MITES (ACARI: PROSTIGMATA & MESOSTIGMATA) INHABITING GREEN PLANTINGS IN URBAN ENVIRONMENT OF NORTH-EASTERN IRAN, INCLUDING SIX NEW RECORDS

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ABSTRACT: In 2007 & 2008, a study of injurious and beneficial mites inhabiting green plantings was carried out in the urban environment of the north-eastern region of Iran, recording 24 species at different localities. Six species, *Eotetranychus willametti, Oligonychus ilicis, Tetranychus truncatus, T. tumidellus, Aceria fraxiniflora, and Aculus dimidiatus* are recorded from Iran for the first time. Also, 18 species are new for the fauna of north-eastern provinces of Iran. Most of the collected mites are phytophagous (19 species), dominated by Tetranychidae, with the presence of Tenuipalpidae and Eriophyidae of secondary importance. It was found that *Oligonychus ununguis* and *Tetranychus turkestani* are the most common and important pest species of conifers and broad leaf plants respectively. Species of 4 families belonging to 2 orders were found as predators. Among them, *Phytoseius corniger* and *Amblyseius bagdasarjani* were the most common predatory mite species in green plantings of the study areas. Plant association and provincial records of identified species are given.

KEY WORDS: Acarofauna, Iran, New records, Ornamental plants, Khorasan provonces

Green plantings in big cities, especially trees contribute to many quality of life factors. Some of the benefits that urban trees provide can be mentioned as follow: providing shade that lowers temperature; reducing air pollution of cities by removing pollutants from the air; trees also sequester and reduce carbon dioxide while releasing oxygen as they photosynthesize; reducing noise pollution; protecting our eyes and skin from harmful sun damage and they contribute to beautifying the urban landscape that we live and work in. There is no doubt that performance of such functions would be impossible if trees are not healthy.

There are a number of environmental stressors that urban trees have to combat as compared with those growing in a forested environment: 1) poor urban soils that are compacted, lack adequate organic matter, and have poor drainage; 2) the presence of detrimental contaminants such as salt and oils; heat island effect phenomenon that traps heat in cities and result in temperatures that can be as much as 10 degrees higher than the surrounding suburbs; 4) construction and mechanical damage to root, trunk and branches and 5) tree disease and pests. The cumulative effect of these factors results in decreasing the vital activity of green plants. On the other hand, urban conditions can also stimulate the reproduction of some important phytophages. In this respect, Tetranychoid mites are one of the most dangerous groups, especially in large cities (Zhovnerchuk, 2006).

Reviewing literature revealed that in Iran up to now, only a few faunistic studies mainly around the capital and northern regions of Iran have been carried out on mites associated with forest trees and bushes. On the other hand, of more than 1040 species of mites reported from Iran (Kamali *et al.* 2001; Khanjani & Haddad Iraninejad, 2005) about 90 species have been found on shade trees and

ornamental plants. Except the only report of the occurrence of the Eriophyid, *Trisetacus* sp. on *Pinus* sp. in Mashhad (Kamali, 2007) , to our best knowledge, there has been no previous study on mites associated with green plantings in urban environments in Northern, Southern & Razavi Khorasan provinces of Iran and no information in this regard is available in the literature. This study aimed to investigate the occurrence and species diversity of herbivorous and predatory mites of arboreal plant parts of urban and suburb parks in north-eastern Iran, for further ecological work needed for the urban green plantings integrated pest management program.

MATERIALS AND METHODS

Mites associated with urban trees and plants were surveyed in the main cities of the north-eastern region of Iran in 2007 and 2008. Green plantings in various city and suburb parks as well as botanical gardens were investigated. The mites were collected together with leaves taken from different parts of plants or by shaking them off branches onto a white tray every 2-3 weeks throughout the growing season. The materials were placed in plastic bags or in plastic tubes with 70% ethanol, and after that transported to the laboratory where plant materials were examined under a binocular microscope. Collected mites were slide mounted in Hoyer's medium. Generic and specific identifications were made by the author at 40-100x with a phase contrast microscope, using as reference Bolland *et al* (1998); Jeppson *et al*. (1975); Khanjani & Haddad Iraninejad (2005); Khosrowshahi & Arababi(1997). A representative number of slides were verified or in some cases identified by Dr Hong (China), Dr Ueckermann (South Africa) and Dr Gotoh (Japan).

The sampled plant families were: Salicaceae, Moraceae, Simaroubaceae, Rosaceae, Platanaceae, Pinaceae, Cupressaceae, Fabaceae, Malvaceae, Aceraceae, Ulmaceae, Oleaceae, Meliaceae, Asteraceae, Bignoniaceae, Lamiaceae, Convolvulaceae. Plant names follow Mozaffarian (2003).

The type specimens are held in the mite reference collection of Plant Protection Department, Agricultural College of Ferdowsi University of Mashhad, Iran. Also, some specimens are hold by Dr. Ueckermann (South Africa), Dr. Hong (China) and Dr Gotoh (Japan).

RESULTS

A total of 24 species of 8 families were identified in this study, as indicated subsequently. Six species, *Eotetranychus willametti, Oligonychus ilicis, Tetranychus truncatus, T. tumidellus, Eriophyes fraxiniflora, and Aculus dimidiatus* were new to the fauna of Iran. Also, 18 species were new records for the region. The following list includes records made by author with comments on the plant association from which our collected materials was taken.

I- Order Mesostigmata
Family Phytoseiidae
Phytoseius corniger Wainstein

Materials examined and associations: 11 specimens (9 ♀♀, 2 ♂♂), Neyshabor (Baghrod), (*Alianthus altissima*), 12 August 2007; Torogh forest park, (*Fraxinus excelsior*), 21 June 2007; Ferdowsi University campus, (*Fraxinus excelsior*), (*Acer* sp.), (*Ulmus* sp.), 14 September 2007; Torbat heidarieh, (*Platanus orientalis*), 11 October 2008.
Previous provincial records for Iran: it is found all over Iran (Kamali et al., 2001).
Comments: This phytoseiid was the most frequently found predator on a variety of plants. It was interesting to observe this predator on plants there were no phytophagous mites.

***Typhlodromus bagdasarjani* Wainstein & Arutunjan, 1967**

Materials examined and associations: 3 specimens (3 ♀♀), Mashhad Airport surrounding, (*Acer* sp.), 29 August 2008; Mashhad (Mellat park), (*Fraxinus excelsior*), Kashmar, 8 October 2008.

Previous provincial records for Iran: East Azerbaijan (Daneshvar, 1978; Modarres Awal, 1997).

Comments: This predatory mite was found on some sampled plants, but it was far less abundant and not as widely distributed as *Phytoseius corniger* species. It is the second record of this mite species in Iran and is new for the province fauna.

II- Order Prostigmata

Family Anystidae

***Anystis baccarum* L.**

Materials examined and associations: 2 ♀♀, Chenara, (*Thuja orientalis*) 28 July 2007; 1 ♀, Mashhad(Vakil abad forest park), (*Platanus orientalis*), 3 August 2008.

Previous provincial records for Iran: Western Azerbaijan, Mazandaran, Khuzestan, East Azerbaijan, Hamadan, Charmahal & Bakhtiari, Tehran (Kamali et al., 2001).

Comments: *Anystis baccarum* L. is a general predator living in diverse habitats, is known to feed on various arthropods including tetranychids, and has been found in association with several perennial crops (Sorenson et al., 1976).

Family Cheyletidae

***Cheyletogenus ornatus* (Canestrini & Fanzago, 1876)**

Materials examined and associations: 5 ♀♀, Ferdowsi University Campus (*Pinus* sp.), October 2008.

Previous provincial records for Iran: Kerman (Merhnejad & Ueckermann, 2001; Yazdani & Ebrahimi 1993); Tehran (Sorush & Kamali, 2002); Mazandaran (Barimani & Kamali, 1999; Faraji & Kamali, 1993; Taghavi et al., 1998).

Comments: Mehrnejad and Ueckermann (2001) found this mite species in the colonies of armored scale insects (*Pistaciaspis pistaciae* and *Salisicola davatchi* B. & K., Diaspididae) on pistachio trees. According to the latter, this mite is a useful predator, but is not deemed an especially promising biocontrol agent.

Family Diptilomiopidae

***Diptacus gigantorhynchus* (Nalepa, 1892)**

Materials examined and associations: 3 specimens, Botanical garden of Ferdowsi University of Mashhad, (*Prunus* sp.), 21 July 2007.

Previously recorded from Guilan on *Mespilus germanica* L. (Hajizadeh, 2004).

Family Eriophyidae

***Aceria fraxiniflora* Felt.,1906**

Materials examined and associations: 51 specimens, Ferdowsi University Campus (*Fraxinus excelsior*), May-October 2007; Torogh forest park, 19 June & 18 August 2008.

Previous records for Iran: Before this study, there was no record of this Eriophyoid species occurring in Iran.

Comments: Numerous specimens of this mite were found on deformed flowers on ash trees (*Fraxinus excelsior*) in May 2007 in Mashhad (Ferdowsi University Campus). Subsequent sampling showed that this species is active throughout the summer and has the potential to produce several generations per year. Frequency of observed deformed male flowers of ash trees in response to this mite feeding which remain on trees as green masses until end of summer suggested that this species could be an important pest of ash in all growing areas.

***Aculus dimidiatus* (Hall, 1967)**

Materials examined and associations: 30 specimens, Mashhad (Mellat park), 5 September 2007, (*Populus* sp.).

Previous records for Iran: This is the first report of the occurrence of this mite species in Iran.

Comments: This vagrant eriophyid was found on both upper and lower leaf surfaces of poplar tree without any specific symptom of feeding injury.

***Rhinophytoptus dudichi* Farkas, 1963**

Materials examined and associations: 3 specimens, botanical garden of Ferdowsi University of Mashhad, (*Prunus* sp.), 21 July 2007.

Previous records for Iran: There is no provincial record of this mite species in Iranian literature, but according to the data base, www.faunaeur.org, Iran is included in the distribution map of this species.

Comments: No damage to the host was observed.

Family Eupalopsellidae

***Eupalopsellus olandicus* Sellnick**

Materials examined and associations: 3 specimens, Ferdowsi University Campus (*Chrysanthemum* sp.), 28 September 2007; Mashhad (Mellat park), (*Chrysanthemum* sp.), 16 October 2007.

Previous provincial records for Iran: Eastern Azerbaijan (Bagheri et al., 2007).

Comments: Eupalopsellid mites play a role in the biological control of spider mites (Tetranychidae) and some insects such as Coccoidea and Diaspididae (Fan, 2004). It is the second record of this mite species in Iran and is new for the province fauna**.**

Family Tenuipalpidae

***Aegyptobia meyerae* Khosrowshahi & Arbabi, 1997**

Materials examined and associations: 5 specimens, Fariman, (*Thuja orientalis*), 18 September 2008, Mashhad (Mellat park), (*Thuja orientalis*), 18 November 2008.

Previous provincial records for Iran: Tehran (Khosrowshahi & Arbabi, 1997).

Comments: This is the second record of *A. meyerae* in Iran and new for the province.

***Agyptobia ueckermanni* Khosrowshahi & Arbabi, 1997**

Materials examined and associations: 3 specimens (♀♀), Mashhad Airport suroundings, (*Thuja orientalis*), 19 October 2008; Mashhad (Mellat park), (*Thuja orientalis*), 2 November 2008.

Previous provincial records for Iran: Tehran (Khosrowshahi & Arbabi, 1997).

Comments: This is the first report of the occurrence of *A. ueckermanni* in Razavi Khorasan province.

***Brevipalpus lewisi*, McGregor, 1949**

Materials examined and associations: 4 specimens (4 ♀♀), Ferdowsi University campus, (*Syringa vulgaris*), 15 October 2007.

Previous provincial records for Iran: Tehran, Lorestan (Khosrowshahi & Arbabi, 1997; Kamali et al., 2001).

Comments: This is the first report of the occurrence of this mite species in Razavi Khorasan province.

***Cenopalpus meyerae* Khosrowshahi, 1991**

Materials examined and associations: 17 specimens, Vakil abad, (*Platanus orientalis*), 2 July 2007, Torogh forest park, (*Platanus orientalis*), 4 August 2007, Mashhad Air port, 23 September 2008, Neyshabor(Baghrod), (*Platanus orientalis*), 13 October 2008.

Previous provincial records for Iran: it is said that this species is widely distributed throughout Iran, but localities are not specified (Khosrowshahi, 1991; Khosrowshahi & Arbabi, 1997).

Comments: This is the second report of the occurrence of this species in Iran and it is new for the Razavi Khorasan fauna.

***Cenopalpus saryabiensis* Akbar & Chuadhri,1985**

Materials examined and associations: 6 specimens (♀♀), Mashhad (Mellat park), (*Pinus eldarica*), 4 August 2007; Torogh , (*Pinus* sp.), 20 September 2007.

Previous provincial records for Iran: Tehran (Khosrowshahi & Arbabi, 1997).

Comments: This is the second record of this mite species in Iran.

Family Tetranychidae

***Eotetranychus willametti* (McGregor, 1917)**

Materials examined and associations: 19 specimens (7 ♂♂, 12 ♀♀), Ferdowsi University campus (*Ulmus campestris*), 19 October & 3 November 2008.

Previous provincial records for Iran: This is the first record of this mite species in Iran.

Comments: This mite is a serious pest of grape in California. Also, it has been reported from elm, white oak, apple pear and other plants (Jeppson et al., 1975).

***Oligonychus coffeae* McGregor, 1952**

Materials examined and associations: 4 specimens (3♀♀, 1♂), Ferdowsi University Campus (*Querqus* sp.), 12 June 2007.

Previous provincial records for Iran: Razavi Khorasan (Sadeghi, 1995); Mazandaran (Barimani et al., 2004).

Comments: Quercus is a new host for *Oligonychus coffeae* in Iran. This mite has already been reported from apple and quince trees in the region.

***Oligonychus ilicis* McGregor, 1917**

Materials examined and associations: 7 specimens (3♂♂, 4♀♀), Mashhad (Bahrabad park), (*Thuja orientalis*), 18 November 2008.

Previous provincial records for Iran: this is the first record of this species from Iran.

Comments: this species has been found on holly, conifers, azalea, camellia, Cranberries, walnut and sycamore in USA, coffee in Brazil, and on tea, rice, laurel holly & boxwood in Japan. It also attacks camphore, eucalyptus, oak, spruce, pear and quince (Jeppson et al., 1975).

***Oligonychus judithae* Meyer, 1974**

Materials examined and associations: 11 specimens (7♀♀, 4♂♂), Mellat park, (*Thuja orientalis*), 27 May 2007, Torogh forest park (*Thuja orientalis*), 6 September 2007, Ferdowsi University Campus (*Thuja orientalis*) October 2008.

Previous provincial records for Iran: Isfahan (Behdad, 1998; Kamali et al., 2001; Khanjani & Haddad Irani Nejad, 2005).

Comments: This is the first record of this species in Razavi Khorasan province.

***Oligonychus ununguis* (Jacobi, 1905)**

Materials examined and associations: 21 specimens (12 ♀♀, 9 ♂♂), Torogh forest Park (*Thuja orientalis*), 23 September 2007; FUC (*Pinus* sp., *Thuja orientalis*, *Juniperus* sp.), May-December 2008; Mashhad (Vakil abad), *Pinus* sp., 4 October 2008.

Previous provincial records for Iran: Mazandaran (Barimani Varandi & Kamali, 1999); Guilan(Kamali et al., 2001, Khanjani & Haddad Irani Nejad, 2005).

Comments: Spruce spider mite is regarded as one of the most serious mites attacking conifers throughout the world. A number of conifers are host to the spruce spider mite including: arborvitae, cypress, fir, false cypress, hemlock, incense cedar, larch, juniper, redwood, pine, yew, Douglas-fir and spruce (Jeppson et al., 1975).

***Panonychus ulmi* (Koch, 1836)**

Materials examined and associations: 5 specimens (3♀♀, 2♂♂), Mashhad (Mellat park), (*Morus alba*), 7 September 2007.

Previous provincial records for Iran: It is widely distributed in major growing areas of Iran: Golestan, West Azerbaijan, East Azerbaijan, Tehran, Razavi Khorasan, (Khanjani & Haddad Irani Nejad, 2005).

Comments: European red mite, *P. ulmi* is a major pest of most deciduous fruit orchards such as apple, pear, plum, peach, cherry, walnut, almond, and several other trees (Jeppson et al., 1975).

***Tetranychus truncatus* Ehara, 1956**

Materials examined and associations: 8 specimens (5♀♀, 3♂♂), Mashhad (Vakil abad), (*Mentha* sp., Lamiaceae), 20 October 2008.

Previous provincial records for Iran: this is the first record of this mite species from Iran.
Comments: This mite has been reported as a pest of mulberry and other plants in Japan and the Philipines (Ehara, 1956).

***Tetranychus tumidellus*, Pritchard & Baker, 1955**
Materials examined and associations: 5 specimens(2 ♀♀, 3 ♂♂), Ferdowsi University Campus, (*Aster* sp.), 14 October 2008.
Previous provincial records for Iran: this is the first record of this mite species from Iran.
Comments: This mite has been reported as pest of wild and cultivated peanut in Brazil, South Turkey, Georgia and Alabama in USA (Jeppson et al., 1975).

***Tetranychus turkestani* (U. & N., 1937)**
Materials examined and associations: 37 specimens (24 ♀♀, 13 ♂♂), Fariman, (*Ailanthus altissima*), 2 June 2007, Ferdowsi University campus, (*Rosa* spp., *Melia azaderach*, *Fraxinus excelsior* , *Ulmus* sp., *Catalpa speciosa*), 27 July 2007; (*Syringa vulgaris* , *Robinia pseudoacacia* L), 7August 2007; Khaf (Torbat Heidarieh), (*Morus alba*), 9 September 2007; Neyshabor (Baghrod), (*Morus nigra*), 29 July 2008.
Previous provincial records for Iran: Ardabil, Isfahan, Southwestern Iran, Tehran Hamadan, Kerman, Charmahal & Bakhtiari, Khuzestan, West Azerbaijan (Kamali et al., 2001; Khanjani & Haddad Irani Nejad, 2005).

***Tetranychus urticae* Koch, 1836**
Materials examined and associations: 25 specimens (16 ♀♀, 9 ♂♂), Shirvan, (*Fraxinus excelsior*), 25 June 2007, Chenaran, (*Robina pseudoacasia*), 1 August 2007, Ferdowsi Univ. campus, (*Rosa* spp., *Acer* sp., *Morus* spp. Ulmus sp.), 1 September 2007.
Previous provincial records for Iran: This species is widely distributed in all growing areas of Iran (Kamali et al., 2001; Rafiei et al., 2004; Khanjani & Haddad Irani Nejad, 2005).
Comments: It is known that this species has more than 150 host plants, including most deciduous fruit trees, vegetables and ornamental plants (Jepson et al., 1975). Two spotted spider mite is predominantly found on mature leaves and is encountered much less frequently on the young expanding leaves.

DISCUSSION

Of 30 mite species collected in this survey, one species each from genera *Tetranychus* (on Wisteria), *Schizotetranychus* (on willow), *Meyernychus* (on Mulberry), *Bryobia* (on Cypress), *Aceria* (on C*onvolvulus* sp.) and *Agistemus* (on *Chrysantemum*) remained undetermined, which are either new species or species of which the identity is still unconfirmed. Of collected species, 19 species were phytophagous. Except in cases of *Tetranychus* spp., *Oligonychus ununguis*, and *A. fraxiniflora*, the majority were relatively not numerous and far from reaching economic injury level.

In this study, *T. turkestani*, *T. urticae* and *O. ununguis* were the predominant species in the complex of Tetranychoid mites on landscape plants and collected from different locations and plants.

Among the predatory mites, *Phytoseius corniger* and *Typhlodromus bagdasarjani* were present on a variety of plants, even where no phytophagous mites were found. This may allow them to prevent the outbreaks of harmful mites also in the urban environment. Although mite predators of families Stigmaeidae, Anystidae and Cheyletidae are relatively important controlling agents of phytophagous mites (Gerson, *et al.* 2003). Generally the species richness and abundance of these natural enemies on sampled plants was relatively low in the studied areas.

Phytophagous mites diversity is related to the number of predators in the system and their efficiency in preventing single species from monopolizing food resources. Therefore, predators play an important role in diverse and stable conditions and stabilizing factors involved in predator-prey population dynamics (Price, 1997).

High population of certain phytophagous mites may be explained by the lack of predatory mites, which could effectively control various plant pests but are rare in urban environments, possibly because of their sensitivity to air pollution. Several factors have been mentioned to markedly affect the pests of green plantings in urban areas: microclimatic conditions, feed quality, and activities of predatory species as well. All these seem so interconnected that further investigation of this problem requires a more complex approach, taking into account the accumulating anthropogenic stress.

CONCLUSION

The majority of species collected in this study were found in low abundance, with the exception of *Tetranychus turkestani*, *Oligonychus ununguis*, *Aceria fraxiniflora*, *Aculus dimidiatus*. Species diversity of predatory mites was low. This survey was conducted over 2 years. We therefore consider that this study represents preliminary results, and that further faunistic studies are required. Clearly, more species are to be expected after more intensive collecting. Investigations on the effectiveness of the predatory phytoseiid species for the control of the pest species should be a further step.

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