

Predatory mite fauna of Phytoseiidae of northwest Iran (Acari: Mesostigmata)

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Abstract: To determine the predatory mite family Phytoseiidae associated with spider mites in northwest Iran, a survey was carried out during 2006-2007. Nineteen species from 7 genera of the family Phytoseiidae were collected and identified. Measurements are given and some morphological characters are discussed. A key is provided to identify the adult females of the known 27 species of Phytoseiidae of that area. The following new synonymies are proposed: *Neoseiulus vardgesi* (Arutunjan, 1968) as a junior synonym of *N. zwoelferi* (Dosse, 1957); *Transeius caspiansis* (Denmark and Daneshvar, 1982) and *T. patellae* (Karg, 1982) as junior synonyms of *T. wainsteini* (Gomelaury, 1968); *Phytoseius ciliatus* Wainstein, 1975 as a junior synonym of *P. juvenis* Wainstein and Arutunjan, 1970; and *Typhlodromus iranensis* (Denmark and Daneshvar, 1982) as a junior synonym of *T. (A.) kazachstanicus* Wainstein, 1958.

Key words: Fauna, Iran, key, Phytoseiidae, synonymy

Introduction

Family Phytoseiidae has been generally considered to be the most promising group of predators of pest mites on different crops (Gerson et al., 2003) and other small arthropods. This taxon is relatively well known in Iran and more than 70 species have been reported as new species or new records (Khalil-Manesh, 1973; McMurtry, 1977; Sepasgosarian, 1977; Daneshvar 1980; 1987; Daneshvar and Denmark, 1982; Hajizadeh et al., 2002; Hajizadeh, 2006; Kolodochka et al., 2003;

Kamali et al., 2001; Faraji et al., 2007a; Faraji et al., 2007b; Faraji et al., 2008; Shirdel et al., 2008). The study area, northwest Iran, consists of 4 provinces, namely East Azarbaijan, West Azarbaijan, Ardabil, and Zanzan. The only notable study in this region was carried out by Shirdel (2003) in East Azarbaijan. The objective of the present study was to reveal the species composition of phytoseiid mites associated with spider mites in northwest Iran and to provide a key to facilitate identification of the known species in the area.

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Materials and methods

The specimens were collected by placing plant foliage, litter, and soil in a Berlese/Tullgren set-up or by direct examination under a stereomicroscope. More than 1000 specimens of Phytoseiidae were collected and mounted. The specimens were taken during spring and summer 2006. Mites were cleared in lactophenol solution and mounted in Hoyer's medium on microscope slides. The notations used for dorsal and ventral setations follow those of Rowell et al. (1978) and Chant and Yoshida-Shaul (1992), respectively. All specimens were collected by the senior author unless stated otherwise. All measurements are given in micrometers (μm). The average measurements followed by the respective ranges in parentheses. The synonyms and worldwide distributions are based on Ecevit (1981), Düzgüneş and Kılıç (1983), Çobanoğlu (1989, 1993a, 1993b, 1997, 2004), Çobanoğlu et al. (2003), Moraes et al. (2004), and Faraji et al. (2007a). The voucher slide mounted materials are deposited in the mite collection of the Department of Entomology, Faculty of Agriculture, Tarbiat Modares University, Tehran, Iran. Species of *N. zwoelferi* and *T. (A.) kazachstanicus* were examined from the private collection of Dr. D. Shirdel (Department of Plant Pests and Diseases Research, Agricultural and Natural Research Centre of East Azarbaijan Province, Khosrowshahr, Iran).

Results and discussion

Kampimodromus aberrans (Oudemans, 1930)

Typhlodromus aberrans Oudemans, 1930: 48

Distribution: Algeria, Armenia, Azerbaijan, Bulgaria, Byelorussia, Canada, Caucasus region, Czech Republic, England, France, Georgia, Germany, Greece, Hungary, Iran, Israel, Italy, Moldova, Montenegro, Netherlands, Norway, Poland, Portugal, Russia, Spain, Switzerland, Turkey, Ukraine, and USA.

Collection data: 15.6.2006 in Uromiyeh on the ground of an apple orchard, 1 female.

Remarks: Measurements of 1 adult female collected in this study are: dorsal shield length 280, width at level of j_6 228, j_1 17, j_3 28, j_4 16, j_5 16, j_6 17, J_2 22, J_5 8, z_2 28, z_4 34, z_5 17, Z_1 22, Z_4 38, Z_5 55, s_4 40, S_2 39, S_5 21, r_3 30, R_1 27, length of ventrianal shield 83,

width at ZV_2 level 52, length of calyx of spermatheca 10. The data regarding the female collected in this study agree with the measurements given in the re-descriptions by Kolodochka (1978) and Miedema (1987). This species was found associated with *Tetranychus urticae* Koch (Tetranychidae) and *Tydeus* sp. (Tydeidae).

Transeius wainsteini (Gomelauri, 1968)

Amblyseius wainsteini Gomelauri, 1968: 518

Amblyseius patellae Karg, 1982: 204, **New Synonym**

Typhlodromips caspiansis Denmark & Daneshvar, 1982: 5, **New Synonym**

Distribution: Armenia, Azerbaijan, Denmark, Georgia, Germany, Russia, Iran, and Poland.

Collection data: 26.7.2006 in Fandogloo on hazelnut (*Corylus avellana* L.), 3 females; 11.7.2006 in Fandogloo on common medlar (*Prostanthera lasianthos* Labill.), 3 females and 1 male; 16.7.2006 in Zanjan on sunflower (*Helianthus annuus* L.), 2 females; 11.7.2006 in Fandogloo on common alder (*Alnus* sp.), 1 female and 2 males; 11.7.2006 in Fandogloo on pussy willow (*Salix discolor* Muhl.), 1 female; 26.7.2006 in Fandogloo on European plum (*Prunus domestica* L.), 4 females and 1 male; 12.7.2006 in Fandogloo on wild apple (*Malus* sp.), 2 females.

Remarks: There has been a big confusion on the identification of this species in Iran (Faraji et al., 2007a). First Daneshvar (1980) reported *Amblyseius similis* (Koch) from northern Iran. Later, Denmark and Daneshvar (1982) described it as a new species, *T. caspiansis* under genus *Typhlodromips*. Eventually, the same species collected from the northern Iran was reported as *T. patellae* by Abbasipour et al. (2005). Faraji et al. (2007a) examined the type material of *T. patellae* and found it conspecific with *T. caspiansis*. *Transeius wainsteini*, which has been described from Georgia, has all the morphological characters similar to these 2 species. Since the holotype of *A. similis* has been lost (Yoshida-Shaul and Chant, 1995), we consider *A. similis* as *nomen dubium* and the oldest available and valid name for this species is *T. wainsteini*. Measurements of 5 adult females collected in this study are: Dorsal shield length 377 (365–384), width at level of j_6 226 (220–

229), j_1 23 (21–24), j_3 47 (45–49), j_4 8 (7–8), j_5 8 (7–8), j_6 8 (7–8), J_2 9 (7–10), J_5 8, z_2 23 (22–24), z_4 32 (30–33), z_5 7 (7–8), Z_1 13 (11–14), Z_4 109 (105–112), Z_5 117 (112–120), s_4 68 (65–70), S_2 29 (26–31), S_4 17 (16–18), S_5 12 (11–14), r_3 25 (22–26), R_1 15 (14–17), length of ventrianal shield 114 (107–117), width at ZV_2 level 88 (85–90), length of calyx of spermatheca 13 (10–16), *Sge* IV 91 (83–94), *Sti* IV 57 (54–63), *St* IV 57 (55–61), and *Sge* III 42 (37–47). Measurements of the specimens collected in this study agree well with the original description of *T. wainsteini* (Gomelaui, 1968) and re-description by Karg (1977). The Iranian strain of this species can have longer Z_5 seta up to 130 μm (F. Faraji, pers. obser.). This is the first report of *T. wainsteini* from northwestern Iran. This mite is predacious on other mites and maybe some small insects. In the hazelnut orchards and sunflower, this mite was found associated with *T. urticae* and in wild apple trees, it was collected among populations of *Panorychus ulmi* (Koch) and *Aceria* sp. (Eriophyidae).

***Paraseiulus soleiger* (Ribaga, 1904)**

Seiulus soleiger Ribaga, 1904: 176

Paraseiulus incognitus Wainstein & Arutunjan, 1967: 1768

Paraseiulus trimediosetus (Xin et al., 1980): 469

Paraseiulus xiningensis Chen & Chu, 1980: 12 (according to Wu et al., 1992)

Distribution: Alaska, Armenia, Austria, Azerbaijan, Byelorussia, Canada, Caucasus region, China, Czech republic, Denmark, England, Finland, France, Georgia, Germany, Hungary, Iran, Italy, Japan, Kazakhstan, Latvia, Moldova, Netherlands, Norway, Poland, Russia, Sweden, Switzerland, Turkey, Ukraine, and USA.

Collection data: 26.7.2006 in Fandogloo on hazelnut (*C. avellana*), 2 females; 11.7.2006 in Fandogloo on pussy willow (*S. discolor*), 2 females; 11.7.2006 in Fandogloo on common alder (*Alnus* sp.), 2 females.

Remarks: Measurements of 5 adult females collected in this study are: dorsal shield length 310 (300–315), width at level of j_6 195 (188–198), j_1 15 (12–16), j_3 19 (18–20), j_4 11 (10–13), j_5 15 (14–17), j_6 17 (16–19), J_2 18 (17–20), J_5 6 (5–8), z_2 20 (19–22), z_3

24 (21–25), z_4 24 (21–25), z_5 14 (13–15), z_6 16 (15–17), Z_4 24 (22–27), Z_5 30 (29–33), s_4 26 (25–27), s_6 26 (25–27), S_2 24 (23–26), S_4 24 (23–26), S_5 29 (26–31), r_3 22 (20–25), R_1 18 (16–19), length of ventrianal shield 96 (91–99), width at ZV_2 level 44 (41–46), length of calyx of spermatheca 21 (18–23). Measurements of the specimens collected in northwestern Iran agree well with the re-descriptions given by Chant and Yoshida-Shaul (1982). *Paraseiulus soleiger* was found in association with *Acalitus alnusae* Hong et al. (Eriophyidae) on common alder (*Alnus* sp.) and *Phytoptus avellanae* Nalepa (Eriophyidae) on hazelnut.

***Paraseiulus talbii* (Athias-Henriot, 1960)**

Typhlodromus talbii Athias-Henriot, 1960: 75

Paraseiulus amaliae (Ragusa & Swirski, 1976): 183

Paraseiulus ostiolatus Athias-Henriot, 1978: 699

Paraseiulus subsoleiger Wainstein, 1962: 139

Paraseiulus tetramedius (Zaher & Shehata, 1970): 117

Distribution: Algeria, Armenia, Azerbaijan, Caucasus region, China, Denmark, Egypt, Finland, France, Germany, Georgia, Greece, Hungary, Iran, Israel, Italy, Kazakhstan, Moldova, Netherlands, Slovakia, Spain, Sweden, Switzerland, Turkey, and Ukraine.

Collection data: 5.9.2006 in Mahabad on beet (*Beta vulgaris* L.), 3 females.

Remarks: Measurements of 3 adult females collected in this study are: dorsal shield length 367 (364–372), width at level of j_6 221 (216–225), j_1 20 (19–22), j_3 26 (24–28), j_4 24 (20–26), j_5 20 (18–21), j_6 33 (32–34), J_2 33 (30–34), J_5 13, z_2 27 (26–29), z_3 27 (26–29), z_4 33 (31–34), z_5 24 (22–26), z_6 21 (18–22), Z_3 29 (26–32), Z_4 40 (38–42), Z_5 46 (45–48), s_4 34 (32–35), s_6 38 (36–40), S_2 42 (41–44), S_4 33 (32–34), S_5 39 (38–40), r_3 24 (22–25), R_1 28 (27–30), length of ventrianal shield 150 (149–152), width at ZV_2 level 45 (43–47), length of calyx of spermatheca 16 (14–17). The measurements of the Iranian specimen are similar to those given by Chant and Yoshida-Shaul (1982). This mite was observed in association with members of the family Tenuipalpidae and Eriophyidae.

***Paraseiulus triporus* (Chant & Yoshida-Shaul, 1982)**

Typhlodromus triporus Chant & Yoshida-Shaul, 1982: 3029

Distribution: Denmark, Finland, Georgia, Germany, Greece, Iran, Italy, Kazakhstan, Moldova, Netherlands, Portugal, Russia, Sweden, Turkey, Ukraine, and USA.

Collection data: 11.7.2006 in Fandogloo on common medlar (*P. lasianthos*), 1 female; 11.7.2006 in Fandogloo on common alder (*Alnus* sp.), 1 female.

Remarks: Measurements of 2 adult females collected in this study are: dorsal shield length 350 (345–355), width at level of j_6 180 (178–182), j_1 21 (20–22), j_3 20 (18–22), j_4 12 (10–14), j_5 11, j_6 13, J_2 13, J_5 5, z_2 15 (14–16), z_3 21 (20–22), z_4 21 (20–22), z_5 12 (11–13), z_6 13 (12–14), Z_4 22 (20–24), Z_5 53 (50–56), s_4 22 (20–24), s_6 23 (22–24), S_2 24 (23–25), S_4 26 (25–27), S_5 24 (23–25), r_3 23 (22–24), R_1 21 (20–22), length of ventrianal shield 109 (107–111), width at ZV_2 level 47 (45–49), length of calyx of spermatheca 16. The lengths of dorsal setae of the specimens collected in this study are significantly shorter than those given by Faraji et al. (2007b) on the specimens collected from northern Iran. The existence of short and long dorsal setae strains in a country is contrary to the claim made by Chant and Yoshida-Shaul (1982) that the Old World specimens have longer dorsal setae than those of the New World. This species was found associated with colonies of eriophyid mites on common medlar (*P. lasianthos*) and common alder (*Alnus* sp.).

***Phytoseius juvenis* Wainstein & Arutunjan, 1970**

Phytoseius (*Dubininellus*) *juvenis* Wainstein & Arutunjan, 1970: 1501

Phytoseius (*Dubininellus*) *ciliatus* Wainstein, 1975: 921, **New Synonym**

Distribution: Iran and Russia.

Collection data: 11.7.2006 in Fandogloo on pussy willow (*S. discolor*), 4 females.

Remarks: Measurements of 4 adult females collected in this study are: dorsal shield length 380 (370–385), width at level of j_6 170 (167–173), j_1 33 (30–35), j_3 38 (36–40), j_4 15 (14–17), j_5 5, j_6 5 (4–6), J_2 5 (4–6), J_5 6, z_2 10 (9–11), z_3 28 (26–30), z_4 68 (65–70),

z_5 82 (81–83), Z_4 83 (80–86), Z_5 94 (92–98), s_4 93 (87–96), s_6 101 (97–105), length of ventrianal shield 91 (89–92), width at ZV_2 level 72 (70–74), length of calyx of spermatheca 18 (16–19), *Sge* IV 41 (39–44) *Sti* IV 90 (80–96) and *St* IV 30 (28–30). All the measurements and morphological characters in the original descriptions of *P. juvenis* and *P. ciliatus* are similar to each other. Therefore, we consider *P. ciliatus* a junior synonym of *P. juvenis*. This species was found feeding on *T. urticae* and eriophyids.

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

Gamasus plumifer Canestrini & Fanzago, 1876: 130

Phytoseius dubinini (Beglyarov, 1958): 116

Phytoseius finitimus Ribaga, 1904: 178

Phytoseius tropicalis Daneshvar, 1987: 30

Distribution: Algeria, Armenia, Azerbaijan, Caucasus region, Egypt, France, Georgia, Greece, Hungary, Iran, Israel, Italy, Jordan, Kazakhstan, Lebanon, Montenegro, Portugal, Spain, Turkey, Ukraine, and USA.

Collection data: 10.7.2006 in Bilesavar on raspberry (*Rubus ideaus* L.), 7 females; 13.7.2006 in Parsabad on sunflower (*H. annuus*), 1 female; 10.7.2006 in Zanjan on the ground of a fruit orchard, 1 female; 10.9.2006 in Zanjan on weeds, 2 females.

Remarks: Measurements of 5 adult females collected in this study are: dorsal shield length 315 (310–322), width at level of j_6 150 (147–154), j_1 27 (25–28), j_3 57 (52–59), j_4 15 (14–17), j_5 11 (9–12), j_6 11 (9–12), J_2 14 (12–16), J_5 12 (10–13), z_2 9, z_3 41 (38–45), z_4 14 (12–15), z_5 102 (98–106), Z_4 63 (58–66), Z_5 110 (95–115), s_4 95 (92–100), s_6 114 (110–117), r_3 45 (43–47), R_1 19 (18–21), length of ventrianal shield 80 (77–81), width at ZV_2 level 42 (39–44), length of calyx of spermatheca 13, *St* IV 34 (32–36). *Phytoseius plumifer* was collected on raspberry (*R. ideaus*) in association with *T. urticae*, in fruit orchards with the colonies of *Aphis gossypii* (Glover), *Cenopalpus ruber* Wainstein, and *C. pulcher* (Canestrini and Fanzago) (Tenuipalpidae).

***Euseius amissibilis* Meshkov, 1991**

Euseius amissibilis Meshkov, 1991: 138

Distribution: Iran and Tajikistan.

Collection data: 26.7.2006 in Tabriz on the ground of an apple orchard, 1 female.

Remarks: Measurements of 1 adult female collected in this study are: dorsal shield length 340, width at level of j_6 167, j_1 33, j_3 33, j_4 13, j_5 17, j_6 14, J_2 17, J_5 9, z_2 29, z_4 28, z_5 15, Z_1 15, Z_4 25, Z_5 65, s_4 38, S_2 22, S_4 26, S_5 26, r_3 20, R_1 17, St IV 50. Due to poor mounting, measurements of ventrianal shield and spermatheca cannot be given. This is the first report of *E. amissibilis* from northwestern Iran. It was found associated with *T. urticae* colonies mixed with eriophyids.

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

Seiulus finlandicus Oudemans, 1915: 183

Euseius pruni (Oudemans, 1929): 32

Distribution: Algeria, Angola, Argentina, Armenia, Austria, Azerbaijan, Belgium, Bulgaria, Byelorussia, Canada, Caucasus region, China, Costa Rica, Czech republic, Denmark, El Salvador, England, Finland, France, Georgia, Germany, Greece, Honduras, Hungary, India, Indonesia, Iran, Italy, Japan, Kazakhstan, Latvia, Mexico, Moldova, Montenegro, Netherlands, Nicaragua, Norway, Paraguay, Poland, Russia, Scandinavia, South Korea, Spain, Sweden, Switzerland, Turkey, Ukraine, and USA.

Collection data: 11.9.2006 in Zonooz on walnut (*Juglans regia* L.), 1 female; 15.9.2006 in Meshkinshahr on grapevine (*Vitis vinifera* L.), 1 female; 15.7.2006 in Meshkinshahr on walnut (*J. regia*), 1 male.

Remarks: Measurements of 2 adult females collected in this study are: dorsal shield length 390 (387–393), width at level of j_6 180 (176–184), j_1 31 (30–32), j_3 33 (30–36), j_4 15 (14–16), j_5 18 (17–19), j_6 15 (14–16), J_2 17 (16–18), J_5 4, z_2 25 (24–26), z_4 31 (29–33), z_5 15 (14–16), Z_1 20 (19–21), Z_4 21 (20–22), Z_5 55 (51–59), s_4 37 (35–39), S_2 26 (25–27), S_4 28 (26–30), S_5 25 (24–26), r_3 21 (20–22), R_1 11 (10–12), length of ventrianal shield 91 (88–93), width at ZV_2 level 25 (23–27), length of calyx of spermatheca 8, Sge IV 26 (24–28), Sti IV 60 (57–63), St IV 31 (28–34), Sge III 28 (24–32) and Sti III 34 (31–36). In walnut orchards this mite was encountered in *Amphitetranynchus viennensis* (Zacher) colonies.

***Neoseiulus barkeri* Hughes, 1948**

Neoseiulus mycophilus (Karg, 1970): 290

Neoseiulus masiaka (Blommers & Chazeau, 1974): 308

Neoseiulus mckenziei (Schuster & Pritchard, 1963): 268

Neoseiulus oahuensis (Prasad, 1968): 1518

Neoseiulus picketti (Specht, 1968): 681

Neoseiulus usitatus (van der Merwe, 1965): 71

Neoseiulus kermanicus Daneshvar, 1987: 14

Distribution: Algeria, Australia, Brazil, Canary islands, Cape Verde, China, England, Hawaii, India, Iran, Ivory coast, Finland, France, Georgia, Germany, Ghana, Greece, Guinea, Iran, Israel, Italy, Japan, Jordan, Madagascar, Mozambique, Netherlands, Nigeria, Norway, Reunion island, Russia, South Africa, South Korea, Spain, Sweden, Tahiti, Taiwan, Turkey, Ukraine, USA, and Yemen.

Collection data: 10.10.2006 in Zanjan on the ground surface of Apple orchard, 3 females.

Remarks: Measurements of 3 adult females collected in this study are: dorsal shield length 365 (360–370), width at level of j_6 213 (208–217), j_1 13 (12–14), j_3 20 (17–21), j_4 18 (17–20), j_5 17 (16–19), j_6 20, J_2 24 (21–25), J_5 11 (10–13), z_2 24 (22–25), z_4 24 (22–25), z_5 18 (17–19), Z_1 27 (25–29), Z_4 46 (41–48), Z_5 55 (53–59), s_4 39 (37–40), S_2 30 (29–32), S_4 26 (25–27), S_5 27 (25–28), r_3 23 (22–25), R_1 21 (20–22), length of ventrianal shield 117 (114–119), width at ZV_2 level 96 (93–95), length of calyx of spermatheca 23 (21–24), St IV 55 (52–56). This is the first report of *N. barkeri* from northwestern Iran. In the apple orchards, this species was found in association with *A. gossypi* and *Cenopalpus* spp.

***Neoseiulus bicaudus* (Wainstein, 1962)**

Amblyseius bicaudus Wainstein, 1962: 146

Distribution: Azerbaijan, Caucasus region, France, Georgia, Greece, Iran, Israel, Italy, Moldova, Norway, Russia, Spain, Switzerland, Tajikistan, Turkey, Ukraine, and USA.

Collection data: 11.7.2006 in Fandogloo on pussy willow (*S. discolor*), 1 female.

Remarks: Measurements of 1 adult female collected in this study are: dorsal shield length 380, width at level of j_6 196, j_1 22, j_3 23, j_4 13, j_5 12, j_6 14, J_2 16, J_5 14, z_2 18, z_4 17, z_5 21, Z_1 18, Z_4 38, Z_5 84, s_4 28, S_2 32, S_4 26, S_5 26, r_3 24, R_1 24, length of ventrianal shield 135, width at ZV_2 level 106, spermathecae not clear, St IV 71. The measurements and morphological characters of the Iranian specimen fit completely with the re-descriptions given by Kolodochka (1978) and Livshitz and Kuznetsov (1972). This mite was found associated with *Thrips* sp.

***Neoseiulus brevispinus* (Kennett, 1958)**

Typhlodromus brevispinus Kennett, 1958: 473

Distribution: Caucasus region, Hungary, Iran, Russia, and USA.

Collection data: 10.10.2006 in Zanjan on the ground of a fruit orchard, 1 female.

Remarks: Measurements of 1 adult female collected in this study are: dorsal shield length 429, width at level of j_6 273, j_1 21, j_3 26, j_4 23, j_5 15, j_6 18, J_2 13, J_5 13, z_2 18, z_4 26, z_5 26, Z_1 26, Z_4 39, Z_5 55, s_4 34, S_2 21, S_4 26, S_5 21, r_3 26, R_1 23, length of ventrianal shield 109, width at ZV_2 level 91, length of calyx of spermatheca 10, St IV 73. This is the first report of *N. brevispinus* from northwestern Iran. This mite's feeding habit is unknown to us.

***Neoseiulus marginatus* (Wainstein, 1961)**

Typhlodromus marginatus Wainstein, 1961: 158

Neoseiulus polyporus (Wainstein, 1962): 143

Distribution: Algeria, Armenia, Azerbaijan, France, Georgia, Greece, Hungary, Iran, Kazakhstan, Kenya, Moldova, Russia, Turkmenistan, and Ukraine.

Collection data: 10.9.2006 in Bostanabad on alfalfa (*Medicago sativa* L.), 1 female; 15.9.2006 in Zanjan on alfalfa (*M. sativa*), 1 female.

Remarks: Measurements of 2 adult females collected in this study are: dorsal shield length 350 (348–352), width at level of j_6 194 (190–198), j_1 16 (15–17), j_3 23 (22–24), j_4 16 (14–18), j_5 17 (16–18), j_6 20, J_2 24 (21–25), J_5 9, z_2 24 (22–26), z_4 23 (22–24), z_5 18 (17–19), Z_1 22 (20–24), Z_4 50 (47–53), Z_5 55 (51–59), s_4 32 (30–34), S_2 40 (38–42), S_4 35 (32–38), S_5 27 (25–29), r_3 16 (14–18), R_1 12 (10–14), length of

ventrianal shield 109 (105–113), width at ZV_2 level 91 (88–94), length of calyx of spermatheca 18 (17–19), St IV 55 (52–58). The morphological characters of the Iranian specimens fit well with the re-descriptions by Kolodochka (1978) and Livshitz and Kuznetsov (1972). There are however some variations with the length of dorsal setae. This is the first report of *N. marginatus* from northwestern Iran. It was found in association with *T. urticae*.

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

Typhlodromus zwölferi Dosse, 1957: 301

Amblyseius vardgesi Arutunjan, 1968: 92, **New Synonym**

Neoseiulus zeitunicus (Wainstein & Arutunjan, 1970): 1500

Distribution: Armenia, Azerbaijan, Finland, Germany, Iran, Israel, Kazakhstan, Montenegro, Norway, Russia, Sweden, Switzerland, Turkey, Ukraine, and USA.

Collection data: 21.11.1998 on apple (*Malus* sp.), in Saeed abad; 9.10.1999 on alfalfa (*M. sativa*), in Sarab; 14.6.2000 on alfalfa (*M. sativa*), in Bostanabad; 6 females and 8 males, collected by D. Shirdel.

Remarks: Measurements of 5 adult females: dorsal shield length 397 (390–406), width at level of j_6 211 (206–219), j_1 18 (16–18), j_3 23 (21–26), j_4 15 (13–16), j_5 17 (16–18), j_6 19 (18–21), J_2 18 (16–21), J_5 10 (9–12), z_2 20 (18–21), z_4 22 (21–23), z_5 17 (16–18), Z_1 21 (18–23), Z_4 35 (31–36), Z_5 52 (47–55), s_4 27 (23–29), S_2 27 (26–29), S_4 29 (26–32), S_5 22 (21–23), r_3 21 (18–23), R_1 22 (21–23), length of ventrianal shield 121 (109–137), width at ZV_2 level 108 (101–117), length of calyx of spermatheca 8 (6–9), macroseta on leg IV (St) 66 (62–68). All the measurements and morphological characters in the original descriptions of *N. zwoelferi* and *N. vardgesi* are similar to each other. Therefore, *N. vardgesi* is considered as a junior synonym of *N. zwoelferi*.

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

Typhlodromus bagdasarjani Wainstein & Arutunjan, 1967: 1765

Typhlodromus (*Anthoseius*) *kettanehi* Dosse, 1967: 32

Distribution: Armenia, Azerbaijan, Iran, Lebanon, Turkmenistan, and Turkey (Bayram and Çobanoğlu, 2007).

Collection data: 10.9.2006 in Moghan on elm (*Ulmus glabra* Huds.), 2 females; 23.7.2006 in Uromiyeh on grape (*V. vinifera*), 1 female; 21.9.2006 in Abhar on grapevine (*V. vinifera*), 2 females; 18.9.2006 in Salmas on apple (*Malus* sp.), 1 female; 11.9.2006 in Zanjan on apple (*Malus* sp.), 2 female; 11.9.2006 in Zanjan on apricot (*Prunus armeniaca* L.), 2 females; 11.9.2006 in Zanjan on eggplant (*Solanum melongena* L.), 1 female.

Remarks: Measurements of 5 adult females collected in this study are: dorsal shield length 340 (336–346), width at level of j_6 188 (182–194), j_1 20 (18–21), j_3 25 (19–27), j_4 17 (16–18), j_5 18 (16–19), j_6 23 (20–25), J_2 25 (23–26), J_5 7 (5–8), z_2 21 (19–22), z_3 24 (20–26), z_4 23 (22–25), z_5 17 (16–19), Z_4 55 (52–58), Z_5 65 (62–67), s_4 31 (30–33), s_6 32 (30–34), S_2 37 (35–40), S_4 34 (30–36), S_5 27 (26–28), r_3 31 (30–34), R_1 21 (20–23), length of ventrianal shield 106 (104–107), width at ZV_2 level 83 (79–85), length of calyx of spermatheca 16 (14–17), macroseta on basitarsus (*St*) leg IV 30 (27–31). Abbasova (1972) made *T. (A.) kettanehi* junior synonym of *T. (A.) bagdasarjani*. For a long time, this species was recognized as *T. (A.) kettanehi* in the Iranian literature. The measurements and characters of the specimens collected in this study fit perfectly with those in the original description by Wainstein and Arutunjan (1967) and the re-description by McMurtry (1977) under *T. (A.) kettanehi*. This species is considered to be an important factor in the control of spider mites in Iran. It preys the eggs and nymphal stages of *T. urticae*. It was found feeding on eriophyid mites of grapevine. It was also found associated with the colonies of *C. pulcher* in apple, *T. urticae* in eggplant, and tydeids in apricot orchards.

***Typhlodromus (Anthoseius) bakeri* (Garman, 1948)**

Seiulus bakeri Garman, 1948: 15

Typhlodromus (Anthoseius) clavatus (Wainstein, 1972): 1481

Distribution: Alaska, Armenia, Australia, Azerbaijan, Canada, Caucasus region, Czech republic, Denmark, England, Finland, France, Germany,

Greece, Georgia, Hawaii, Hungary, India, Iran, Italy, Moldova, Montenegro, Netherlands, New Zealand, Norway, Poland, Portugal, Russia, Sweden, Switzerland, Turkey, Ukraine, and USA.

Collection data: 11.7.2006 in Fandogloo on common medlar (*P. lasianthos*), 1 female.

Remarks: Measurements of 1 adult female collected in this study are: dorsal shield length 411, width at level of j_6 197, j_1 28, j_3 28, j_4 22, j_5 22, j_6 20, J_2 27, J_5 13, z_2 19, z_3 26, z_4 28, z_5 21, Z_1 22, Z_4 28, Z_5 50, s_4 27, s_6 28, S_2 31, S_4 32, S_5 34, r_3 27, R_1 22, length of ventrianal shield 115, width at ZV_2 level 95, length of calyx of spermatheca 19, macroseta on basitarsus leg IV (*St*) 38. The measurements and characters of the specimens collected in this study resemble those given by Faraji et al. (2008), Miedema (1987), and Livshitz and Kuznetsov (1972). This is the first report of *T. (A.) bakeri* from northwestern Iran. Knowledge of this mite's feeding habits is still unknown.

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

Typhlodromus kazachstanicus Wainstein, 1958: 203

Typhlodromus iranensis (Denmark & Daneshvar), 1982: 8, **New Synonym**

Distribution: Armenia, Iran, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Turkey, and Uzbekistan.

Collection data: 10.10.1999 in Sarab on apple (*Malus* sp.), 2 females; 01.07.2001 in Varzegon on alfalfa (*M. sativa*), 1 female collected by D. Shirdel.

Remarks: Measurements of 2 adult females: dorsal shield length 353 (350–355), width at level of j_6 172 (170–173), j_1 21 (19–22), j_3 30 (29–30), j_4 18, j_5 18 (17–18), j_6 22 (21–22), J_2 25 (23–26), J_5 4, z_2 25 (24–25), z_3 26 (25–27), z_4 27 (26–27), z_5 19 (18–19), Z_4 44 (43–44), Z_5 56 (54–58), s_4 30 (29–31), s_6 35 (33–37), S_2 37 (35–38), S_4 35 (34–36), S_5 27 (26–28), r_3 30 (29–30), R_1 29 (28–30), length of ventrianal shield 113 (110–115), width at ZV_2 level 75 (73–77), length of calyx of spermatheca 15 (14–16), macroseta on basitarsus leg IV (*St*) 52 (50–53). All the measurements and morphological characters in the original descriptions of *T. (A.) kazachstanicus* and *T. (A.) iranensis* are similar to each other. Therefore, we consider *T. (A.) iranensis* a junior synonym of *T. (A.) kazachstanicus*.

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

Typhlodromus recki Wainstein, 1958: 203

Distribution: Algeria, Armenia, Azerbaijan, Caucasus region, France, Georgia, Greece, Hungary, Iran, Israel, Italy, Kazakhstan, Lebanon, Moldova, Russia, Turkey, and Ukraine.

Collection data: 12.7.2006 in Fandogloo on European plum (*P. domestica*), 9 females; 15.7.2006 in Parsabad on European plum (*P. domestica*), 4 females and 2 males; 11.7.2006 in Fandogloo on alder (*Alnus* sp.), 1 female; 15.7.2006 in Moghan on olive (*Olea europaea* L.), 1 female; 12.7.2006 in Ardabil on potato (*Solanum tuberosum* L.), 2 females.

Remarks: This is the first report of *T. (A.) recki* from northwestern Iran. Measurements of 5 adult females collected in this study are: Dorsal shield length 344 (336–357), width at level of j_6 176 (174–179), j_1 21 (20–23), j_3 28 (26–29), j_4 16 (15–18), j_5 15 (13–16), j_6 17 (15–19), J_2 20 (18–21), J_5 6 (5–8), z_2 21 (20–23), z_3 29 (26–31), z_4 25 (23–26), z_5 21 (16–22), Z_4 31 (28–33), Z_5 50 (46–52), s_4 29 (26–31), s_6 32 (31–34), S_2 31 (29–34), S_4 32 (31–34), S_5 25 (23–26), r_3 29 (28–31), R_1 24 (23–26), length of ventrianal shield 110 (107–112), width at ZV_2 level 78 (76–81), length of calyx of spermatheca 18 (16–19), macroseta on basitarsus leg IV (*St*) 31 (28–32). The measurements and characters of the

specimens found in northwestern Iran completely fit with the re-description given by Swirski et al. (1998). Swirski et al. (1998) stated that ventrianal shield bears a pair of preanal pores (gv_3), which in some specimens were scarcely visible. These pores were not depicted in the original description by Wainstein (1958) and re-description by Livshitz and Kuznetsov (1972). The Iranian specimens clearly show these pores (Figures 1A and 1B). Presence or absence of preanal pores is one of the main characters in the key by Karg (1993) to identify the European species of *Anthoseius*. Specimens of *T. (A.) recki* get misidentified based on this key. This species was reported for the first time from northern Iran on eriophyids and thrips (Hajizadeh, 2006). It was found in association with the colonies of *Tetranychopsis horridus* (Tetranychidae). *Tetranychopsis horridus* was recently reported as a new species record for the Iranian mite fauna (Rahmani et al., 2008).

***Typhlodromus (Typhlodromus) tubifer* Wainstein, 1961**

Typhlodromus tubifer Wainstein, 1961: 157

Typhlodromus (Typhlodromus) ajsel Abbasova, 1980: 832

Distribution: Armenia, Azerbaijan, Belgium, Caucasus region, Iran, Georgia, Moldova Norway, and Turkey.

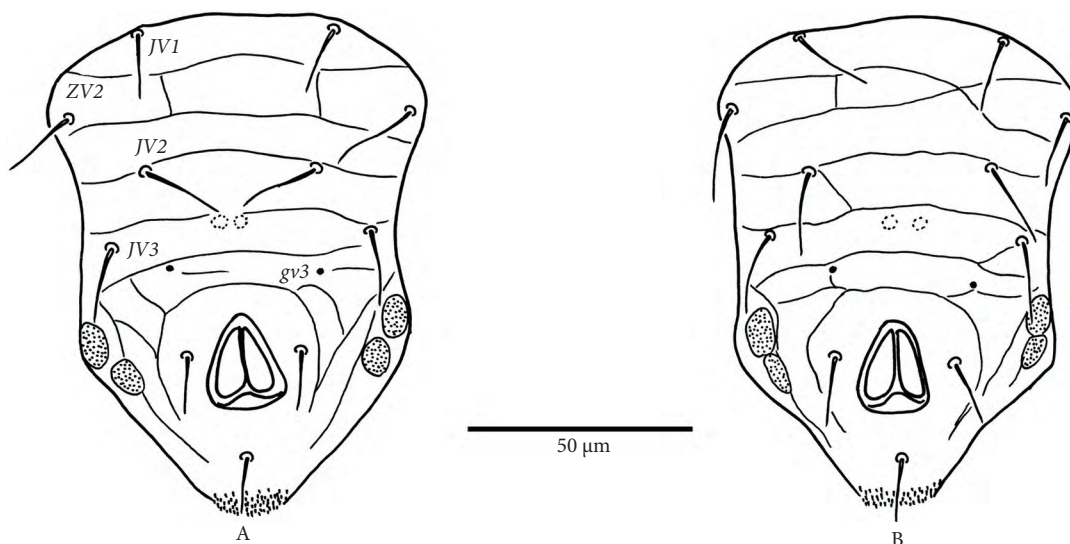


Figure 1. *Typhlodromus (Anthoseius) recki* Wainstein, A and B: ventrianal shields of 2 females with clear preanal pores (gv_3).

Collection data: 16.7.2006 in Fandogloo on Pussy willow (*S. discolor*), 2 females.

Remarks: Measurements of 2 adult females collected in this study are: dorsal shield length 300 (295–305), width at level of j_6 149 (146–152), j_1 21 (18–24), j_3 26 (24–28), j_4 12 (10–14), j_5 15 (14–16), j_6 17 (16–18), J_2 21 (19–23), J_5 9, z_2 21 (19–23), z_3 24 (23–25), z_4 25 (24–26), z_5 22 (20–24), Z_4 30 (28–32), Z_5 52 (49–55), s_4 30 (29–31), s_6 30 (29–36), S_2 29 (27–31), S_4 29 (27–31), r_3 29 (28–30), R_1 21 (20–22), St IV 47 (44–49), length of ventrianal shield 101 (98–104), width at ZV_2 level 75 (73–77), length of calyx of spermatheca 10. Chant and Yoshida-Shaul (1987) examined the type material of *T. (T.) tubifer* and *T. (T.) aysel*. They made *T. (T.) aysel* a junior synonym of *T. (T.) tubifer*. The measurements of the specimens found in Iran are similar to those given by Chant and Yoshida-Shaul (1987). This mite was found in *T. urticae* colonies.

Key to the Phytoseiidae of northwestern Iran (female)

1. Seta z_3 and s_6 absent.....*Amblyseiinae* Muma **3**
 - Either or both setae z_3 and s_6 present.....**2**
2. Setae Z_1 , S_2 , S_4 and S_5 absent*Phytoseiinae* Berlese, *Phytoseius* Ribaga **16**
 - At least one of setae Z_1 , S_2 , S_4 and S_5 present.....*Typhlodrominae* Chant & McMurtry **17**
3. Seta S_4 absent.....*Kampimodromus aberrans* (Oudemans)
 - Seta S_4 present.....**4**
4. Preanal setae in transverse rows; Jv_1 almost in behind of front margin of ventrianal shield; cheliceral digits short and stout, fixed digit with a few small teeth near distal end...*Euseius* Wainstein **5**
 - Preanal setae are not in transverse rows; Jv_1 set on front margin of ventrianal shield; cheliceral digits elongate.....**6**
5. Peritremes reaching to level of seta j_3 ; calyx of spermatheca tube-like.....*E. amissibilis* Meshkov
 - Peritremes short and not reaching to level of seta z_4 ; calyx of spermatheca short and bulged.....*E. finlandicus* (Oudemans)
6. Macrosetae at least on genua III, as well as on leg IV.....**7**
 - Macrosetae present only on leg IV or absent.....*Neoseiulus* Hughes **8**
7. Ratio seta $s_4:S_2 < 2.7:1.0$, seta z_4 longer than z_2 *Transeius wainsteini* (Gomelauri)
 - Ratio seta $s_4:S_2 > 3.0:1.0$...*Amblyseius obtusus* (Koch)
8. Spermatheca with atrium forked at juncture with major duct, or atrium appearing thick-walled, vacuolated.....**9**
 - Spermatheca with atrium not forked at juncture with major duct, nor appearing thick-walled, vacuolated.....**12**
9. Spermatheca with a stalk between atrium and calyx.....*N. marginatus* (Wainstein)
 - Spermatheca without a stalk between atrium and calyx.....**10**
10. Seta Z_5 shorter than $40\mu\text{m}$*N. agrestis* (Karg)
 - Seta Z_5 longer than $40\mu\text{m}$**11**
11. Calyx of spermatheca long, slender, flaring towards vesicle.....*N. brevispinus* (Kennett)
 - Calyx cone-shaped.....*N. barkeri* Hughes
12. Ventrianal shield long and narrow (L/W ratio = 2:1).....*N. astutus* (Beglyarov)
 - Ventrianal shield pentagonal (L/W ratio < 2:1)...**13**
13. Calyx elongate, usually tubular, flaring distally*N. tauricus* (Livshitz & Kuznetsov)
 - Calyx of spermatheca cup-, bell-, dish- or V-shaped or short saccular.....**14**
14. Calyx of spermatheca bell-shaped and without a stalk between it and atrium; fixed digit of chelicera with 3 teeth...*N. cucumeris* (Oudemans)
 - Calyx with a stalk joining it to atrium; fixed digit of chelicera with more than 3 teeth.....**15**
15. Calyx of spermatheca bowl-shaped; fixed cheliceral digit with 6 teeth, movable digit with one tooth.....*N. bicaudus* (Wainstein)
 - Calyx funnel-shaped; fixed digit with 4 teeth, movable digit without teeth...*N. zwoelferi* (Dosse)

16. Seta R_1 present...*P. plumifer* (Canestrini & Fanzago)
 – Seta R_1 absent...*P. juvenis* Wainstein & Arutunjan
17. Setae z_6 present.....Paraseiulini Wainstein 18
 – Setae z_6 absent.....
Typhlodromini Chant & McMurtry 21
18. Setae Jv_2 absent; ventrianal shield without pores and with 2 pairs of preanal setae (*Paraseiulus* Muma).....19
 – Setae Jv_2 present; ventrianal shield with pores and with 4 pairs of preanal setae (*Kuzinellus* Wainstein).....*K. kuzini* Wainstein
19. Seta Z_3 present.....*P. talbii* (Athias-Henriot)
 – Seta Z_3 absent.....20
20. Calyx of spermatheca bell-shaped; three pairs of prominent pores on dorsal shield.....
*P. triporus* (Chant & Yoshida-Shaul)
 – Calyx of spermatheca elongate and narrow; without three pairs of prominent pores on dorsal shield.....*P. soleiger* (Ribaga)
21. Seta Z_1 present.....
Typhloseiulus carmonae (Chant & Yoshida-Shaul)
 – Seta Z_1 absent.....*Typhlodromus* Scheuten 22
22. Seta S_5 absent.....
subgenus *Typhlodromus* Scheuten 23
 – Seta S_5 present...subgenus *Anthoseius* De Leon 24
23. Dorsal shield with 3 pairs of prominent pores.....
(*T. tubifer* Wainstein)
 – Dorsal shield with 4 pairs of prominent pores.....
*T. (T.) cotoneastri* Wainstein
24. Dorsal shield heavily sclerotized; movable digit of chelicera with 3 teeth...*T. (A.) bakeri* (Garman)
 – Dorsal shield weakly sclerotized; movable digit of chelicera smooth or with 1 tooth.....25
25. Dorsal shield with 5 pairs of large pores; movable digit of chelicera smooth.....
*T. (A.) bagdasarjani* Wainstein & Arutunjan
 – Dorsal shield with 3 pairs of large pores; movable digit of chelicera with 1 tooth.....26
26. Macroseta on basitarsus IV longer (about 53 μm) with knobbed tip; peritremes short reaching at most to level of z_4 setae.....
*T. (A.) kazachstanicus* Wainstein
 – Macroseta on basitarsus IV short (28–32 μm) with a pointed tip; peritremes longer reaching to level of between z_2 and j_3 setae.....
*T. (A.) recki* Wainstein

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