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Article

New record and ontogenic development of *Oligonychus washingtoniae* (Trombidiformes: Tetranychidae) based on materials from Iran

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ABSTRACT

Oligonychus washingtoniae Mushtaq, Kamran & Alatawi, 2022 (Acari: Tetranychidae) is reported for the second time in the world based on new materials from Iran. The ontogenetic changes in leg chaetotaxy and new data of this species is also provided.

KEYWORDS: Chaetotaxy, Kish Island, ontogeny, spider mite, Tetranychini, *Washingtonia filifera*.

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INTRODUCTION

Previously, two phytophagous mites have been recorded from *Washingtonia filifera* (Arecaceae) in Iran: *O. afrasiaticus* (McGregor, 1939) and *Phyllozetanonychus hadii* Mahdavi, Latifi & Asadi, 2019 (Mahdavi *et al.* 2019; Migeon and Dorkeld 2023). The third species is reported in this paper with redescription of *Oligonychus washingtoniae* Mushtaq, Kamran & Alatawi, 2022 which was described for the first time from Saudia Arabia in 2022. Based on collected Iranian material from *Washingtonia filifera* (Arecaceae) in Kish Island (Persian Gulf), the ontogenetic changes of leg chaetotaxy, figures, measurements and additional morphological data are provided and compared with type material. This is the second report of *O. washingtoniae* worldwide and the first report from Iran.

MATERIAL AND METHODS

Leaves and twigs of *Washingtonia filifera* (Arecaceae) (Fig. 1a) were collected in bags and transferred to the laboratory. The twigs were cut layer by layer and washed in a solution of water and commercial detergent. The dipping-washing-filtering method (Boller 1984) was used to remove the mites from plant material. The resulting solution was filtered through a sieve (400 mesh), and the mites retained on the sieve were washed with 70% ethanol into a Petri dish, then collected individually under a stereomicroscope and mounted in Hoyer's medium. Mites were described with an Olympus® BX51

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phase-contrast compound microscope. Measurements were calculated using an imaging system including DinoCapture® 2.0 software and are given in micrometers (μm). The terminology and setal notations used for the description follow that of Lindquist *et al.* (1985). Body size was measured between dorsal setae v_2-h_1 for length and between sc_2-sc_2 for width (Saito *et al.* 1999). Distances between setae were measured as the distance from the inside edge of one setal base to the other (i.e., the minimum distance between two setal bases). Depositories are cited using the following abbreviations:

SBUK – Collection of the Acarology Laboratory, Shahid Bahonar University of Kerman, Kerman, Iran.

ACASI – Acarological Collection, Acarological Society of Iran (ASI), Department of Plant Protection, Faculty of Agriculture, University of Tehran, Karaj, Iran.



Figure 1. *Oligonychus washingtoniae* mites on *Washingtonia filifera* (Arecaceae) – **a & b.** Damage symptoms; **c.** Colonies and damage symptoms; **d.** Egg and adult; **e.** *Stethorus gilvifrons* Mulsant (Coleoptera: Coccinellidae).

Family Tetranychidae **Donnadieu, 1875**
Subfamily Tetranychinae **Berlese, 1913**
Tribe Tetranychini **Reck, 1950**
Genus *Oligonychus* **Berlese, 1886**
Subgenus *Oligonychus* (*Reckiella*) **Tuttle & Baker, 1968**

Type species: *Heteronychus brevipodus* Targioni-Tozzetti, 1878: 255.

Diagnosis of the genus is based on Mushtaq *et al.* (2021).

Material examined

Ten males, 15 females, two deutonymphs, two protonymphs and two larva ex. *Washingtonia*

filifera (Arecaceae), Kish Island, Hormozgan Province, Iran, 26° 31' N, 54° 02' E, altitude 32 m a.s.l., March 2020, coll. N. Rezaei.

Type deposition

All specimens at SBUK, except one female and one male paratype at ACASI.

***Oligonychus (Reckiella) washingtoniae* Mushtaq, Kamran & Alatawi, 2022 (Figs. 1–8)**

Distinctive characters

Male – Empodium I-II with proximoventral hairs fused into single claw. Aedeagus turned upwards; dorsal margin of knob curved with a dent near the posterior projection; knob of aedeagus with slight angle to that of main shaft (about 33 degrees); posterior projection about 2 times as long as anterior projection; knob twice as long as neck. Dorsal striae without lobes. **Female** – Opisthosoma medially with transverse striae except longitudinal striae between setae f_1 – f_1 and without forming inverted V-shaped pattern in-between setae f_1 and f_2 . Dorsal striae with lobes. Tibia I with 9+(1 ω) and tibia II with 7 setae. Tarsus I with four tactile setae ($l'1$, $l''1$, $v'2$, $v''1$) well proximal to proximal duplex setae and one solenidion ($\omega''1$) at the level of proximal duplex setae. Peritreme straight distally ending in small bulb.

Morphological data of Iranian specimens

MALE (Figs. 1d, 2, 3) – Length of body (v_2 – h_1) 228–238.

Dorsum – Color in living specimens light-yellow (Figs. 1c–e). Dorsal striae without lobes; propodosoma medially with longitudinal striae; opisthosoma medially with transverse striae. Dorsal body setae serrate, slender and longer than distances between consecutive setae. Lengths of setae v_2 60–61, sc_1 84–89, sc_2 60–65, c_1 78–79, c_2 72–76, c_3 62–65, d_1 75–76, d_2 77–80, e_1 67–69, e_2 76–80, f_1 60–61, f_2 52–55, h_2 30–33.

Venter – Ventral striae without lobes and integument medially with transverse striae. Lengths of setae: $1a$ 34–35, $3a$ 37–40, $4a$ 43–49, ag 38–44, ps_1 10–11, ps_2 10–11, g_1 15–16, g_2 16–17, ag 38–44, h_3 17–22.

Gnathosoma – Peritreme straight distally ending in a small bulb. Palp setation typical, spinneret ($su\zeta$) about 2 times as long as broad, 3–4 long, 1–2 wide, solenidion (ω) length 3–4 (Fig. 3c).

Legs (Figs. 2a–d) – Setation of legs I–IV coxae 2($1b$, $1c$)–2($2b$, $2c$)–1($3b$)–1($4b$); trochanters 1(v')–1(v')–1(v')–1(v'); femora 10(d , v' , v'' , l' , l'' , $v'1$, $v''1$, $l'1$, $l''1$, bv'')–6(d , v' , $v''1$, $l'1$, $l''1$, bv'')–4(d , v' , $l'1$, ev')–4(d , v' , $l'1$, ev'); genua 5(d , v' , v'' , l' , l'')–5(d , v' , v'' , l' , l'')–4(d , v' , v'' , l')–4(d , v' , v'' , l'); tibiae 13(db , v' , v'' , l' , l'' , $v'1$, $v''1$, $l'1$, $l''1$, $\phi 1$, $\phi 2$, $\phi 3$, $\phi 4$)–7(d , v' , v'' , l' , l'' , $v'1$, $l'1$)–6(d , v' , v'' , l' , l'' , $v'1$)–7(d , v' , v'' , l' , l'' , $v'1$, $l'1$); tarsi 16($p'\zeta$, $p''\zeta$, u' , u'' , tc' , tc'' , pv'' , $pv'\zeta$, $v'1$, $v''1$, $v'2$, $l'1$, $l''1$, $\omega'1$, $\omega''1$, $\omega''2$ + 2dupl. (ft' , ω' , ft'' , ω''))–14($p'\zeta$, $p''\zeta$, u' , u'' , tc' , tc'' , pv'' , $pv'\zeta$, $v'1$, $v''1$, $v'2$, ft' , $l'1$, $\omega''1$ + 1dupl. (ft'' , ω''))–10(u' , u'' , tc' , tc'' , pv' , pv'' , ft' , ft'' , $v'1$, ω')–10(u' , u'' , tc' , tc'' , pv' , pv'' , ft' , ft'' , $v'1$, ω'). Empodia I-II with proximoventral hairs fused into single claw (Figs. 3d–e); dorsal claw of empodia III-IV claw-like with three pairs proximoventral hairs (Fig. 3f). Tarsus I with four tactile setae ($l'1$, $l''1$, $v'2$, $v''1$) and two solenidia ($\omega'1$, $\omega''2$) well proximal to a proximal set of duplex setae, one solenidion ($\omega''1$) at the level of proximal duplex setae (Fig. 2a). Tarsi I–IV with solenidia $I\omega'1$ 23–26, $I\omega''1$ 30–33, $I\omega''2$ 26–28, $II\omega'1$ 30–35, $III\omega'1$ 32–36, $IV\omega'1$ 35–37. Lengths of legs (from trochanter): I 229–239, II 180–209, III 184–208, IV 184–208.

Aedeagus (Fig. 3a) – Aedeagus turned upwards; dorsal margin of knob curved with a dent near the posterior projection; knob of aedeagus with slight angle to that of main shaft (about 33 degrees); posterior projection about 2 times as long as anterior projection; knob twice as long as neck.

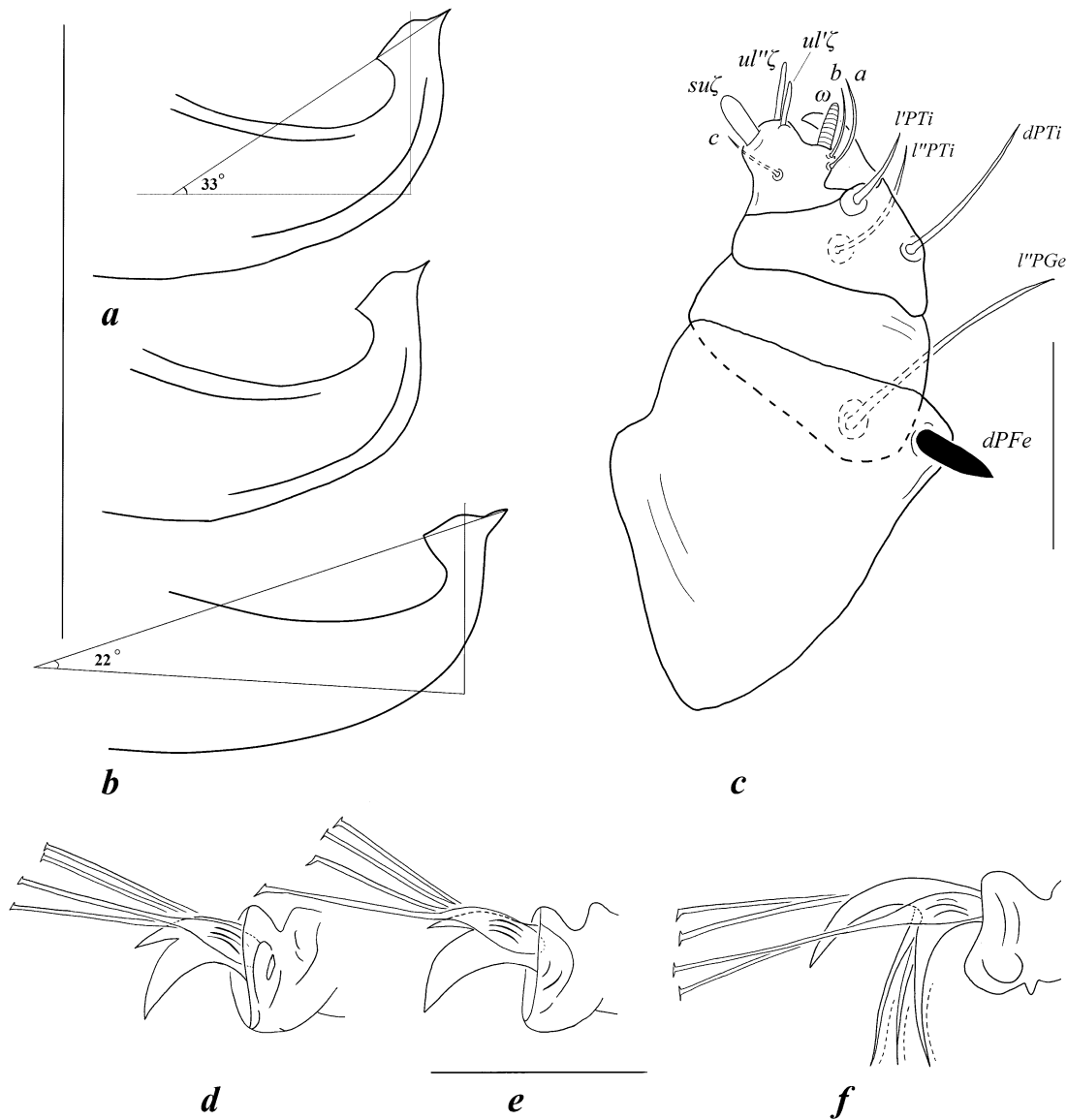


Figure 3. *Oligonychus washingtoniae* (male) – **a.** Aedeagus; **b.** Aedeagus (reproduced from original description); **c.** Palp; **d.** Empodium I; **e.** Empodium II; **f.** Empodia III-IV (Empodia III-IV is similar); Scale bars = 20 μ m (a-f).

FEMALE (Figs. 4–8) – Length of body (excluding gnathosoma) 372–423, (v_2-h_1) 309–328; width 234–293, (sc_2-sc_2) 182–187.

Dorsum – Color in living specimens light-yellow. Dorsal striae with lobes (Figs. 4c, 5a); propodosoma medially with longitudinal striae; opisthosoma medially with transverse striae except area between setae f_1-f_1 with longitudinal striae; idiosoma with longitudinal to oblique striae laterally (Figs. 4a, 5a). Dorsal body setae serrate, slender and longer than distances between consecutive setae. Lengths of setae: v_2 65–73, sc_1 99–103, sc_2 70–73, c_1 85–90, c_2 88–90, c_3 84–88, d_1 85–90, d_2 89–92, e_1 79–82, e_2 90–91, f_1 75–78, f_2 74–78, h_2 47–50. Distances between dorsal setae: v_2-v_2 68–76, sc_1-sc_1 88–89, sc_2-sc_2 182–187, c_1-c_1 70–73, c_2-c_2 148–154, c_3-c_3 217–251, d_1-d_1 81–90, d_2-d_2 161–169, e_1-e_1 45–52, e_2-e_2 131–138, f_1-f_1 36–38, f_2-f_2 70–77, h_2-h_2 20–24.

Venter – Ventral striae without lobes except laterally with similar to dorsal lobes (Fig. 6); pregenital striae with irregular to oblique striae (Figs. 5b, 6). Lengths of setae: $1a$ 35–40, $3a$ 41–46,

4a 50–60, ag 50–59, g₁ 30–35, g₂ 32–34, ps₁ 14–16, ps₂ 13–15, h₃ 37–38, 1b 43–48, 1c 50–57, 2b 57–63, 2c 65–67, 3b 48–54, 4b 38–51; distances between setae 1a–1a 29–32, 3a–3a 61–62, 4a–4a 68–77, ag 66–69, g₁ 25–27, g₂ 84–88.

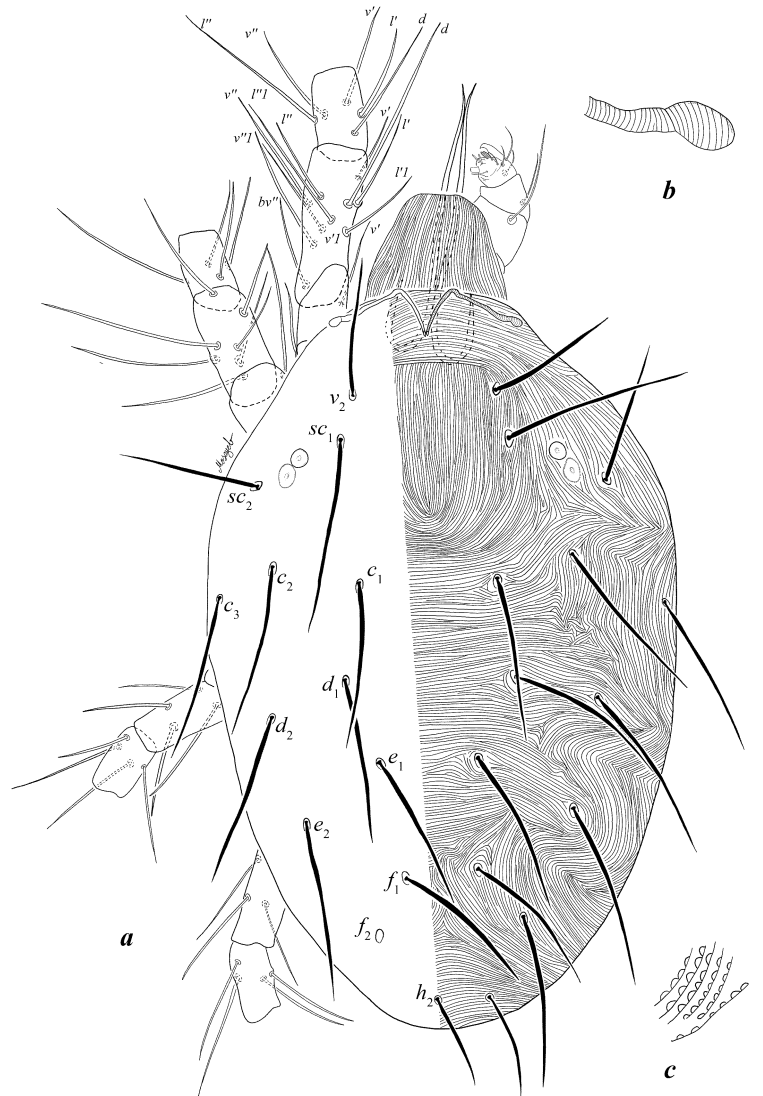


Figure 4. *Oligonychus washingtoniae* (female) – **a.** Dorsum, habitus; **b.** End of peritreme; **c.** Lobes on dorsal striae. Scale bars = 50 μ m (a), 20 μ m (b–c).

Gnathosoma – Peritreme straight, distally ending in a small bulb (Figs. 4a, b); ventral infracapitulum with seta *m* (40–48). Palp setation typical, spinneret (*su* ζ) about 1.6 times as long as broad, 5 long, 3 wide, solenidion (ω) length 5 (Fig. 8d).

Legs – Setation of legs I–IV coxae 2(1b, 1c)–2(2b, 2c)–1(3b)–1(4b); trochanters 1(v')–1(v')–1(v')–1(v'); femora 10(d, v', v'', l', l'', v'1, v''1, l'1, l''1, bv'1, bv''1)–6(d, v', v''1, l'1, l''1, bv'1)–4(d, v', l'1, ev')–4(d, v', l'1, ev'); genua 5(d, v', v'', l', l'')–5(d, v', v'', l', l'')–4(d, v', v'', l')–4(d, v', v'', l'); tibiae 10(db, v', v'', l', l'', v'1, v''1, l'1, l''1, ϕ 1)–7(d, v', v'', l', l'', v'1, l'1)–6(d, v', v'', l', l'', v'1)–7(d, v', v'', l', l'', v'1, l'1); tarsi 14(p' ζ , p'' ζ , u', u'', tc', tc'', pv'', pv' ζ , v'1, v''1, v'2, l'1, l''1, ω '1 + 2dupl. (ft', ω ', ft'', ω ''))–14(p' ζ , p'' ζ , u', u'', tc', tc'', pv'', pv' ζ , v'1, v''1, v'2, ft', l'1, ω '1 + 1dupl. (ft'', ω ''))–10(u', u'', tc', tc'', pv', pv'', ft', ft'', v'1, ω ')–10(u', u'', tc', tc'', pv', pv'', ft', ft'', v'1, ω ') (Figs. 7–8a, b). Empodia I–IV claw-like with three pairs proximoventral hairs (Fig. 8c); tarsus I with four tactile setae (l'1, l''1, v'2, v''1) well

proximal to proximal set of duplex setae, and one solenidion ($\omega''I$) at the level of proximal duplex setae (Fig. 7a). Tarsi III–IV with solenidia III ω' 30–36, IV ω' 38–41. Lengths of legs: I 250–275, II 197–214, III 210–226, IV 256–273.

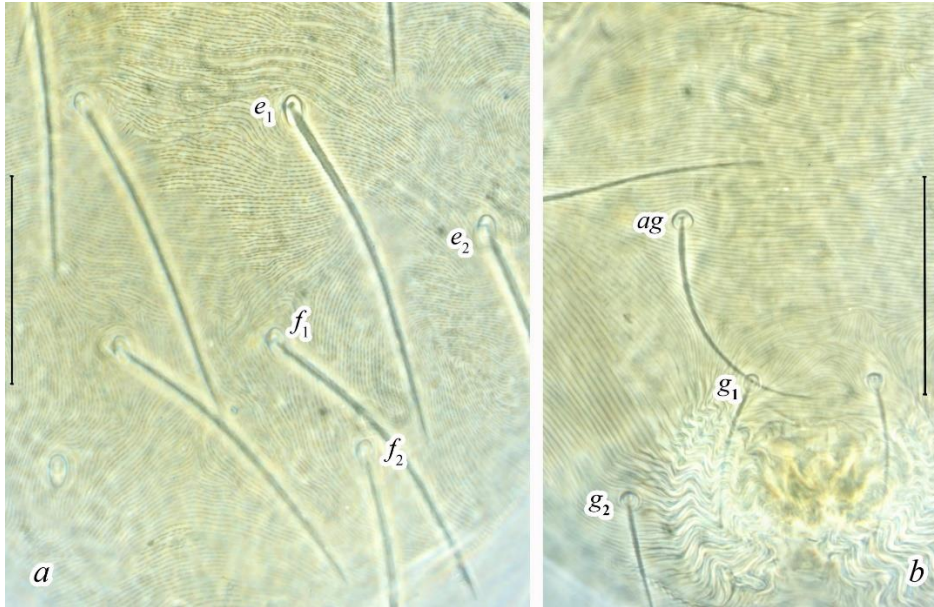


Figure 5. *Oligonychus washingtoniae* (female) – **a.** Dorsum (area between setae e_1 – f_2); **b.** Pregenital area. Scale bars = 50 μ m.



Figure 6. *Oligonychus washingtoniae* (female) – Venter (area between setae $4a$ – ps_1). Scale bar = 50 μ m.

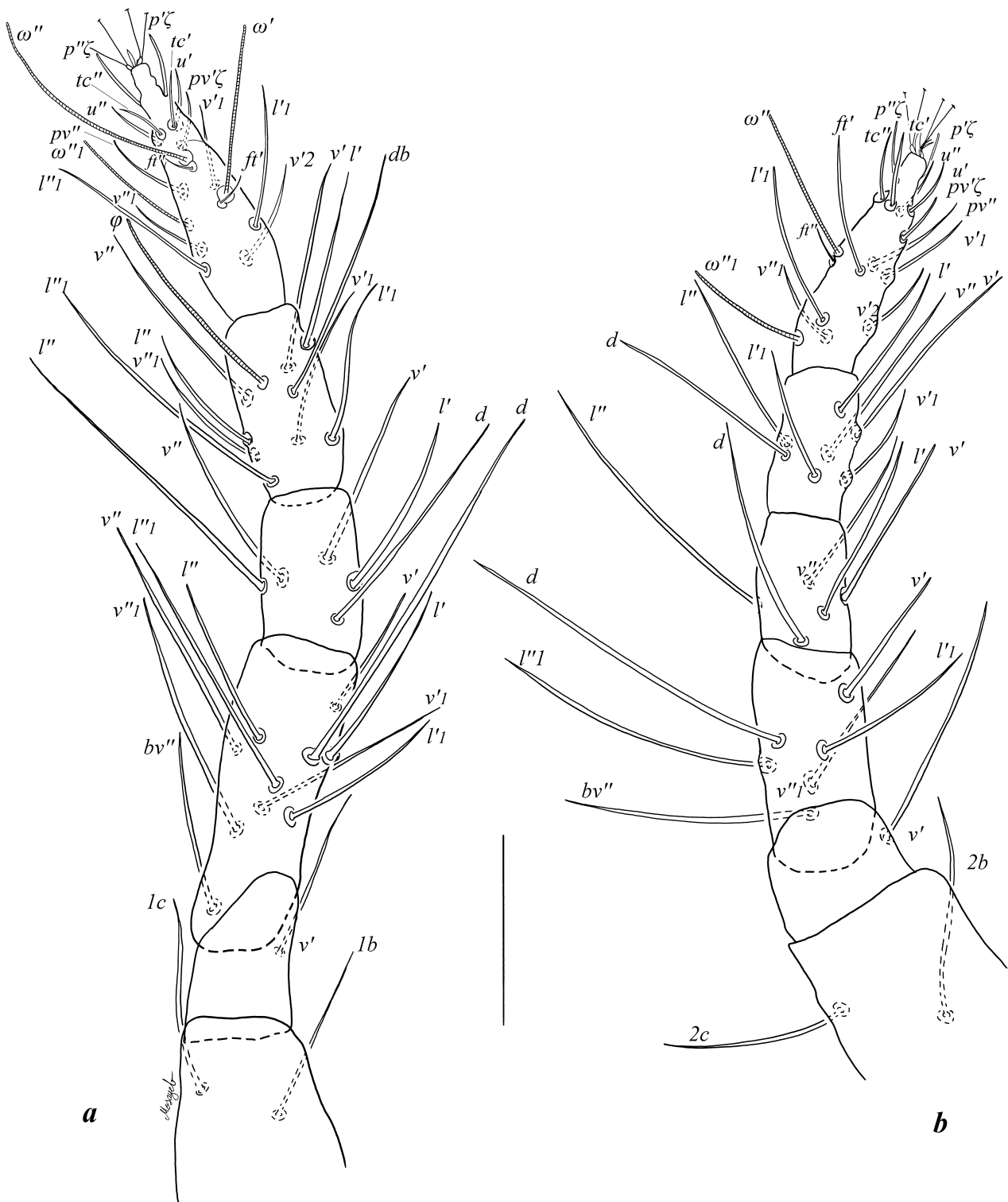


Figure 7. *Oligonychus washingtoniae* (female) – a. Leg I; b. Leg II. Scale bar = 50 μm (a, b).

DISCUSSION

The Iranian specimens and the original description have some differences as follows (Iranian specimens vs. original description in Mushtaq *et al.* 2022):

Male – knob of aedeagus with about 33 degrees angle to that of main shaft (*vs.* 22 degrees in Fig. 3b); tarsus I with different lengths of solenidia $I\omega'1$ 23–26, $I\omega''1$ 30–33, $I\omega''2$ 26–28 (*vs.* equal lengths); length of ft' on tarsus II is almost equal with ω'' (*vs.* ft' about two-third of ω''). **Female** – Area between setae f_1 – f_1 with longitudinal striae (Figs. 4a, 5a) (*vs.* with transverse striae); without forming inverted V-shaped pattern in-between setae f_1 and f_2 (*vs.* with or without). Length of body and dorsal setae in the Iranian specimens longer than original description in both males and females.

Note – This species is collected from Kish Island in the southern coast of Iran in the Persian Gulf. *Oligonychus (Reckiella) washingtoniae* was observed with a very high population on the back surface of the leaves of all Washington palm trees and is active all year round in these weather conditions. The peak population of this species is observed in May and June. This population decreases slightly due to the heat of the July. The damaged leaves are yellow to orange at first glance and show symptoms similar to nutrient deficiency. They are covered with a dense webbings, full of eggs and nymphs (Fig. 1b). Ladybug *Stethorus gilvifrons* Mulsant (Coleoptera: Coccinellidae) was actively collected on this mite colonies (Fig. 1e). Anntogenic development of leg setae is provided for the first time (Table 1).

Table 1. Ontogenetic development of leg setae in *Oligonychus washingtoniae*. Setae are represented in the stage in which they first appear. Setal pairs are shown in parentheses. L, larva; P, protonymph; D, deutonymph; F, female; M, male.

Leg, stage	Cx	Tr	Fe	Ge	Ti	Ta
Leg I						
L	1b	-	d, v', bv''	(v), (l)	$db, (v), (l), \phi$	($p\zeta$), (ft), (u), (pv), ω''
P	1c	-	-	-	-	(tc), $v'1, \omega'$
D	-	v'	$v'', (l)$	d	(l1)	$\omega''1, v''1, l'1$
F	-	-	(v1), (l1)	-	(v1)	$v'2$
M	-	-	(v1), (l1)	-	(v1), ($\phi1$), $\phi''2$	$v'2, \omega'1, \omega''2$
Leg II						
L			d, v', bv''	(v), (l)	$d, (v), (l)$	($p\zeta$), (ft), (u), (pv), ω''
P	2b	-	-	-	-	(tc)
D	2c	v'	-	d	-	$v'1$
F	-	-	$v''1, (l1)$	-	$v'1, l'1$	$v''1, v'2, l'1, \omega''1$
M	-	-	$v''1, (l1)$	-	$v'1, l'1$	$v''1, v'2, l'1, \omega''1$
Leg III						
L			d, ev'	l', v'	$d, (v), (l)$	(ft), (u), (pv)
P	3b	-	-	-	-	(tc)
D	-	v'	-	d	-	ω'
F	-	-	$v', l'1$	v''	$v'1$	$v'1$
M	-	-	$v', l'1$	v''	$v'1$	$v'1$
Leg IV						
P	-	-	d, ev'	l', v'	$d, (v), (l)$	(ft), (u), (pv)
D	4b	-	-	d	-	(tc)
F	-	v'	$v', l'1$	v''	$v'1, l'1$	$\omega', v'1$
M	-	-	$v', l'1$	v''	$v'1, l'1$	$\omega', v'1$

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نوگزارش و نمو انتوزنیک (*Oligonychus washingtoniae* (Trombidiformes: Tetranychidae) بر اساس نمونه‌های ایران

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چکیده

گونه *Oligonychus washingtoniae* Mushtaq, Kamran & Alatawi, 2022 (Acari: Tetranychidae) برای دومین بار در جهان بر اساس نمونه‌های جدید جمع‌آوری شده از ایران گزارش می‌شود. تغییرات نموی در کتوتاکسی پاها و اطلاعات جدیدی از این گونه ارایه شده است.

کلمات کلیدی: کتوتاکسی، جزیره کیش، نموشناسی، کنه تارتن، *Tetranychini*، *Washingtonia filifera*.

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