–5(1 ϕ)–5 (vs.

8(2)–5–6(1)–5(1), setation of tarsi II–III 7(1)–7 setae (vs. 8(1)–8), the palp tibiotarsus with rod-like solenidion (vs. clavate), setae *4a* and *agl* inserted on the soft cuticle (vs. on shield).

Also chaetotaxy of legs segments of the known species are compared in Table 1.

Material examined. Holotype female and 1 female paratype from litters under *Phragmites australis* (Cav.) Trin. (Poaceae), IRAN: Markazi province, Mahallat vicinity, Amirabad village, 33°51'51"N, 50°29'51"E, 1665 m a.s.l., 24 July 2012, coll. M.R. Amin. The holotype is deposited at the Collection of Acarology Laboratory, University of Bu-Ali Sina, Hamadan, Iran; female paratype will be deposited in the National Collection of Arachnida, Plant Protection Research, Pretoria, South Africa.

REFERENCES

- Atyeo, W.T. and Baker, E.W. 1964. Tarsocheylidae, a new family of prostigmatic mites (Acarina). *Bull. University of Nebraska State museum*, 4: 243–256.
- Berlese, A. 1904. Acari nuovi. Manipulus III. *Redia*, 2: 10–32.
- Berlese, A. 1913. *Acarotheca Italica*, fasc.1–2. Manipulus Ricci, Firenze, 19 pp.
- Delfinado, M.D. and Baker, E.W. 1974. Terrestrial mites of New York (Acarina: Prostigmata), tarsocheylidae, paratydeidae, and pseudocheylidae. *Journal of The New York Entomological Society*, 82: 202–211.
- Kethley, J. 1990. Acarina: Prostigmata (Actinedida). In: D.L. Dindal (Ed.). *Soil Biology Guide*. New York, John Wiley & Sons, 667–756 pp.
- Lindquist, E.E. 1976. Transfer of the Tarsocheylidae to the Heterostigmata, and reassignment of the Tarsonemina and Heterostigamta to lower hierarchic status in the Prostigamta (Acari). *Canadian Entomologist*, 108: 23–48.
- Lindquist, E.E. 1987. Observations on the larva and protonymph of tarsocheylid mites (Acari: Heterostigmata). *Agriculture Canada, biosystematics res. cent., Ottawa ON K1A 0C6, Canada*, 28: 137–150.
- Livshitz, I.Z. and Mitrofanov, V.I. 1973. [A new species of the genus *Hoplochylus* (Tarsocheylidae, Acari-formes)]. *Zoologicheskii Zhurnal*, 52: 1576–1577. [in Russian]
- Smiley, R.L. and Moser, J.C. 1968. New species of mites from pine (Acarina: Tarsocheylidae, Eupalopsellidae, Caligonellidae, Cryptognathidae, Raphignathidae, and Neophyllobiidae). *Proceedings of the entomological society of Washington*, 70: 307–317.