

## 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 ( $\mu\text{m}$ ). 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.

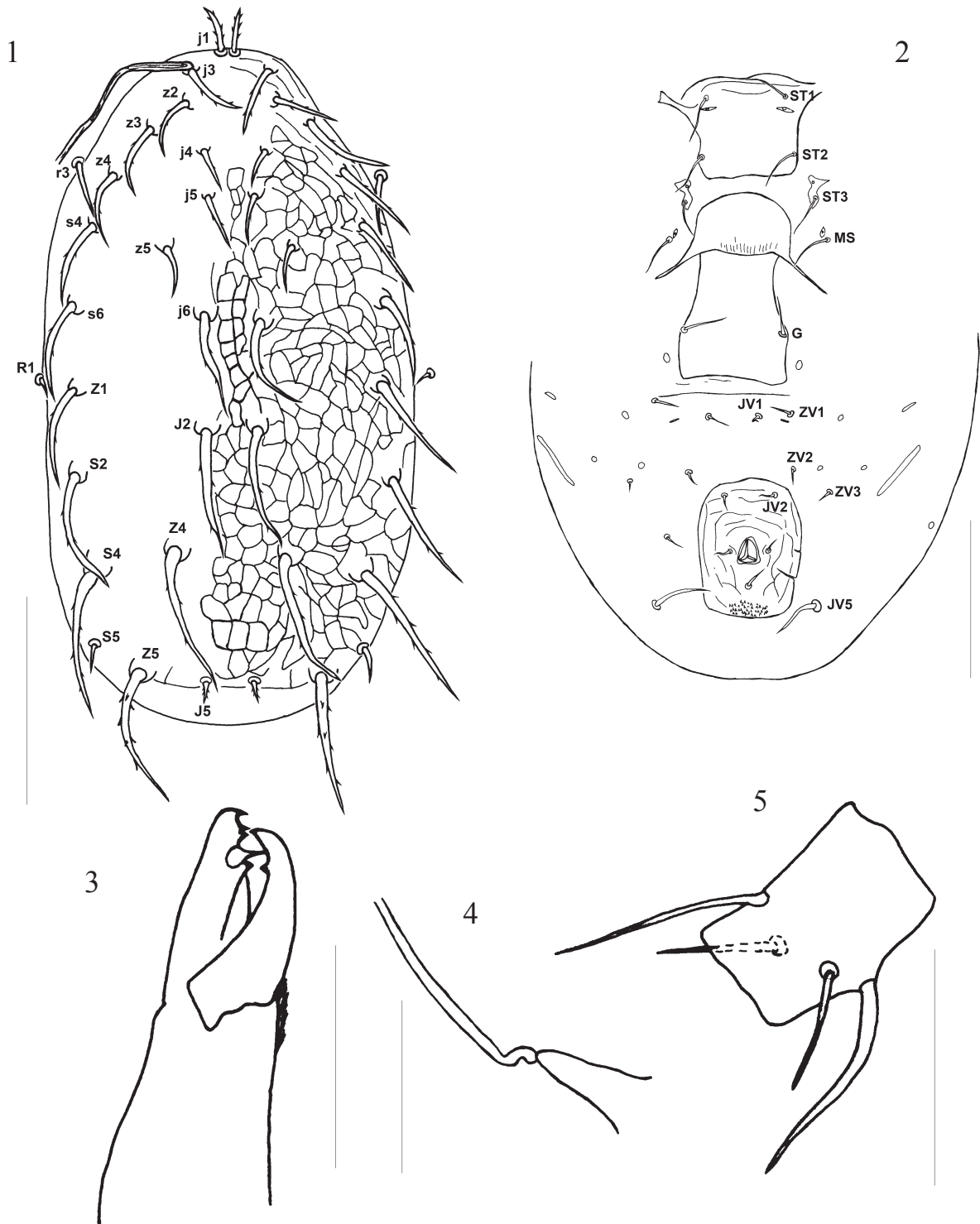
### SYSTEMATICS

**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,  $s_4$



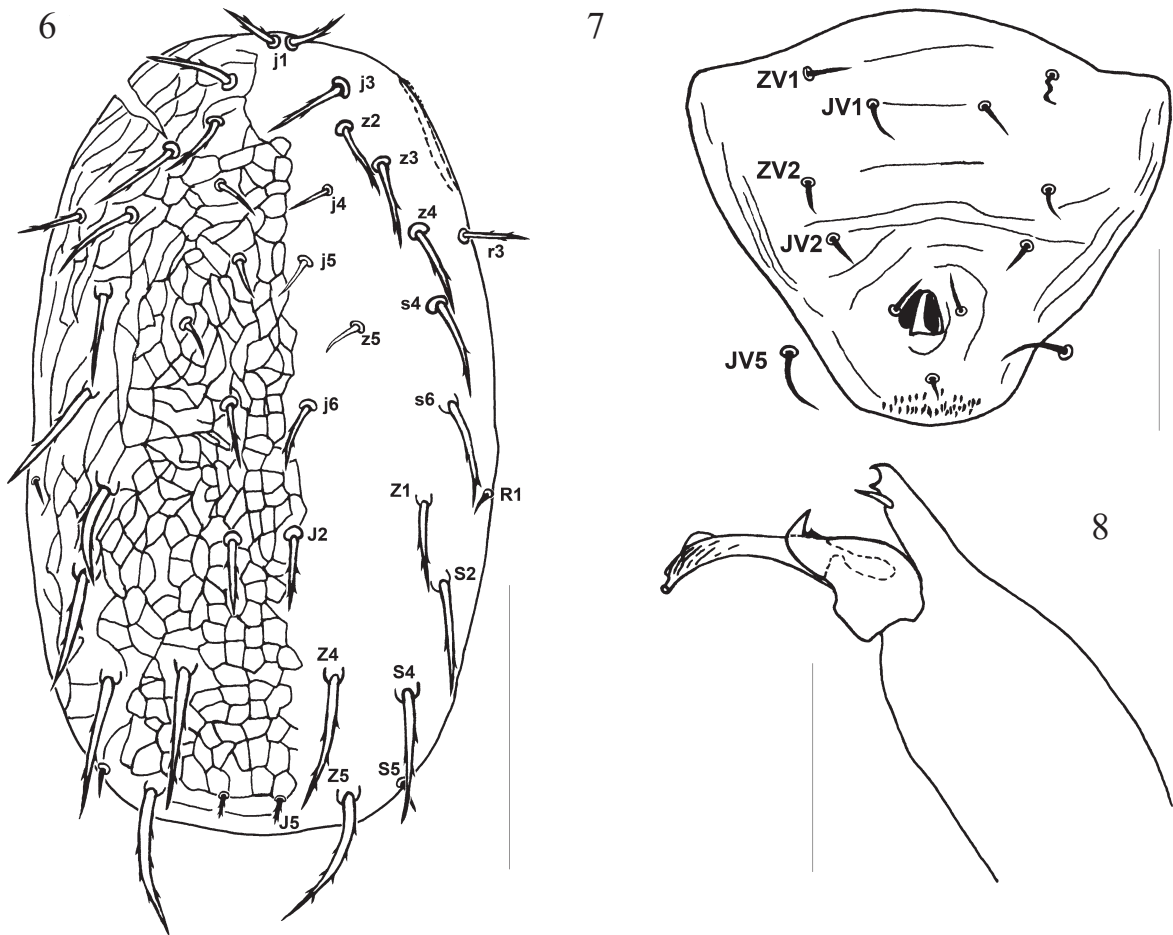
Figs. 1–5. *Typhloseiulus carmonae*, female: 1 — dorsal shield; 2 — ventral surface; 3 — chelicera; 4 — spermatheca; 5 — basitarsus IV. Scale bar: 100  $\mu$ m for 1–2 and 25  $\mu$ m for 3–5.

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  $\mu\text{m}$  for 6, 50  $\mu\text{m}$  for 7, and 25  $\mu\text{m}$  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  $\mu$ 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  $\mu\text{m}$  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  $\mu\text{m}$  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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