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Phytoseiid mites of Hakkâri province, with *Typhlodromus (Anthoseius) tamaricis* Kolodochka, 1982 (Acari: Phytoseiidae), a new record for the predatory mite fauna of Turkey

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Abstract: This study was based on 8 species of 5 genera of Phytoseiidae of the order Mesostigmata (Acari) found in 67 samples. These specimens were collected from Hakkari province in 2005 and 2006. Among the species, *Typhlodromus (Anthoseius) tamaricis* Kolodochka, 1982 is a new record for the Turkish fauna. The descriptions and drawings of female *T. (A.) tamaricis* are given in this paper. The distribution of each species, worldwide and in Turkey, is also presented.

Key words: Acari, Hakkari, Phytoseiidae, predatory mites, Turkey

Typhlodromus (Anthoseius) tamaricis Kolodochka, 1982, Türkiye akar faunası için yeni bir kayıt ile Hakkâri ilinin Phytoseiid akarları (Acari: Phytoseiidae)

Özet: Bu çalışma Mesostigmata (Acari) takımı Phytoseiidae familyasının 5 cins ve 8 türüne ait 67 örneğe dayanmaktadır ve bu örnekler 2005-2006 yılları arasında Hakkari ilinden toplanmıştır. Türler arasından *Typhlodromus (Anthoseius) tamaricis* Kolodochka, 1982 Türkiye faunası için yeni kayıttır. Makalede ayrıca, *T. (A.) tamaricis*'e ait dişi bireylerin resimleri ve yapısal özellikleri ile her bir türün Türkiye ve dünyadaki yayılışı ayrıntılı olarak verilmiştir.

Anahtar sözcükler: Acari, Hakkâri, Phytoseiidae, predatör akar, Türkiye

Introduction

Mites of the family Phytoseiidae are of considerable economic importance, since they are predators of several mites, including spider mites

(Tetranychidae). They have received much attention given the possible use for biological control of pests (Swirski and Amitai, 1982; Şekeroğlu, 1984; Çobanoğlu, 1992; Yıldız, 1998). Çobanoğlu (1989a,

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1989b, 1992, 2004) and Şekeroğlu (1984) carried out several detailed studies on phytoseiid mites (Mesostigmata: Phytoseiidae) in the regions of Anatolia and the Thrace (Trakya) area of Turkey. Kasap et al. (2007) and Kasap and Çobanoğlu (2007) provided a survey of the phytoseiid mites on apple and walnut orchards in the Van and Bitlis provinces of Turkey. However, prior to this study, there have been no available data on the phytoseiid mites of Hakkari province, which is in the southeastern part of Turkey. The aim of this study was to determine the phytoseiid mite fauna and offer a quantitative assessment of mite species collected from Hakkari province.

Materials and methods

During 2005-2006, mite samples were collected from various plants in Hakkari, a province in the southeastern part of Turkey, close to the Iraqi and Iran border (Yüksekova, Şemdinli, Esendere, and Geçimli). The collection sites are shown on the map below (Figure 1). The area is generally covered by steppe vegetation at an elevation of 1000-2100 m altitude. Specimens were collected from various plants, such as weeds and apple, pear, and apricot trees. The samples were taken mainly from unsprayed areas during the summer months of 2005-2006. They were transferred to the laboratory (Plant Protection Department, Agricultural Faculty, Yüzüncü Yıl University, Van) in an icebox. In total, 67 samples from different plants were collected, of which 21 plant species were infested

with mites. Mites were removed from the leaf samples under a stereomicroscope and were preserved in 70% ethyl alcohol. The mites were cleared in lactophenol solution and mounted in Hoyer's medium. The slides were dried (2-4 weeks) at 35 °C. All mites mounted were considered to assess the abundance of the mite's species. The method of identification was based on Rowell et al. (1978), Kolodochka (1978), Arutunjan (1977), Beglyarov (1981), and Chant and Yoshida-Shaul (1987) and all measurements are given in micrometers (µm). The slides of the mounted specimens were deposited in the collection of both authors' collection at the University of Ankara, Department of Plant Protection, Ankara and Çanakkale Onsekiz Mart University, Department of Plant Protection, Çanakkale.

Results

Eight species belonging to the Phytoseiidae family of Mesostigmata (Acari) were collected, of which one is a new record for the mite fauna of Turkey: *Neoseiulus zwoelferi* (Dosse), *Kampimodromus aberrans* (Oudemans), *Euseius finlandicus* (Oudemans), *Phytoseius plumifer* (Canestrini and Fanzago), *Typhlodromus (Anthoseius) kazachstanicus* Wainstein, *T. (A.) tranquillus* Livshitz and Kuznetsov, *T. (A.) bagdasarjani* Wainstein and Arutunjan and *T. (A.) tamaricis* Kolodochka (Table 1). *Typhlodromus (Anthoseius) tamaricis* is the first record for the Turkish acarofauna.



Figure 1. Map of Hakkari province. Collection sites (o).

Table 1. Number of specimens of each Phytoseiidae species, host plants and their abundance which were collected in Hakkari, Turkey.

Genus	Species	Host plants	Number of specimens	Abundance (%)
<i>Kampimodromus</i>	<i>K. aberrans</i>	<i>Malus communis</i> , wild apple	76♀♀ 25♂♂	101 67
<i>Euseius</i>	<i>E. finlandicus</i>	<i>Malus communis</i>	12♀♀	2 1.3
<i>Phytoseius</i>	<i>P. plumifer</i>	<i>Rosa</i> sp.	16♀♀ 1♂	17 11.4
<i>Neoseiulus</i>	<i>N. zwoelferi</i>	<i>Malus communis</i>	3♀♀	3 1.9
<i>Typhlodromus</i>	<i>T. (A.) kazachstanicus</i>	<i>Rosa</i> sp.	11♀♀ 1♂	12 7.6
	<i>T. (A.) tranquillus</i>	<i>Malus communis</i> <i>Prunus</i> sp.	4♀♀	4 2.6
	<i>T. (A.) bagdasarjani</i>	<i>Urtica urens</i>	4♀♀	4 2.6
	<i>T. (A.) tamaricis</i>	<i>Tamarix</i> sp.	6♀♀ 1♂	7 4.4

***Kampimodromus aberrans* (Oudemans, 1930)**

Material examined: Şemdinli; 03.VIII.2005, *Malus communis* L. (2♀♀) (N: 37°47'304; E: 44°35'822; 1394 m), Esendere; 03.VIII.2005, *M. communis* (57♀♀, 25♂♂) (N: 37°42'905; E: 44°36'772; 1640 m), Esendere; 03.VIII.2005, wild apple (8♀♀) (N: 37°42'415; E: 44°32'033; 1810 m), Esendere; 16.VII.2006, *M. communis* (17♀♀, 5♂♂) (N: 37°42'905; E: 44°36'772; 1640 m), Yüksekova; 03.VIII.2005, *M. communis*, (9♀♀) (N: 37°40'446; E: 44°23'138; 2062 m), Yüksekova; 16.VII.2006, *M. communis*, (15♀♀, 7♂♂) (N: 37°40'446; E: 44°23'138; 2062 m) (Table 1).

Comments: *Kampimodromus aberrans* is very commonly found on various plants such as apple, hazelnut, and pear in all regions of Turkey (Swirski and Amitai, 1982; Düzgüneş and Kılıç, 1983; Çobanoğlu et al., 2003; Kasap and Çobanoğlu, 2007; Kasap et al., 2007). It was previously collected among the colonies of Eriophyidae, Tarsonomidae, and Tenuipalpidae (Çobanoğlu, 2004). *Kampimodromus aberrans* was found associated with the colonies of Eriophyidae, Tarsonomidae, Tetranychidae, and Tydeidae in the area visited during the surveys in Hakkari.

***Euseius finlandicus* (Oudemans, 1915)**

Material examined: Şemdinli; 03.VIII.2005, *M. communis* (12♀♀) (N: 37°47'304; E: 44°35'822; 1394 m) (Table 1).

Comments: *Euseius finlandicus* is a very common species and distributed all over the country. It was collected by Çobanoğlu (2004) and is associated with the colonies of Tetranychidae, Tenuipalpidae, and Eriophyidae. This species was also found on various plants in Turkey, such as apple, hazelnut, pear, citrus, and grape (Düzgüneş and Kılıç, 1983; Şekeroğlu, 1984; Çobanoğlu, 1989a; Kasap et al., 2007). In this survey, *Euseius finlandicus* was collected from the colonies of Tetranychidae.

***Phytoseius plumifer* (Canestrini and Fanzago, 1876)**

Material examined: Esendere; 03.VIII.2005, *Rosa* sp. (6♀♀, 1♂) (N: 37°42'998; E: 44°37'194; 1646 m) (Table 1).

Comments: *Phytoseius plumifer* is a very common species and distributed all over Turkey. It was collected on apple leaves from Ankara (Çobanoğlu, 1997, 2004). The dorsal shield lightly sclerotized and some of the dorsal setae are thickened, massive and crenate (Çobanoğlu, 1997).

***Neoseiulus zwoelferi* (Dosse, 1957)**

Material examined: Yüksekova (Köprücük); *M. communis*, 03.VIII.2005, (3♀♀) (N: 32°34'233; E: 44°10'873; 1866 m) (Table 1).

The dorsal shield is moderately sclerotized and this species has funnel-shaped spermatheca with conical calyx and an atrium on a long neck (Figure 2a). It has

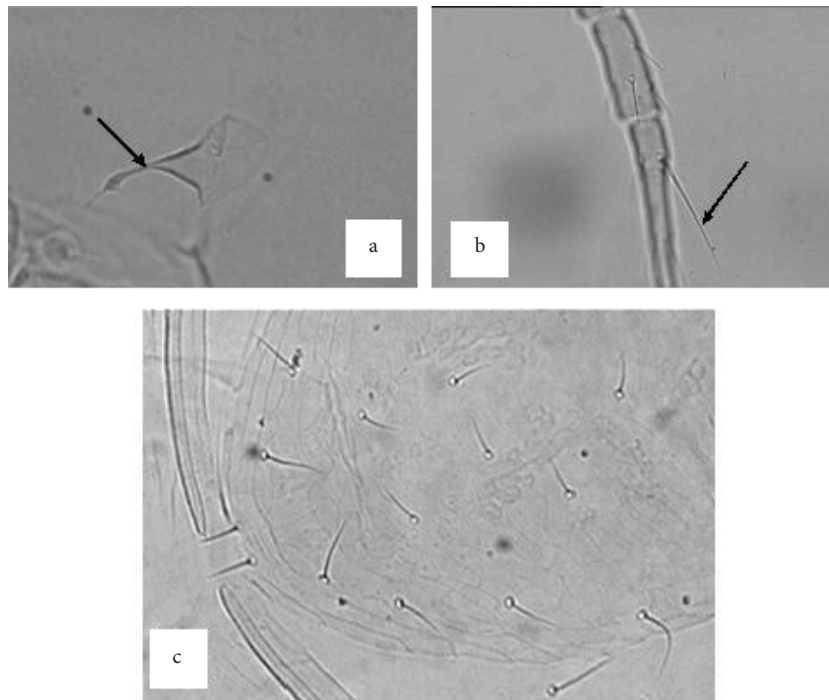


Figure 2. *Neoseiulus zwoelferi* (Dosse), a: spermatheca (♀), b: macroseta on leg IV, c: anterior part of dorsal shield and peritreme.

long macroseta on basitarsus IV. Apex of the peritreme reaches the vertical setae (Figure 2b-c).

Comments: *Neoseiulus zwoelferi* was collected from apple trees in Erzurum (Çobanoğlu, (1989b), *Rosa damascena*, *Rosa canina*, and *Elaeagnus* sp. in Ankara (Çobanoğlu and Bayram, 1999), and from *Betula pendula* and *Populus* sp. in Erzurum (Alaoğlu, 1996).

***Typhlodromus (Anthoseius) kazachstanicus* Wainstein, 1958**

Material examined: Başkale; 03.VIII.2005, *M. communis*, (3♀♀) (N: 37°31'822; E: 44°21'574; 1890 m), Esendere; 03.VIII.2005, *Rosa* sp., (1♀, 1♂) (N: 37°42'998; E: 44°37'194; 1646 m), Esendere; 16.VII.2006, *M. comminis* (8♀♀, 3♂♂) (N: 37°42'905; E: 44°36'772; 1640 m), Yüksekova (Köprücük); 03.VIII.2005, *M. communis* (7♀♀) (N: 32°34'233; E: 44°10'873; 1866 m), Yüksekova; 17.VII.2006, *M. comminis*, (4♀♀) (N: 37°40'446; E: 44°23'138; 2062 m) (Table 1).

Typhlodromus (Anthoseius) kazachstanicus has cup-shaped spermatheca (Figure 3a) and the seta S5 is

relatively shorter than the other opisthosomal setae (Figure 3b). This species has a long macroseta on the tarsi of leg IV (Figure 4a) and the peritreme is relatively shorter (Figure 4b).

Comments: *Typhlodromus (A.) kazachstanicus* was firstly reported from apple trees in Erzurum, Turkey (Ecevit, 1977). It was previously collected with the colonies of *Bryobia rubrioculus* (Scheuten) (Prostigmata: Tetranychidae), Tydeidae, and Stigmaeidae in Tatvan (Bitlis) (Kasap and Çobanoğlu, 2007). In this study, *T. (A.) kazachstanicus* was collected with the colonies of *B. rubrioculus* on apple leaves.

***Typhlodromus (Anthoseius) tranquillus* (Livshitz and Kuznetsov, 1972)**

Material examined: Başkale; 03.VIII.2005, *M. communis*, (1♀) (N: 37°31'822; E: 44°21'574; 1890 m), Şemdinli; 03.VIII.2005, *Prunus* sp., (3♀♀) 03.VIII.2005 (N: 37°18'890; E: 44°33'878; 1405 m) (Table 1).

Comments: *Typhlodromus (Anthoseius) tranquillus* was collected on apple leaves and vineyards from

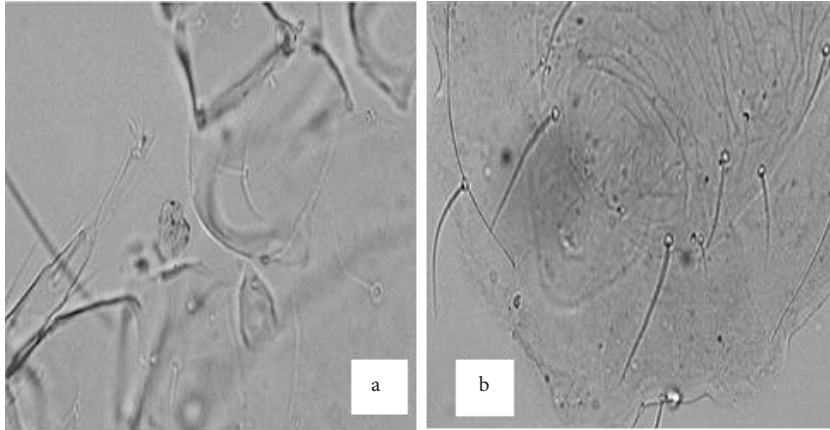


Figure 3. *Typhlodromus (Anthoseius) kazachstanicus* Wainstein (♀), a: spermatheca, b: arrangement of dorsal setae on opisthosoma.

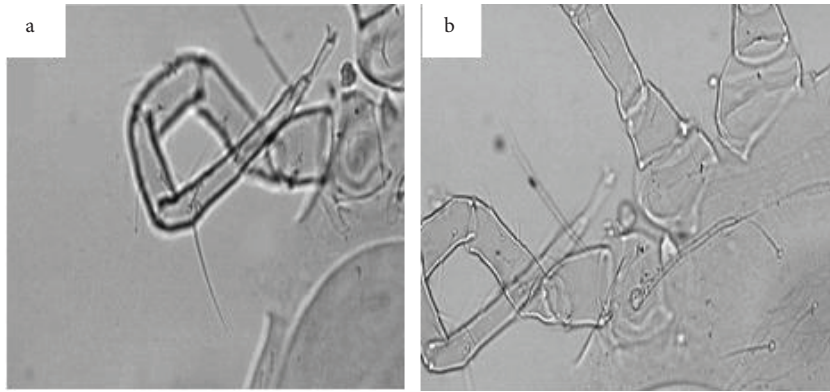


Figure 4. *Typhlodromus (Anthoseius) kazachstanicus* Wainstein (♀), a: macroseta on leg IV, b: lateral view of idiosoma with peritreme.

Ankara and İzmir (Çobanoğlu, 1997; Göven et al., 1999) and Van (Kasap and Çobanoğlu, 2007). It was found associated with the colonies of *B. rubrioculus* on apple leaves in this study.

***Typhlodromus (Anthoseius) bagdasarjani* (Wainstein and Arutunjan, 1967)**

Material examined: Hakkari (Geçimli); 03.VIII.2005, *Urtica urens* L. (Urticaceae) 03.VIII.2005, (4♀♀) (N: 37°22'355; E: 43°31'030; 931 m) (Table 1).

Comments: *Typhlodromus (Anthoseius) bagdasarjani* was mentioned in association with *Tetranychus telarius* Linn. (= *T. urticae* Koch), *Eriophyes tristriatus* (Nalepa) and *Aceria hippophaenus* (Nalepa) (Arutunjan, 1977). In

addition, Kolodochka (1978) collected it from olive and tamarisk plants in Turkmenia. During this study, it was found among the colonies of *T. urticae* and stigmatid mites.

***Typhlodromus (Anthoseius) tamaricis* (Kolodochka, 1982)**

Material examined: Esendere; 03.VIII.2005, *Tamarix* sp. 03.VIII.2005, (6♀♀, 1♂) (N: 37°42'905; E: 44°36'772; 1640 m) (Table 1).

Comments: *Typhlodromus (Anthoseius) tamaricis* is a new record for the fauna of Turkey. This mite was collected for the first time on *Tamarix* sp. in Turkmenia in 1982 by Kolodochka. *Typhlodromus (Anthoseius) tamaricis* resembles *T. (A.) bagdasarjani* and *T. (A.) kazachstanicus*. There are no preanal pores

on ventrianal shield and with a long macroseta on the tarsi of leg IV in all these species. The differences are that the spermatheca of *T. (A.) tamaricis* has a long tube-like calyx and longer peritremes than the other 2 species.

Female

Dorsum: Dorsal plate 355 ± 7.63 (345-370) long and 188 ± 3.47 (180-205) μm wide ($n = 3$). Dorsal shield is well sclerotized, reticulated, and with lateral margins constricted, it bears 5 pairs of distinct dorsal pores and 18 pairs of dorsal setae (Figure 5a). One pair of verticals (j1), 4 pairs of dorsocentrals (j4, j5, j6, J2), 2 pairs of mediolaterals (z5, Z4), 6 pairs of prolaterals (j3, z2, z3, z4, s4, s6), 4 pairs of postlaterals (S2, S4, S5, Z5), and 1 pair of clunals. The last lateral (Z5) and the posterior mediolateral (Z4) setae are slightly serrated. The dorsal setae extending to the bases of following setae. Anterior two laterals (j3, z2) almost equal in length and not extending to the bases of the following setae. On opisthosomal shield, seta

(S5) slightly longer or equal length of S2 and S4 (Figure 5a). The length of dorsal setae as follows: j1: 21 ± 1.02 (20-23); j3: 21 ± 1.66 (18-23); j4- j6 and J2: 9 ± 1.02 (8-10); z2: 14 ± 1.66 (13-18); z3: 19 ± 4.40 (13-28); z4: 16 ± 3.06 (13-20); s4: 14 ± 1.66 (13-18); s6: 22 ± 1.66 (20-25); S2: 29 ± 2.20 (25-33); S4: 28 ± 1.44 (25-30); S5: 29 ± 2.20 (25-33); Z4: 35 ± 2.5 (33-40) and Z5: 50 ± 1.44 (48-53) μm ($n = 3$) (Table 2). Chelicera: fixed digit with four subapical teeth on the base and a pilus dentilis. The mobile digit of the chelicerae had 1 tooth (Figure 5b). The peritremes extend beyond the level of the first lateral setae (Figure 5a). Leg IV: had 3 small macrosetae on genu tibia and basitarsus. The longest macroseta was on the basitarsus with a small apical knob (Figure 5c). The measurement of these setae are: 18 ± 1.66 (15-20); 19 ± 0.83 (18-20); 48 ± 0.83 (48-50) μm long, respectively (Table 2).

Venter: Sternal, genital and ventrianal plates exist on the ventral side. Sternal shield with 2 pairs of setae and 2 pairs of slit-like pores. The third pair of sternal seta (St3) situated on the interscutal membrane (Figure 6a). The metasternal setae are placed on small platelets. Linear plates occur between genital and ventrianal shields. The ventrianal plate is elongate with lateral margins constricted and bears 4 pairs of preanal setae and without preanal pores. Ventrianal shield 108 ± 2.5 (105-113) μm length and 79 ± 8.45 (63-90) μm width (Table 2). Spermatheca: with a relatively long, narrow tube-like and almost parallel sides calyx (Figure 6b).

One male was found in this study, but was not in a good condition for body measurements. Kolodochka (1982) reported that males are smaller than females with spermatodactyl r-shaped (Figure 6c). The measurements of the specimens obtained from Turkey were also compared with those of Turkmenian population given by Kolodochka (1982). All measurements are concurred with the samples from Turkey and are shown in Table 2.

Discussion

In the present study, 8 species of phytoseiid mites belonging to 5 genera were recorded for the first time for Hakkari province. From the collected species in that province, *T. (A.) tamaricis* is a new record for

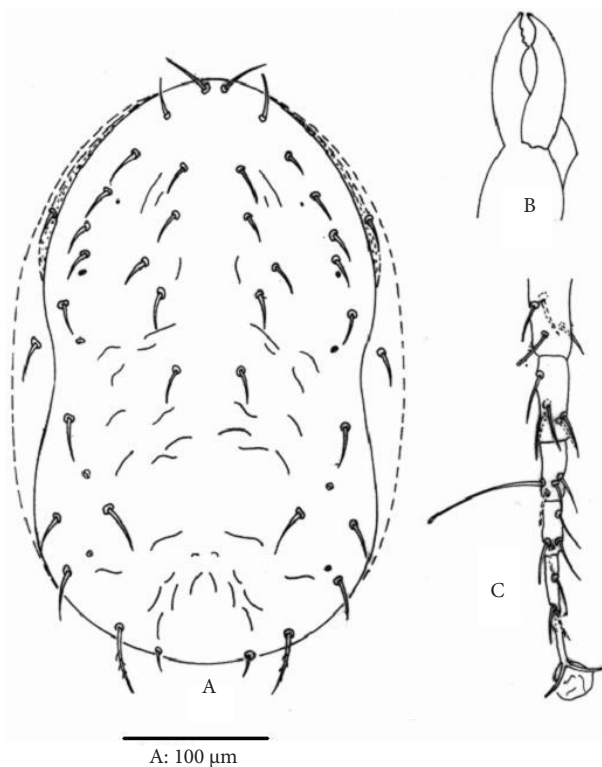


Figure 5. *Typhlodromus (Anthoseius) tamaricis* (Kolodochka) (♀), A: dorsal shield B: chelicera C: leg IV with macroseta.

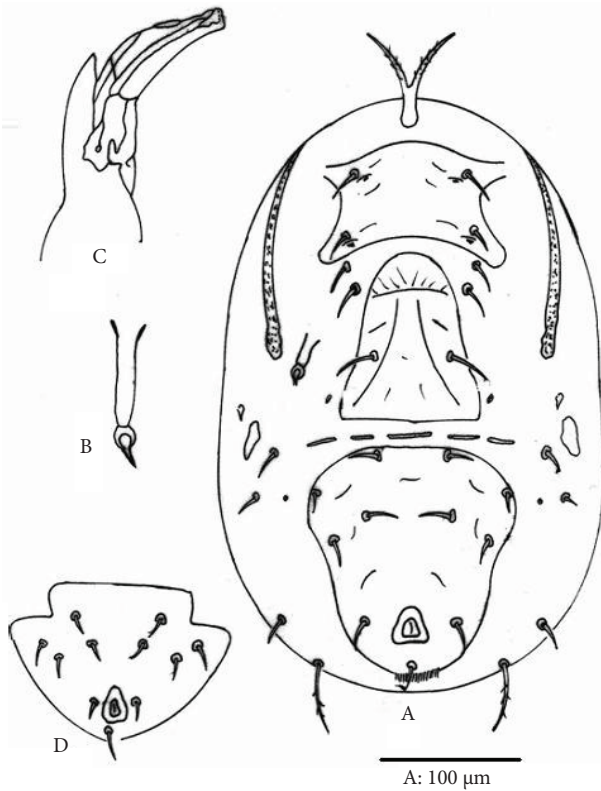


Figure 6. *Typhlodromus (Anthoseius) tamaricis* (Kolodochka) (♀), A: ventral view of idiosoma B: spermatheca, C: spermatodactyl (♂), D: ventrianal shield (♂) (Figure 6 C and D after Kolodochka (1982)).

Turkish acarofauna. The measurements of *T. (A.) tamaricis* obtained from Turkey were compared with those of Turkmenian population given by Kolodochka (1982). Furthermore, the drawings of spermatheca, macroseta on leg IV, basitarsus, length of peritreme and setae on opisthosoma of *T. (A.) tamaricis* obtained from Hakkari are presented in this manuscript.

In this study, *K. aberrans* and *T. (A.) kazachstanicus* were the most common species. The other phytoseiid species collected from this region were *E. finlandicus*, *T. (A.) tranquillus*, *P. plumifer*, *N. zwoelferi*, and *T. (A.) bagdasarjani*. The figures of spermatheca, macroseta on leg IV, basitarsus, peritreme and setae on opisthosoma of *T. (A.)*

Table 2. Measurements of the *Typhlodromus (Anthoseius) tamaricis* (Kolodochka) obtained from Hakkari (Turkey) and Turkmenia population (Kolodochka, 1982).

Measurements (μm)	Turkey	Turkmenia
Dorsal length	355	350
Dorsal width	188	155
j1	21	23
j3	21	15
j4	9	14
j5	-	15
j6	-	17
J2	-	19
z2	14	20
z3	19	20
z4	16	20
z5	-	15
Z4	35	36
Z5	50	50
s4	14	21
s6	22	24
S2	29	28
S4	28	-
S5	29	15
Macroseta Leg IV	48	45
Ventrianal length	108	110
Ventrianal width	79	92

kazachstanicus and *N. zwoelferi* are also presented in this manuscript. We regard this study as a preliminary effort in determining the predatory mite fauna in this region and possibly considering them in the context of a biological control system.

Acknowledgements

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