

REDESCRIPTION OF *TYPHLOSEIULUS CARMONAE* (CHANT AND YOSHIDA-SHAUL) (MESOSTIGMATA: PHYTOSEIIDAE) NEW SPECIES FOR IRAN

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ABSTRACT: *Typhloseiulus carmonae* (Chant et Yoshida-Shaul, 1983) recorded in Iran for the first time is redescribed. The external morphology of the specimens from Iran is compared with those given in the original description from Portugal (Chant and Yoshida-Shaul 1983) and redescription from Spain (Ferragut 1991). Females of this species from Iran differ from those from other two localities by the fixed digit of chelicerae with 3 teeth (vs 2). In males from Iran, setae of dorsal shield are significantly longer than those of allotype from Portugal. A key to the species of *Typhloseiulus* spp. recorded from Iran is given.

KEY WORDS: Acari, Phytoseiidae, *Typhloseiulus carmonae*, Iran

INTRODUCTION

Mites of the family Phytoseiidae are effective natural enemies of plant-feeding mites, e.g. spider and eriophyid mites. Some of them are successfully used in biological control programmes (Gerson et al. 2003; Zhang 2003). Prior to this study, about 70 species of Phytoseiidae have been reported from Iran as new species or new records (Khalil-Manesh 1973; McMurtry 1977; Sepasgosarian 1977; Daneshvar 1978, 1980, 1987; Daneshvar and Denmark 1982; Hajizadeh et al. 2002; Kolodochka et al. 2003; Faraji et al. 2007; Noei 2007). Among them there are two species of *Typhloseiulus* namely *T. simplex* (Chant, 1956) and *T. peculiaris* (Kolodochka, 1980). During a survey to determine the diversity of Phytoseiidae species in East Azarbaijan Province of Iran, in 1998–2001, *T. carmonae* (Chant et Yoshida-Shaul, 1983) was recorded on oak leaves (*Quercus* sp.). This species was originally collected in Portugal and misidentified by Carmona (1970) as *T. simplex*. Later on, Chant and Yoshida-Shaul (1983) described it as a new species. It was also recorded and redescribed by Ferragut (1991) from Spain and by Papadoulis and Emmanouel (1993) from Greece.

We redescribe the female and male of *T. carmonae* based on the Iranian specimens. We also compare the morphology of specimens found in Iran with those given in the original description from Portugal (Chant and Yoshida-Shaul 1983) and redescription from Spain (Ferragut 1991).

MATERIAL AND METHODS

The specimens of *T. carmonae* were cleared in Nesbitt's solution before mounting in Hoyer's

medium on microscope slides. The classification system of Chant and McMurtry (1994), the setal nomenclature used by Rowell et al. (1978) and the setal idiosomal patterns proposed by Chant and Yoshida-Shaul (1992) are followed. Measurements are given in micrometers (μm). The materials are preserved as slide mounted specimens. They are deposited in the collection of the Plant Pests and Diseases Research Department, Agricultural and Natural Resources Research Centre of East Azarbaijan, Iran.

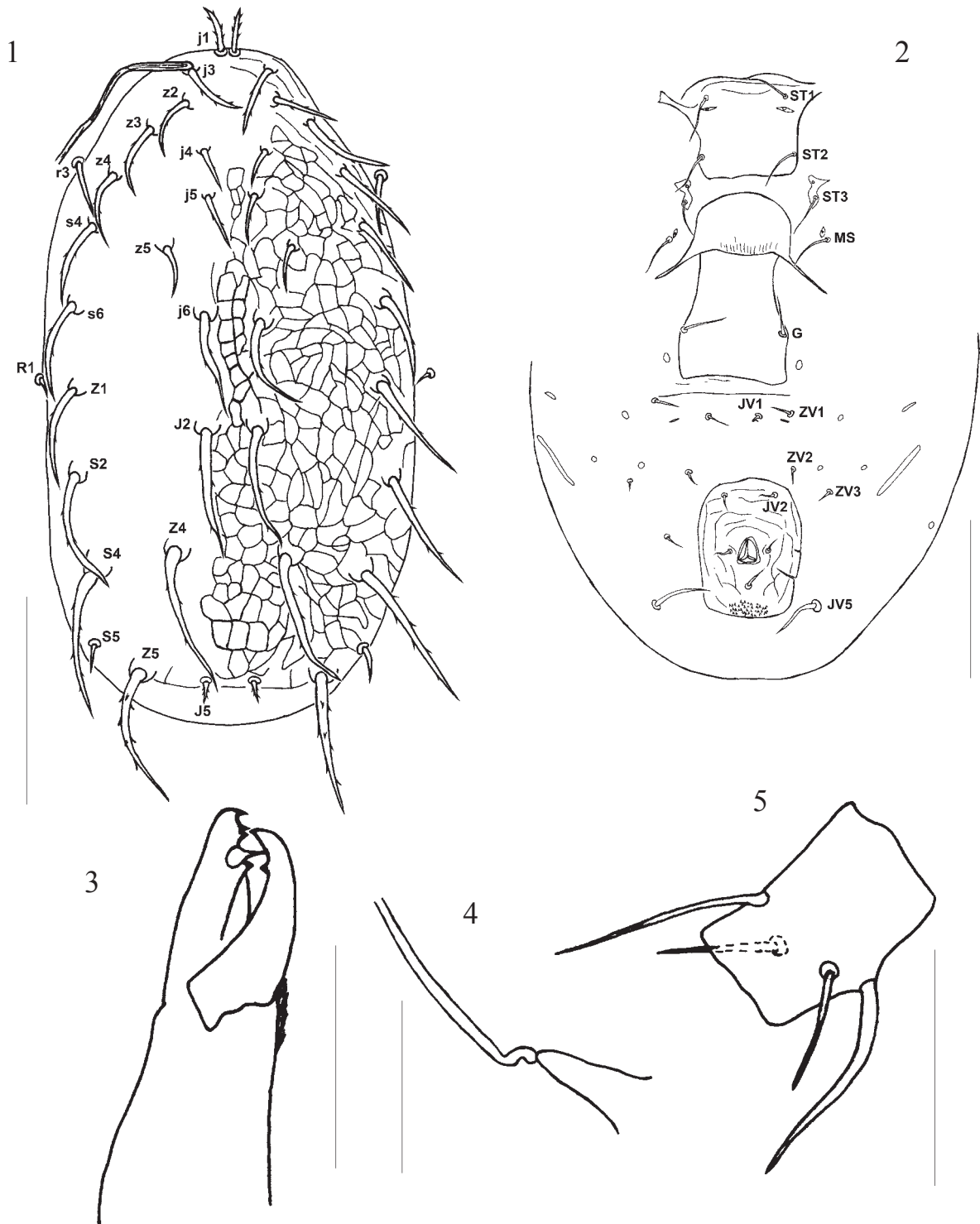
SYSTEMATICS

Family Phytoseiidae Berlese, 1916
Genus *Typhloseiulus* Chant and McMurtry, 1994
Typhloseiulus carmonae
(Chant et Yoshida-Shaul, 1983)

Figs 1–8

Female (Figs 1–5; 5 specimens measured).

Dorsum. (Fig. 1). Dorsal shield 327–338 long, 189–195 wide at level of Z_1 . Dorsal shield oval, strongly sclerotized and reticulated mostly centrally and posteriorly; without distinct waist; with 19 pairs of dorsal setae. Most of dorsal setae thick and long, inserted on tubercles; S_5 , J_5 and R_1 short. Setae j_1 , j_3 , S_4 , Z_5 strongly serrated, z_5 and S_5 smooth, remaining dorsal setae serrated but to a negligible degree. Setae r_3 and R_1 on interscutal membrane, smooth. Pores on dorsal shield small and faint. Measurements of dorsal and sublateral setae as follows: j_1 24–30, j_3 34–41, j_4 23–26, j_5 23–28, j_6 52–60, J_2 70–76, J_5 10–12, z_2 31–34, z_3 44–46, z_4 44–47, z_5 24–26, Z_1 62–65, Z_4 79–88, Z_5 80–85, s_4



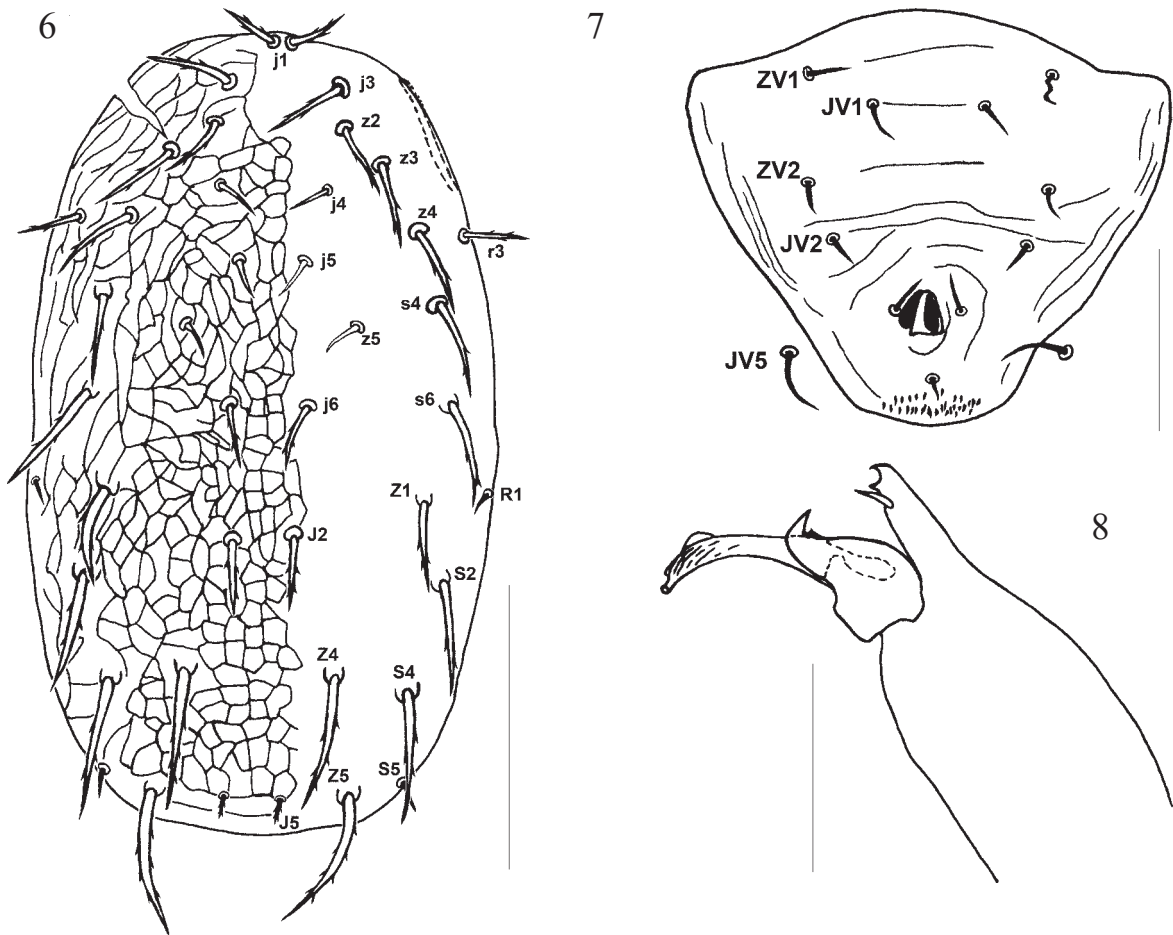
Figs. 1–5. *Typhloseiulus carmonae*, female: 1 — dorsal shield; 2 — ventral surface; 3 — chelicera; 4 — spermatheca; 5 — basitarsus IV. Scale bar: 100 μ m for 1–2 and 25 μ m for 3–5.

49–57, s_6 60–66, S_2 67–78, S_4 79–89, S_5 17–23, r_3 25–34, R_1 8–11.

Peritreme. Extending to the level between seta j_1 and j_3 .

Venter (Fig. 2). Sternal shield smooth slightly sclerotized, with 2 pairs of setae (ST_1 and ST_2) and 1 pair of pores. Third pair of sternal setae (ST_3) on

separate platelets, each accompanied by one pore. Metasternal platelets with 1 pair of pores, metasternal setae (MS) on integument. Length of sternal shield 50–54; width (at the level of setae ST_2) 53–55. Genital shield smooth, slightly sclerotized. Length of genital shield 110–126; width (at level of setae G) 61–70. Ventrianal shield reduced and



Figs. 6–8. *Typhloseiulus carmonae*, male: 6 — dorsal shield; 7 — ventrianal shield; 8 — chelicera. Scale bar: 100 μm for 6, 50 μm for 7, and 25 μm for 8.

lightly sculptured; with one pair of preanal setae (JV_2) on the shield in addition to paranal and postanal setae. Length of ventrianal shield 86–90; width 60–70. Setae ZV_1 , ZV_2 , ZV_3 , JV_4 and JV_5 on integument surrounding ventrianal shield. Seta JV_5 smooth; much longer 37–46 than others. Length of primary metapodal plate 35–43; width 2.

Chelicera (Fig. 3). Fixed digit of chelicera with 3 teeth and pilus dentilis; movable digit 20–23 long, with 1 tooth.

Spermatheca (Fig. 4). Calyx of spermatheca cone-shaped, 15–19 long; atrium distinct and c-shaped; major duct narrower and much longer than calyx, with one bend at junction with calyx; minor duct not visible.

Legs. Chaetotactic formulae of leg segments as follows: femur I 2–5/3–2; genu I 2–2/1, 2/1–2; tibia I 2–2/1, 2/1–2; femur II 2–5/2–1; genu II 2–2/1, 2/0–1; tibia II 1–1/1, 2/1–1; femur III 1–3/1–1; genu III 1–2/1, 2/0–1; tibia III 1–1/1, 2/1–1; femur IV 1–3/1–1; genu IV 1–2/1, 2/0–1; tibia IV 1–1/1, 2/0–1. Basitarsus IV with a stout macroseta, 27–30 long (Fig. 5).

Male (Figs 6–8; 2 specimens measured).

Dorsum (Fig. 6). Dorsal shield 263–278 long and 150–159 wide at level of Z_1 . Dorsal shield strongly sclerotized and reticulated mostly centrally and posteriorly; without distinct waist; with 19 pairs of dorsal setae. Most dorsal setae thickened and inserted on tubercles. Setae $j_1, j_3, j_6, J_2, J_5, Z_4, Z_5, S_4$ strongly serrated, setae j_4, j_5, z_5 and S_5 smooth, remaining dorsal setae serrated but to a negligible degree. Seta r_3 and R_1 on dorsal shield, smooth. Measurements of dorsal and sublateral setae as follows: j_1 13–20; j_3 25–30; j_4 16–17; j_5 13; j_6 23–24; J_2 27–34; J_5 8–10; z_2 23–26; z_3 29–34; z_4 33–34; z_5 13–14; Z_1 36; Z_4 49–53; Z_5 53–54; s_4 30–36; s_6 39–42; S_2 42–44; S_4 48–50; S_5 11–17; r_3 25; R_1 10–12.

Peritreme. Extending to the level of j_3 .

Venter. Sternogenital shield smooth; with five pairs of setae and three pairs of pores. Length of sternogenital shield 120–125; width 67–69. Ventrianal shield with four pairs of preanal setae (ZV_1 , ZV_2 , JV_1 , and JV_2). Length of ventrianal shield 109–114; width 132–137. Seta JV_5 on integument surrounding ventrianal shield; 16–20 long (Fig. 7).

Table

Comparison of some morphological characters of *Typhloseiulus carmonae* from different locations
(measurements in micrometers)

Character	Iran		Portugal		Spain	
	Female (n=5)	Male (n=2)	Female* Holotype	Male* Allotype	Female**	Male*** (n=2)
Dorsal shield length	327–338	263–278	358	293	345	–
Dorsal shield width	189–195	150–159	216	167	200	–
j_1	24–30	13–20	22	18	–	18
j_3	34–41	25–30	35	18	36	22–24
j_4	23–26	16–17	29	14	31	14
j_5	23–28	13	29	13	35	15
j_6	52–60	23–24	56	17	61	24
J_2	70–76	27–34	66	23	75	26–28
J_5	10–12	8–10	8	7	–	7
z_2	31–34	23–26	24	14	30	20
z_3	44–46	29–34	35	20	38	22–25
z_4	44–47	33–34	40	21	37	28
z_5	24–26	13–14	24	14	20	12–13
Z_1	62–65	36	54	22	63	–
Z_4	79–88	49–53	77	40	84	48–50
Z_5	80–85	53–54	77	40	79	44–45
s_4	49–57	30–36	46	22	45	32–34
s_6	60–66	39–42	54	25	60	32
S_2	67–78	42–44	60	26	65	28–30
S_4	79–89	48–50	75	30	78	34–35
S_5	17–23	11–17	14	6	12	–
r_3	25–34	25	34	20	–	18
R_1	8–11	10–12	12	9	–	–
JV_5	37–46	16–20	48	17	–	–
$St IV$	27–30	22–23	–	–	–	16–18
Ventrianal shield length	86–90	109–114	88	120	86	–
Ventrianal shield width	60–70	132–137	67	134	45	–
Length of calyx	15–19	–	12	–	–	–
Length of movable digit	20–23	18–20	21	–	–	–
Teeth of fixed digit	3	1	2	1	2	–
Teeth of movable digit	1	1	1	1	1	–
Level of peritreme extending	between j_1 and j_3	j_3	between j_1 and j_3	Z_3	between j_1 and j_3	–

*From original description (Chant and Yoshida-Shaul 1983); **from Ferragut (1991); ***from Ferragut (unpublished data).

Chelicera. Fixed digit with one tooth and pilus dentilis; movable digit 18–20 long, with one tooth; spermatodactyl as in Fig. 8.

Legs. Basitarsus IV with a stout macroseta, 22–23 long.

Material examined. Five females and 2 males from oak leaves, *Quercus* sp., Iran: East Azarbaijan Province, Osku, 37° 54.39' N, 46° 8.27' E, 1500–1800 m, August 2000, coll. D. Shirdel.

Remarks. The living adults that were reddish-brown in color, found on oak leaves infested by spider mites and an unidentified species of scale insects. One case of preying and feeding on mobile stage of this insect by an adult female of *T. carmonae* was observed.

Typhloseiulus carmonae is easily separated from other species in the genus, by a longer j_6 (more than 50 μ m). The females of Iranian specimens

resemble the description of *T. carmonae* closely in all respects, among them in having longer j_4, j_5, j_6 and z_5 setae (Chant and Yoshida-Shaul 1983; Ferragut 1991). However, the fixed cheliceral digit of females from Iran has 3 teeth as opposed to 2 in those of Portugal (holotype) and Spain. Moreover, the lengths of some dorsal setae of the Iranian specimens like Spanish specimens are longer than those of the type specimen (Table). Males of this species from Iran like the allotype (Portugal) do not have j_6 and J_2 as proportionately long as the female. They differ from the allotype in that the peritremes are longer, extending anteriorly to level of j_3 instead of to level of z_2 in allotype; setae on lateral margins of dorsal shield reach well beyond the insertions of next setae but not in the allotype; seta Z_4 is long, subequal to S_4 and almost as long as the distance between insertions of Z_4 and Z_5 in the Iranian specimens whereas it is conspicuously longer than S_4 and shorter than above distance in allotype; the males of Iranian specimens, from the viewpoint of dorsal setae length are similar to those of Spain (Table).

KEY TO THE IRANIAN SPECIES OF TYPHLOSEIULUS: ADULT FEMALES

1. Seta j_6 longer than 50 μm and more than half distance between insertions of j_6 and J_2 ; peritreme reaching level between j_1 and j_3
..... *T. carmonae* (Chant et Yoshida-Shaul, 1983)
— Seta j_6 shorter than 30 μm and less than half distance between insertions of j_6 and J_2 ; peritreme reaching the level of j_1 2
2. Seta J_2 more than four times as long as j_6 and almost as long as distance between insertions of J_2 and Z_4 *T. peculiaris* (Kolodochka, 1980)
— Seta J_2 twice as long as j_6 and less than distance between insertions of J_2 and Z_4
..... *T. simplex* (Chant, 1956)

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