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Article

Phytoseiid mites (Acari: Phytoseiidae) associated with conifers in northern Iran, with a new species record and an identification key to coniferous phytoseiid mites of Iran

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Abstract

The phytoseiid mite fauna of coniferous trees and shrubs were surveyed in northern Iran. Sixteen phytoseiid species belonging to six genera were identified on 11 plant species. Among them, *Typhlodromus* (*Anthoseius*) *foenilis* Oudemans, 1930 is considered as new record for mite fauna of Iran. Detailed morphological characteristics based on adult of both sexes of *T.* (*A.*) *foenilis* are given. An identification key to phytoseiid mites associated with conifers in Iran is also provided.

Key words: Conifers; fauna; predatory mites, morphological data, *Typhlodromus* (*Anthoseius*) *foenilis*.

Introduction

Almost all conifers world-wide occur in natural habitats, and they are generally used as ornamental trees in gardens and urban areas. Species of the coniferous families, Pinaceae and Cupressaceae (pine, yew, juniper, spruce), are cone-bearing trees, shrubs, or ground cover plants, mostly evergreen, with a wide scope of applications, that can live usually over 100 years in suitable environments (Arslan and Çelem 2000; Xue *et al.* 2007). In recent years, the nursery production of ornamental conifers in Iran, especially in northern zones (Guilan, Mazandaran, and Golestan Provinces) has increased.

Fauna on the coniferous plants includes many groups of harmful and beneficial organisms (Kropczynska *et al.* 1985). Coniferous plants are attacked by several pests. Owing to their perennial nature, coniferous trees can create stable microhabitats for small arthropods (Boczek and Shevchenko 1996). Spider mites and eriophyoids are harmful pests of coniferous plants; they are small, with a short life cycle and high fecundity (Puchalska 2014). Phytoseiid mites (Acari: Phytoseiidae) are important predators of spider and eriophyoid mites (Sabelis 1996; Gerson *et al.* 2003).

Compared to the other mite families of Iran, the fauna of the Phytoseiidae is the best known. According to the literature, about 86 phytoseiid species are known from

Iran (Faraji *et al.* 2007; Hajizadeh *et al.* 2009; Hajizadeh and Mortazavi 2015a, b). Although many reports of phytoseiid mites on coniferous trees exist throughout the world (i.e. Lehman 1982; Moraes *et al*. 1986; Yesilayer and Çobanoğlu 2006; Kazmierczak and Lewandowski 2006; Bayram and Çobanoğlu 2007; Mangini and Hain 2007), very little is known on coniferous mites in Iran. From 1996 to date, only eight species of phytoseiid mites were recorded on coniferous plants in Iran (Brimani Varandi 1996; Barimani Varandi and Kamali 1998; Kamali *et al.* 2001; Amirazodi and Ostovan 2012; Hajizadeh *et al.* 2015b). Hence, the purpose of this survey was to identify phytoseiid mites of coniferous plants in northern Iran.

Materials and Methods

This study was carried out in northern Iran during 2013–2014. Plant foliage and litter samples were collected from forests, nurseries and parks. Mites were extracted using Berlese funnels or by direct examinations of plant materials under a stereomicroscope. Specimens were preserved in 75% ethanol and then cleared in Nesbitt's solution. Cleared mites were mounted in Hoyer's medium on microscopic slides. The mites were examined under an Olympus BX51 phase-contrast microscope (Olympus Optical Co., LTD., Tokyo, Japan) at 1000× magnification. All drawings were prepared with the help of a 1.25X Olympus camera Lucida (Olympus Optical Co., LTD., Japan). All the measurements are given in micrometer (μm); the average followed (in parentheses) by the respective ranges. The dorsal chaetotaxy is widely used as a taxonomic criterion in the Mesostigmata, and the system and notations followed in the present work is that of Lindquist and Evans (1965) and Rowell *et al.* (1978), and Chant and Yoshida-Shaul (1991) and Lindquist (1994) for dorsal and ventral setae, respectively. Nomenclature used for dorsal solenostomes and poroids is that proposed by Athias-Henriot (1975). The classification systems for phytoseiid mites follow those of Chant and McMurtry (1994, 2003a, b, 2004, 2005a, b, c, 2006, 2007). World distribution of each species is based on Demite *et al.* (2014). The voucher specimens of each species was preserved as slide-mounted specimens are deposited in the Mite Collection of the Acarology Laboratory, Department of Plant Protection, Faculty of Agricultural Sciences at University of Guilan, Rasht, Iran. Specimens were identified by the relevant taxonomic keys (Chant and Yoshida-Shaul 1987; Faraji *et al.* 2007; Ferragut and Ueckermann 2012; Hernandes *et al*. 2012; Hajizadeh and Mortazavi 2015a).

Results

In the current survey, a total of 16 phytoseiid mite species, belonging to six genera and three subfamilies were collected and identified from northern Iran (Guilan, Mazandaran and Golestan Provinces) associated with coniferous plants. Among them *Typhlodromus* (*Anthoseius*) *foenilis* Oudemans, 1930 is newly record for the mite fauna of Iran. The male of *T*. (*A*.) *foenilis* is described and illustrated for the first time. An identification key to the adult females of the 16 recorded species associated with coniferous plants in Iran is also provided.

Taxonomy

Family **Phytoseiidae** Berlese

Subfamily **Amblyseiinae** Muma

Amblyseius azerbaijanicus Abbasova, 1970*[1]

Material examined

Guilan Province, Rezvanshahr County (37° 33′ 4″ N, 49° 8′ 22″ E), 11 September 2014, *Platycladus orientalis* (L.) Franco (Cupressaceae) foliage, 1 female, 2 males, collected by M. R. Yazdanpanah.

This species was originally described from Khachmas, Azerbaijan, in nest of the rodent *Micromys minutus* (Pallas) and recorded from Azerbaijan and Iran (Abbasova 1970; Demite *et al*. 2014).

Amblyseius herbicolus (Chant, 1959)

Material examined

Mazandaran Province, Sari County (36° 33′ 48″ N, 53° 3′ 36″ E), 23 September 1995, *Thuja orientalis* (L.) (Cupressaceae) foliage, 1 female, collected by H. Barimani Varandi; Guilan Province, Soumahe Sara County, Bahambar Village (37° 26′ 56″ N, 49° 14′ 50″ E), 11 September 2014, *Pinus roxburghii* Sarg. (Pinaceae) foliage, 2 females and 3 males, collected by M. R. Yazdanpanah.

This species was originally described from Portugal, intercepted at Boston, Massachusetts, USA, on Bromeliaceae, and recorded from Argentina, Australia, Benin, Brazil, Burundi, Canary Islands, China, Colombia, Costa Rica, Dominican Republic, DR Congo, EL Salvador, Ghana, Guadeloupe, Guatemala, Hawaii, Honduras, India, Iran, Kenya, Les Saintes, Malawi, Malaysia, Martinique, New Caledonia, Papua New Guinea, Peru, Philippines, Portugal, Puerto Rico, Reunion Islands, Rwanda, Senegal, Singapore, South Africa, Spain, Taiwan, Thailand, USA, Venezuela and West Indies (Chant 1959; Demite *et al*. 2014).

Amblyseius rademacheri Dosse, 1958*

Material examined

Guilan Province, Rasht County (37° 16′ 51″ N, 49° 34′ 59″ E), 7 July 2014, *Chamaecyparis lawsoniana* (A. Murray) Parl. (Cupressaceae) foliage, 2 females and 1 male, collected by M. R. Yazdanpanah.

This species was originally described from Stuttgart/Hohenheim, Baden Wurttemberg, Germany, on apple, and recorded from Armenia, Austria, Azerbaijan, China, Czechoslovakia, Denmark, Georgia, Germany, Hungary, Iran, Italy, Japan, Latvia, Moldova, The Netherlands, Russia, Slovakia, Slovenia, South Korea, Spain, Switzerland and Ukraine (Dosse 1958; Demite *et al*. 2014).

Neoseiulus barkeri Hughes, 1948*

Material examined

Guilan Province, Rasht County (37° 16′ 51″ N, 49° 34′ 59″ E), 6 July 2014, *Chamaecyparis lawsoniana* (A. Murray) Parl. (Cupressaceae) foliage, 2 females; 7 July 2014, *Pinus eldarica* Medw. (Pinaceae) debrises, 2 females; Guilan Province, Soumahe Sara County, Bahambar Village (37° 26′ 56″ N, 49° 14′ 50″ E), 11 September 2014, *Pinus roxburghii* Sarg. (Pinaceae) foliage, 4 females and 1 male, collected by M. R. Yazdanpanah.

[1] New records for Iranian coniferous mite fauna are marked with an asterisk (*).

This species was originally described from London Docks, England, on germinating barley, and recorded from Algeria, Argentina, Australia, Benin, Brazil, Burundi, Canary Islands, Cape Verde, China, Cyprus, Egypt, England, Finland, France, Georgia, Germany, Ghana, Greece, Guinea, Hawaii, Iran, Israel, Italy, Japan, Jordan, Kenya, Latvia, Malawi, Morocco, Mozambique, The Netherlands, Nigeria, Norway, Oman, Portugal, Reunion Islands, Russia, Saudi Arabia, Senegal, South Africa, South Korea, Spain, Sweden, Syria, Thailand, Tunisia, Turkey, Ukraine, USA, West Bank and Yemen (Hughes 1948; Demite *et al*. 2014).

Neoseiulus brevispinus (Kennett, 1958)*

Material examined

Guilan Province, Rasht County (37° 16′ 51″ N, 49° 34′ 59″ E), 6 July 2014, *Chamaecyparis lawsoniana* (A. Murray) Parl. (Cupressaceae) foliage, 1 female; Guilan Province, Soumahe Sara County, Bahambar Village (37° 26′ 56″ N, 49° 14′ 50″ E), 11 September 2014, *Pinus roxburghii* Sarg. (Pinaceae) foliage, 1 female and 1 male, collected by M. R. Yazdanpanah.

This species was originally described from Watsonville, California, USA, on strawberry, and recorded from Caucasus region, Hungary, Iran, Russia and USA (Kennett 1958; Demite *et al*. 2014).

Neoseiulus marginatus (Wainstein, 1961)*

Material examined

Guilan Province, Rasht County (37° 16′ 51″ N, 49° 34′ 59″ E), 7 July 2014, *Platycladus orientalis* (L.) Franco (Cupressaceae) foliage, 1 female, collected by M. R. Yazdanpanah.

This species was originally described from Kazakhstan, on herb, and recorded from Algeria, Armenia, Azerbaijan, France, Georgia, Greece, Hungary, Iran, Israel, Kazakhstan, Kenya, Latvia, Moldova, Russia, Serbia, Turkey, Turkmenistan and Ukraine (Wainstein 1961; Demite *et al*. 2014).

Neoseiulus sugonjaevi (Wainstein and Abbasova, 1974)*

Material examined

Guilan Province, Soumahe Sara County, Bahambar Village (37° 26′ 56″ N, 49° 14′ 50″ E), 11 September 2014, *Pinus roxburghii* Sarg. (Pinaceae) foliage, 3 females and 1 male; Guilan Province, Rasht County (37° 16′ 51″ N, 49° 34′ 59″ E), 7 July 2014, *Pinus sylvestris* L. (Pinaceae) debrises, 1 female and 1 male; Guilan Province, Rezvanshahr County, Punel Village (37° 32′ 16″ N 49° 06′ 16″ E), 11 September 2014, *Pinus roxburghii* Sarg. (Pinaceae) foliage, 1 females and 3 males, collected by M. R. Yazdanpanah.

This species was originally described from Dzhalilabad, Azerbaijan, in rodent nest, and recorded from Azerbaijan, Iran and Uzbekistan (Wainstein and Abbasova, 1974; Demite *et al*. 2014).

Neoseiulus umbraticus (Chant, 1956)

Material examined

Mazandaran Province, Behshahr County (36° 41′ 32″ N, 53° 33′ 9″ E), 3 November

1994, *Cedrus libani* A. Rich. (Pinaceae) foliage, 3 females, collected by H. Barimani Varandi.

This species was originally described from Newgate Shaw, East Malling Research Station, Kent, England, on *Rubus fruticosus* L. (Neotype designated by Chant and Yoshida-Shaul (1982): Oaken Wood, East Malling, Kent, England, on *Rubus* sp.) and recorded from Armenia, Azerbaijan, Belarus, Caucasus region, Denmark, England, France, Georgia, Germany, Hungary, Iran, Italy, Jamaica, Latvia, Mexico, Moldova, Montenegro, Norway, Poland, Russia, Slovakia, Spain, Switzerland, Turkey, Ukraine and USA (Chant 1956; Demite *et al*. 2014).

Transeius wainsteini **(Gomelauri, 1968)**

Material examined

Guilan Province, Rasht County (37° 16′ 51″ N, 49° 34′ 59″ E), 24 January 2014, 26 March 2014, 26 July 2014, *Cupressus* spp. foliage, 4 females, collected by J. Hajizadeh; Mazandaran Province, Sari County, Sang Deh Village (36° 4′ 5″ N, 53° 13′ 0″ E), 7 October 1995, *Picea abies* (L.) H. Karst. (Pinaceae) foliage; Nowshahr County (36° 38′ 56″ N, 51° 29′ 46″ E), 23 August 1995, *Platycladus orientalis* (L.) Franco (Cupressaceae) foliage, 17 females and 1 male, collected by H. Barimani Varandi; Guilan Province, Rasht County (37° 16′ 51″ N, 49° 34′ 59″ E), 7 July 2014, *Cupressus sempervirens* L. (Cupressaceae) foliage, 6 females and 2 males, 14 July 2014, *Pinus roxburghii* Sarg. (Pinaceae) foliage, 10 females and 3 males, *Chamaecyparis lawsoniana* (A. Murray) Parl. (Cupressaceae) *debrises*, 2 females and 2 males; Guilan Province, Shaft County, Chubar forest (38° 10′ 49″ N, 48° 53′ 36″ E), 13 August 2014, *Pinus roxburghii* Sarg. (Pinaceae) foliage, 11 females and 4 males; Guilan Province, Rezvanshahr County (37° 33′ 4″ N, 49° 8′ 22″ E), 11 September 2014, *Platycladus orientalis* (L.) Franco (Cupressaceae) foliage, 7 females and 4 males, collected by M. R. Yazdanpanah.

This species was originally described from Manglisi, Georgia, on *Corylus* sp. and recorded from Denmark, Georgia, Germany, Iran, Slovakia and Turkey (Gomelauri 1968; Demite *et al*. 2014). *Transeius wainsteini* is senior synonym of *T. caspiansis* (Denmark and Daneshvar), *T. patellae* (Karg) and *T. similis* (Koch) according to Rhamani *et al*. (2010).

Subfamily **Phytoseiinae** Berlese

Phytoseius finitimus **Ribaga, 1904***

Material examined

Guilan Province, Soumahe Sara County, Larsar Village (37° 28′ 20″ N, 49° 10′ 19″ E), *Pinus eldarica* Medw. (Pinaceae) foliage, 4 females, collected by M. R. Yazdanpanah.

This species was originally described from Portici, Campania, Italy, on *Buddleja madagascariensis.* Lam., and recorded from Algeria, Egypt, France, Greece, Iran, Israel, Italy, Montenegro, Portugal, Spain, Syria, Tunisia, Turkey and USA (Ribaga, 1904; Demite *et al*. 2014).

Subfamily **Typhlodrominae** Chant and McMurtry

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

Material examined

Guilan Province, Rasht County (37° 16′ 51″ N, 49° 34′ 59″ E), 26 July 2014, *Cupressus* spp. foliage, 1 female, collected by J. Hajizadeh.

This species was originally described from Ala, Italy, on unknown plant, and recorded from Czech Republic, Czechoslovakia, Denmark, Finland, France, Georgia, Germany, Greece, Hungary, Iran, Italy, Kazakhstan, Moldova, Morocco, The Netherlands, Poland, Portugal, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Syria, Turkey, Ukraine and USA (Chant and Yoshida-Shaul 1982; Demite *et al*. 2014).

Typhlodromus (Anthoseius) bakeri (Garman, 1948)

Material examined

Mazandaran Province, Sari County, Sang Deh Village (36° 4′ 5″ N, 53° 13′ 0″ E), 18 July 1995, *Picea abies* (L.) H. Karst. (Pinaceae) foliage, 2 females, collected by H. Barimani Varandi; Guilan Province, Shaft County, Chubar Village (38° 10′ 49″ N, 48° 53′ 36″ E), 13 August 2014, *Pinus roxburghii* Sarg. (Pinaceae) foliage, 1 female, collected by M. R. Yazdanpanah.

This species was originally described from Westwoods, Hamden, Connecticut, USA, on apple, and recorded from Alaska, Armenia, Australia, Austria, Azerbaijan, Canada, Caucasus region, Czech Republic, Czechoslovakia, Denmark, England, Finland, France, Germany, Greece, Hawaii, Hungary, India, Iran, Italy, Latvia, Montenegro, The Netherlands, New Zealand, Norway, Poland, Portugal, Russia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine and USA (Garman 1948; Demite *et al*. 2014).

Typhlodromus (*Typhlodromus*) *leptodactylus* Wainstein, 1961

Material examined

Golestan Province, Chaman Saver Village (36° 36′ 43″ N, 54° 12′ 3″ E), 9 November 1995, *Picea abies* (L.) H. Karst. (Pinaceae) foliage, 1 female, collected by H. Barimani Varandi.

This species was originally described from Pantishar Canyon, Georgia, on *Juniperus* sp., and recorded from Armenia, Azerbaijan, Cyprus, Georgia, Greece, Iran, Israel and Ukraine (Wainstein 1961; Demite *et al*. 2014).

Typhlodromus (*Typhlodromus*) *perbibus* Wainstein and Arutunjan, 1968

Material examined

Mazandaran Province, Behshahr County (36° 41′ 32″ N, 53° 33′ 9″ E), 27 May 1995, *Thuja occidentalis* L. (Cupressaceae) foliage; *Taxus* sp. (Taxaceae) foliage, 6 females and 2 males, collected by H. Barimani Varandi.

This species was originally described from Rehovot, Central District, Israel, on *Citrus* sp., and recorded from Azerbaijan, Cyprus, Egypt, France, Greece, Iran, Israel, Jordan, Syria and Turkey (Porath and Swirski, 1965; Demite *et al*. 2014).

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

Material examined

Mazandaran Province, Behshahr County (36° 41′ 32″ N, 53° 33′ 9″ E), 27 May

1995, *Cedrus libani* A. Rich. (Pinaceae) foliage, 2 female, collected by H. Barimani Varandi.

This species was originally described from Manglisi, Georgia, on unspecified substrate, and recorded from Armenia, Azerbaijan, Belgium, Caucasus region, Georgia, Iran, Moldova, and Turkey (Wainstein 1961; Demite *et al*. 2014).

Typhlodromus* (*Anthoseius*) *foenilis* Oudemans, 1930

Adult female - Five specimens measured.

Dorsal idiosoma (Fig. 1) - Dorsal shield 367 (362–375) long and 223 (190–240) wide at j_6 level, completely reticulated; with 5 pairs of large solenostomes (*gd2*, *gd4*, *gd6*, *gd8*, *gd9*) and 13 pairs of poroides, 18 pairs of dorsal setae: *j1* 22 (20–25), *j3* 26 (25–28), *j4* 16 (15–18), *j5* 18 (16–19), *j6* 19 (18–20), *J2* 23 (20–25), *J5* 6 (5-8), *z2* 17 (15–18), *z3* 23 (22–25), *z4* 22 (20–23), *z5* 17 (15-18), *Z4* 39 (38–40), *Z5* 48 (45–50), *s4* 26 (25–28), *s6* 26 (25–28), *S2* 31 (30–32), *S4* 31 (30–32), *S5* 21 (20–22); setae *r3* 23 (20–25) and *R1* 25 on lateral integument; all dorsal setae smooth except pectinate *Z5*.

Peritreme (Fig. 1) - Extending to level of setae *j1*.

Ventral idiosoma (Fig. 2) - Sternal shield smooth, 80 (78–82) long and 69 (65–73) wide at level setae *ST2*, posterior margin slightly waved, with two pairs of setae (*ST1* and *ST2*); and two pairs of lyrifissures, setae *ST3* located off shield on small platelets, setae ST_4 and a pair of poroides on metasternal shields. Distances between *ST1*-*ST1* 56 (55–58), *ST2*-*ST2* 60 (58–62), *ST3*-*ST3* 66 (65–68), *ST1–ST3* 71, *ST4–ST4* 72 (70–75), *ST5*-*ST5* 64 (63–67). Lengths *ST1* 24 (23–25), *ST2* 22 (20–25), *ST3* 19 (18-20), *ST4* 19 (18-20); genital shield smooth, width 67 (65–70) at widest level; setae *ST5* 19 (18–20); paragenital poroides located on integument between setae *ST5* and *ZV1*; a narrow integumental platelet located between genital and ventrianal shield; 2 pairs of metapodal shields, primary platelet 21 (20–23) and accessory platelet 8 long; ventrianal shield pentagonal, with a few striae, and with inconspicuous ornamentation; anterior margin convex, length 119 (118–120), width at level of setae *ZV2* 94 (90–100) and width at level of paranal setae 72 (70–75); 4 pairs of preanal setae and without pore: *JV1* 12 (10–13), *JV2* 14 (13–15), *JV3* 16 (15–17), and *ZV*2 14 (13–15); 4 pairs of setae surrounding ventrianal shield on integument, *JV4* 13 (12–15), *JV5* 50, *ZV1* 12 (10–15), *ZV3* 12 (10–13) (Fig. 2).

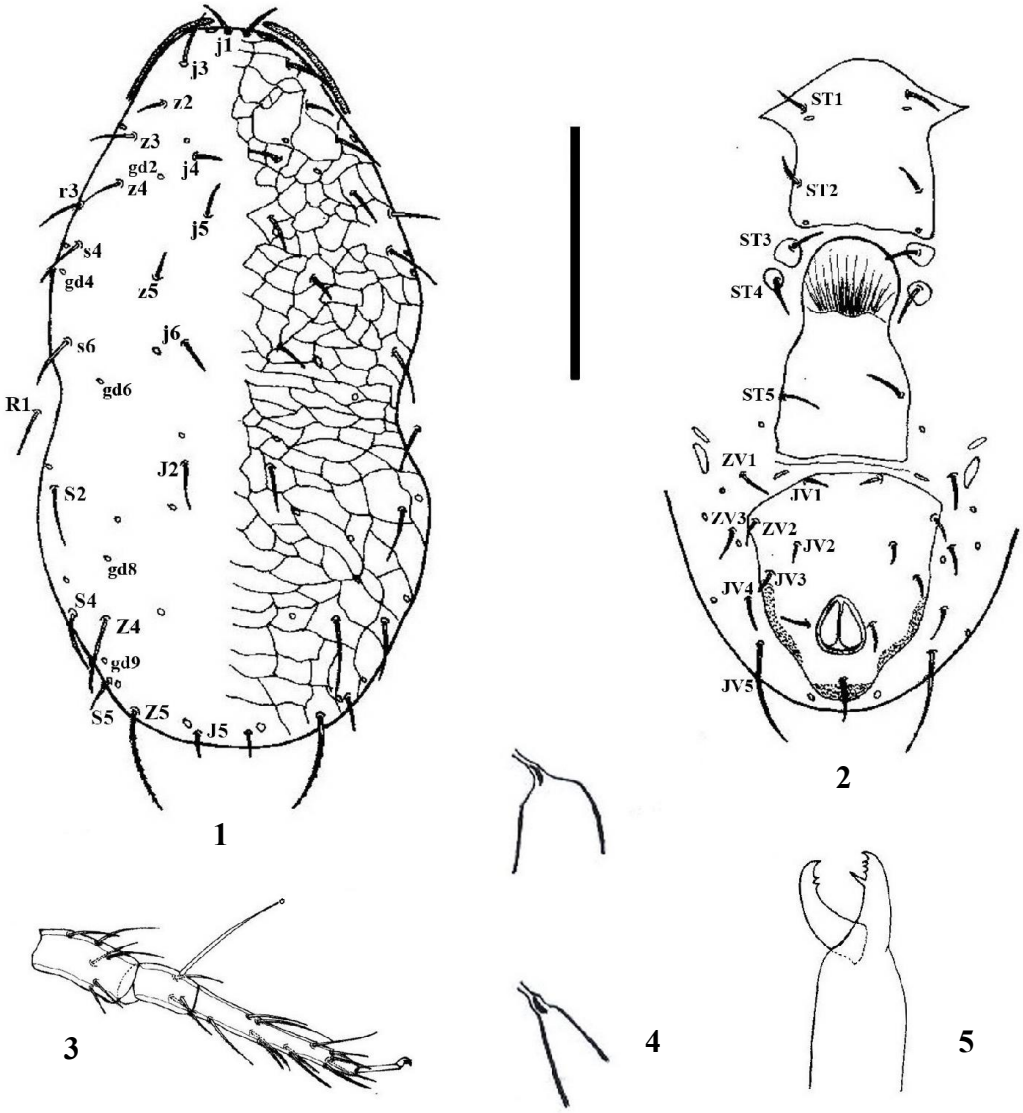
Chelicera (Fig. 5) - Fixed digit 33 long with 3 teeth; movable digit 32 long with 2 teeth.

Spermatheca (Fig. 4) - Calyx cup-shaped and saccular 16 (15–17) long with a c-shaped atrium incorporated in the calyx.

Legs (Fig. 3) - Macroseta on basitarsus IV with a small apical knob, 49 (48–50) long; genua and tibiae I-II-III-IV with 10-7-7-7 and 10-7-7-6 setae, respectively. Chaetotatctic formula of genu II: 2-2/0-2/0-1; genu III: 1-2/1-2/0-1.

Adult male - Two specimens measured.

Dorsal idiosoma (Fig. 6) - Dorsal shield 277 (275–280) long and 205 (200–208) wide at *j6* level, dorsum completely reticulated, with 5 pairs of large solenostomes (*gd2*, *gd4*, *gd6*, *gd8*, *gd9*) and 13 pairs of poroides, 20 pairs of dorsal setae: *j1* 19 (18–20), *j3* 25, *j4* 13, *j5* 13, *j6* 14 (13–15), *J2* 19 (18–20), *J5* 6 (5–7), *z2* 14 (13–15), *z3* 17 (15–18), *z4* 18, *z5* 14 (13–15), *Z4* 35 (33–38), *Z5* 40, *s4* 21 (20–22), *s6* 21 (20–22), *S2* 25, *S4* 21 (20–22), *S5* 14 (13–15), *r3* 21 (20–22), R1 18; setae *r3* and *R1* on the shield, all dorsal setae simple and smooth.



Figures 1–5. *Typhlodromus* (*Anthoseius*) *foenilis* Oudemans (female) - 1. Dorsal view of idiosoma; 2. Ventral view of idiosoma; 3. Tibia and tarsus IV; 4. Spermatheca; 5. Chelicera. Scale bar = 130 μm for Figs. 1 and 2; 90 μm for Fig. 3; 40 μm for Fig. 4; 80 μm for Fig. 5.

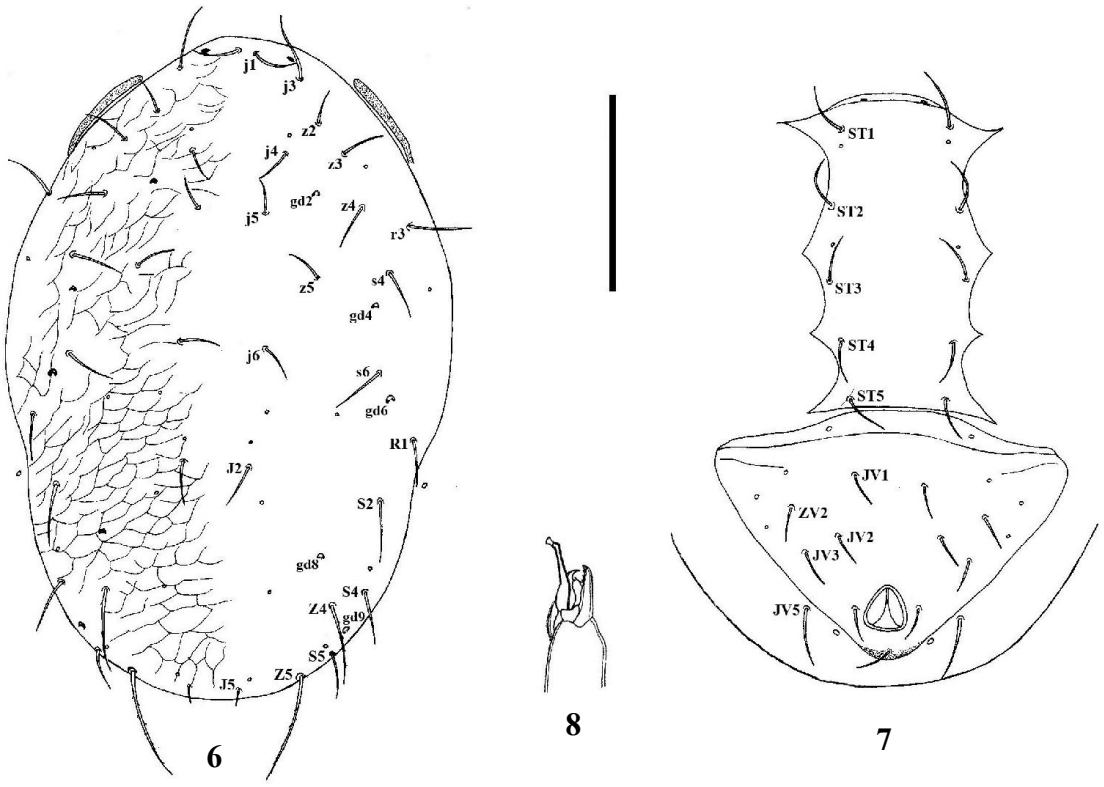
Peritreme (Fig. 6) - Extending to level of setae *z2* or slightly pass bases of setae *z2*.

Ventral idiosoma (Fig. 7) - All shields smooth. Sternogenital shield 129 (125–132) long and 62 (60–63) wide at *ST2* level, with 3 pairs of poroides and 5 pairs of

sternogenital setae, *ST1* 19 (18–20), *ST2* 19 (18–20), *ST3* 18, ST4 18, *ST5* 16 (15–18) long; distance between *ST1* - *ST3* 64 (63–65), and *ST2*-*ST2* 55, and *ST5*-*ST5* 41 (40–43). Ventrianal shield 102 (100–103) long and 128 (125–130) wide at *ZV2* level, and 55 (53-58) wide at level of anus, with 4 pairs of setae, *JV1* 14 (13-15), *JV2* 13, *JV3* 14 (13–15); *ZV2* 15 long; setae *JV5* 23 (20–25) located off shield.

Chelicera (Fig. 8) - Spermatodactyl L-shaped, shaft with 29 (28-30) long. Movable digit of chelicera unidentate, 19 (18-20) long; fixed digit bidentate, 24 (23-25) long.

Legs - Chaetotactic formula of genua II and III are identical to the female. Macroseta of basitarsus IV, 35 long.



Figures 6–8. *Typhlodromus* (*Anthoseius*) *foenilis* Oudemans (male) - 6. Dorsal view of idiosoma; 7. Ventral view of idiosoma; 8. Chelicera. Scale bar = 80 μm.

Material examined

Guilan Province, Rasht County (37° 16′ 51″ N, 49° 34′ 59″ E), 26 July 2014, 26 March 2014, 24 January 2014, *Chamaecyparis lawsoniana* (A. Murray) Parl. and *Cupressus japonica* Thunb. ex L.f. (Cupressaceae) Foliage, 16 females and 2 males, collected by J. Hajizadeh; Rasht County, 14 July 2014, *Pinus eldarica* Medw. (Pinaceae) foliage; Shaft Country, Chubar Village (38° 10′ 49″ N, 48° 53′ 36″ E), 13 August 2014, *Pinus roxburghii* Sarg. (Pinaceae) and *Pinus roxburghii* Sarg. (Pinaceae) foliage, 7 females, collected by M. R. Yazdanpanah.

This species was originally described from Franeker, Friesland, The Netherlands, on hay stack, and recorded from Belgium, Cyprus, England, Greece, Ireland, The Netherlands, Norway, Spain, Syria, Tunisia, Turkey (Oudemans 1930; Andre 1986; Evans and Momen 1988; Evans and Edland 1998; Çobanoğlu 2004; Faraji *et al.* 2008;

Papadoulis *et al.* 2009; Kreiter *et al.* 2010; Tsagkarakis *et al.* 2011; Sahraoui *et al.* 2012; Barbar 2013, 2014; Tsagkarakis *et al.* 2014), and Iran (this study). *Typhlodromus foenilis*, was found in the France by Kreiter *et al*. (2000) and Tixier *et al*. (2000) under the name of *Typhlodromus* (*Anthoseius*) *cryptus* Athias-Henriot. Evans and Momen (1988) made *T. cryptus* a junior synonym of *T. foenilis*.

Key to species of phytoseiid mites associated with coniferous plants in Iran (female)

1. Either or both setae *z3* and *s6* present …… 2
– Seta *z3* and *s6* absent …… (Amblyseiinae Muma) ……...….3
2. Setae *Z1*, *S2*, *S4* and *S5* absent …..... (Phytoseiinae Berlese, *Phytoseius* Ribaga) ...…. ……..…. *P. finitimus* Ribaga
– At least one of setae *Z1*, *S2*, *S4* and *S5* present ……..…….. …… (Typhlodrominae Chant and McMurtry) ...……..... 12
3. Macrosetae present only on leg IV or absent …….. (*Neoseiulus* Hughes) ……... 4
– Macrosetae at least on genu III, as well as on leg IV ……..... 8
4. Spermatheca with atrium not forked at junction with major duct, nor appearing thick walled, vacuolated; movable digit of chelicerae with 2 teeth... *N. umbraticus* (Chant)
– Spermatheca with atrium forked at junction with major duct, or atrium appearing thick walled, vacuolated; movable digit of chelicerae with 1 tooth……...……..... 5
5. Spermatheca with a stalk between atrium and calyx; dorsal shield with 7 pairs of solenostomes ……. *N. marginatus* (Wainstein)
– Spermatheca without a stalk between atrium and calyx; dorsal shield with 3–4 pairs of solenostomes ……..…… 6
6. Calyx of spermatheca constricted at juncture with atrium; fixed digit of chelicerae with 5 teeth ……..…… *N. sugonjaevi* (Wainstein and Abbasova)
– Calyx not constricted at juncture with atrium, calyx, atrium and major duct of approximately same width; fixed digit of chelicerae with 3-4 teeth ……..…… 7
7. Calyx of spermatheca long, slender, flaring towards vesicle; *Z4* 30, *Z5* 48 μm; fixed digit of chelicerae with 3 teeth ……. *N. brevispinus* (Kennett)
– Calyx of spermatheca cone shaped; *Z4* 38, *Z5* 55 μm; fixed digit of chelicerae with 4 teeth ……..…… *N. barkeri* Hughes
8. Seta *J2* absent …… (*Proprioseiopsis* Muma) ……. *P. messor* (Wainstein)
– Seta *J2* present ……..…. 9
9. Ratio of setae *s4*:*S2* < 2.7:1.0 ……... (*Transeius* Chant and McMurtry) ……..… ……..….. *T. wainsteini* (Gomelauri)
– Ratio of setae *s4*:*S2* > 3.0:1.0 ……..….. (*Amblyseius* Berlese) ……..….. 10
10. Seta *z4* about 2/3 distance between insertions of setae *z4* and *s4* ……..… ……..…….. *A. azerbaijanicus* Abbasova
– Seta *z4* shorter than half distance between insertions of setae *z4* and *s4* …… 11
11. Ventrianal shield vase-shaped ……... *A. herbicolus* (Chant)
– Ventrianal shield not vase-shaped …… *A. rademacheri* Dosse
12. Seta *z6* present (Paraseiulini Wainstein) ….. *P. triporus* (Chant and Yoshida-Shaul)
– Seta *z6* absent.. (Typhlodromini Chant and McMurtry, *Typhlodromus* Scheuten).. 13
13. Seta *S5* present ……..… (*Typhlodromus* subgenus *Anthoseius* De Leon) ……. 14
– Seta *S5* absent …… (*Typhlodromus* subgenus *Typhlodromus* Scheuten) ...…… 15

14. Dorsal shield heavily sclerotized; neck of spermatheca sclerotized ……..…
……..…….. *T.* (*A.*) *bakeri* (Garman)
– Dorsal shield not heavily sclerotized; spermatheca not sclerotized ……..…
……..…… *T.* (*A.*) *foenilis* Oudemans
15. Ventrianal shield with three pairs of preanal setae … *T.* (*T.*) *leptodactylus* Wainstein
– Ventrianal shield with four pairs of preanal setae ……..…. 16
16. Dorsal shield with three pairs of solenostomes ……. *T.*(*T.*) *tubifer* Wainstein
– Dorsal shield with four pairs of solenostomes ……..……
…….…….... *T.* (*T.*) *perbibus* Wainstein and Arutunjan

Discussion

Based on specimens collected, relative abundance of phytoseiid species associated with coniferous plants in Northern Iran was calculated. Results showed that *Transeius wainsteini* (Gomelauri, 1968) with 37% relative abundance was the most abundant species among the 16 collected species, followed by *Typhlodromus* (*Anthoseius*) *foenilis* Oudemans, 1930 and *Neoseiulus sugonjaevi* (Wainstein and Abbasova, 1974) with 19% and 8% relative abundance, respectively. *Neoseiulus marginatus* (Wainstein, 1961), *Paraseiulus triporus* (Chant and Yoshida-Shaul, 1982) and *Typhlodromus* (*Typhlodromus*) *leptodactylus* Wainstein, 1961, each with 1% relative abundance were the less abundant species (Fig. 9). In Iran, the predatory mite, *Transeius wainsteini*, is distributed on different plants along the coast of the Caspian Sea (Guilan, Mazandaran, and Golestan Provinces). Laboratory studies showed good potential of this predatory mite for control of tetranychid mites (Daneshvar 1990; Rafatifard *et al*. 2004). Because *T. wainsteini* is abundant on coniferous plants in the above-mentioned areas, conservation measures for protection of this useful species would be advantageous.

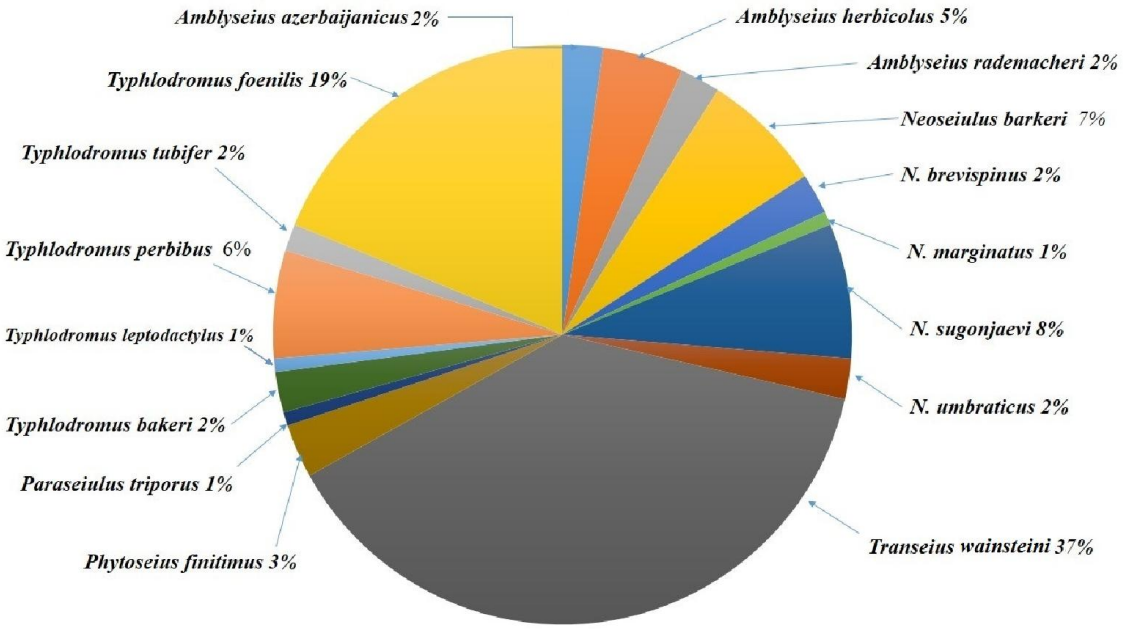


Figure 9. Relative abundance of phytoseiid mites species associated with coniferous plants in Northern Iran, based on samples collected in 2013–2014.

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کنه‌های فیتوزئید (Acari: Phytoseiidae) مرتبط با سوزنی برگان در شمال ایران، همراه با گزارش یک گونهٔ جدید و کلید شناسایی کنه‌های فیتوزئید درختان سوزنی برگ ایران

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چکیده

فون کنه‌های فیتوزئید درختان و درختچه‌های سوزنی برگ در شمال ایران مورد بررسی قرار گرفت. شانزده گونه متعلق به شش جنس از خانوادهٔ Phytoseiidae، از روی یازده گونه از سوزنی برگان شناسایی شدند. از بین گونه‌های شناسایی شده گونه *Typhlodromus* (*Anthoseius*) *foenilis* Oudemans, 1930 برای فون کنه‌های ایران جدید است. ویژگی‌های مفصل ریخت‌شناسی گونه *T. foenilis* (*A.*) بر اساس مرحلهٔ بالغ هر دو جنس نر و ماده ارایه شده است. هم‌چنین کلید شناسایی کنه‌های فیتوزئید مرتبط با سوزنی برگان در ایران، تهیه شده است.

واژگان کلیدی: سوزنی برگان، فون، کنه‌های شکارگر، داده‌های ریخت‌شناسی، *Typhlodromus* (*Anthoseius*) *foenilis*.

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