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First investigation on mites (Acari) associated with flowers in Iran

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Abstract

A faunistic study of mites (Acari) associated with flowers in Guilan province, Northern Iran was carried out during May to June 2015. Flower samples were collected from different parts of Guilan Province. Mites were extracted by placing the sampled flowers in Berlese funnel. Collected mites were cleared in Nesbitt's solution and mounted in Hoyer's medium on microscopic slides. Totally, 13 species from 10 genera and 8 families were collected and identified. All identified species are new for flower mites fauna of Iran. This is first investigation about mites associated with flowers in Iran. The most abundant species were *Allothrombium pulvinum* Ewing (30%) and *Transeius wainsteini* (Gomelauri) (23%).

Keywords: Flower, Mites, Fauna, Guilan, Iran.

Zusammenfassung

Eine faunistische Studie der blütenbewohnenden Milben (Acari) der Provinz Guilan, Nord-Iran wurde in Mai/Juni 2015 durchgeführt. Blumenproben wurden in verschiedenen Teilen der Provinz Guilan eingetragen, aus denen mittels eines Berlese Trichters die Milben extrahiert wurden. Diese wurden in Nesbitt's Lösung mazeriert und in Hoyer's medium auf mikroskopischen Objektträgern montiert. Insgesamt wurden 13 Arten aus 10 Gattungen und 8 Familien identifiziert. Alle Arten sind neu für die Fauna der Blüten-Milben des Iran, wobei dieses Forschungsvorhaben das erste über die der Blüten-Milben-Fauna des Iran darstellt. Als häufigste Arten erwiesen sich *Allothrombium pulvinum* Ewing (30%) und *Transeius wainsteini* (Gomelauri) (23%).

Introduction

Some mites have been collected on flower of different plants and are in association with them. Hummingbird flower mites in the Neotropics are the best studied of these associations (Walter and Proctor, 2013). All species of *Rhinoseius* and *Tropicoseius* in the Melicharidae and lineages of *Proctolaelaps* (Melicharidae) and *Lasioseius* (Blattisociidae) live within the flowers of a variety of shrubs and trees and as adults use hummingbirds for phoretic

transport between plants (DOBKIN 1985; NAEEM et al. 1985; COLWELL 1986; HEYNEMAN et al. 1991; O'CONNOR et al. 1991, 1997; OHMER et al. 1991; COLWELL & NAEEM 1994; PACIOREK et al. 1995; NASKRECKI & COLWELL 1998). As well as utilizing hummingbirds and their flowers in the Neotropics, some African species of *Lasioseius* are associated with sunbirds (Nectariniidae) and the flowers they visit (KALUZ et al. 2011). Species of *Proctolaelaps* also are found in flowers in South Africa (RYKE 1964) and Western Australia (DOMROW 1979), and utilize honey birds and honey opossums, respectively, for transport among flowers. Flower-visiting bats are also carriers of flower mites (TSCHAPKA & CUNNINGHAM 2004; LINDQUIST & MORAZA 2008).

Flower mites also form phoretic associations with insect pollinators (WALTER & PROCTOR, 2013). For example, flower-inhabiting species of *Proctolaelaps* (Melicharidae) are commonly found on butterflies and moths (TREAT 1975; JANZEN 1983; BOGGS & GILBERT 1987) and one species that inhabits bromeliad flowers in Brazil is phoretic on the tropical bumble bee *Bombus morio* (GUERRA et al. 2010). Mites in the genus *Xanthippe* (Melicharidae) apparently feed on pollen or nectar in inflorescences of a palm and may be phoretic on nitidulid beetles that pollinate the palm (NASKRECKI & COLWELL 1995). Species of *Spadiseius* (Melicharidae) utilize flower-feeding bats, but also flower-visiting scarab beetles and bees (LINDQUIST & MORAZA 2008). In Africa, Australasia and Asia mites in the genera *Neocypholaelaps* and *Afrocypholaelaps* (Ameroseiidae) live in flowers, feed on pollen and nectar, and primarily use bees and butterflies for phoretic transport (EVANS 1963; BAKER & DELFI NADO-BAKER 1985; EICKWORT 1994; SEEMAN & WALTER 1995; HALLIDAY 1996).

Guilan Province (36°36' 38°27' N, 48°30' 50°30' E) is one of the 31 provinces of Iran. It is situated adjacent to Caspian Sea and embodied by Alborz Mountains, for these reasons Guilan province enjoys a very variable climate condition. This remarkable situation has prevailed the province with a variety of flora and fauna. The spring (first of April to end of May) is the season of plant flowering in Iran and also in Guilan Province. There is no previous information about mites associated with flowers in Iran. For this reason an investigation was carried out for collection and identification of mites associated with flowers in Guilan Province (Northern Iran) in spring season. This is first investigation about mites associated with flowers in Iran.

Material and Methods

Mites were collected in this study from flowers sampled in different parts of Guilan Province, Northern Iran between May to June 2015. Mites were extracted by placing the sampled flowers in Berlese funnel, preserved in 75% ethanol and cleared in Nesbitt's solution. Cleared mites were mounted in Hoyer's medium on microscopic slides. The slides were placed in an oven at 45°C for 2 weeks. The mites were examined under an Olympus BX51 (Olympus Optical Co., LTD., Tokyo, Japan) microscope and identified using valid keys (ZHANG 2003; KHANJANI & UECKERMANN 2003; SABOORI et al. 2007; HAJIZADEH et al. 2009; HAJIZADEH & MORTAZAVI 2015; DARBEMAMIEH et al. 2016). The voucher specimens of each species was preserved as slide-mounted specimens and were present in Acarology Laboratory, Department of Plant Protection, Faculty of Agricultural Sciences at University of Guilan, Rasht Iran.

Results and Discussion

Thirteen mite species associated with flowers were recorded from Guilan province, Northern Iran. Based on the samples collected from flowers in Guilan Province, during May to June 2015 the most abundant mite species were *Allotrombium pulvinum* EWING (30%) and *Transeius wainsteini* (GOMELAURI) (23%) (Fig. 1). Totally, 75% of collected species (from families of Trombidiidae, Erythreidae, Raphignatidae, Blattisocidae and Phytoseidae) are beneficial as natural enemies of injurious mites and other small arthropods. According to some laboratory studies in Iran, *A. pulvinum* is a common natural enemy of aphids and other arthropods in Iran, larvae of this species are ectoparasites of aphids whereas deutonymphs and adults are free-living predators of aphids and spider mites (SABOORI & ZHANG, 1996; HOSSEINI et al., 2002). In addition, *T. wainsteini* is potential predator for controlling injurious mites in Iran especially Northern Provinces (DANESHVAR, 1990; RAFATIFARD et al., 2004). In Iran, the predatory mite *Transeius wainsteini* is distributed on different plants along the coast of the Caspian Sea, from the eastern parts of Mazandaran province to Astara in Guilan province. Laboratory studies showed good potential of this predatory mite for control of injurious mites such as citrus red mite, *Panonychus citri* (DANESHVAR, 1990; RAFATIFARD et al., 2004). This study showed that flowers could be a reservoir for various beneficial mites.

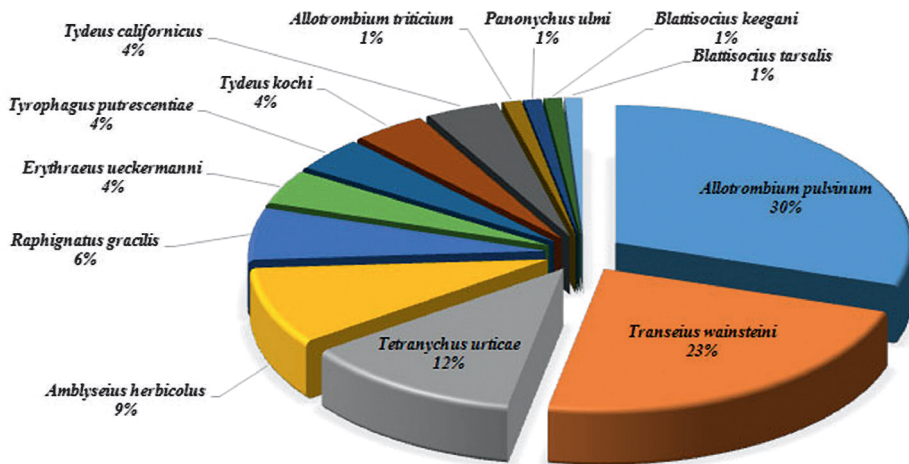


Fig. 1: Mites species collected on flowers in Guilan province, Northern Iran (May to June 2015).

Collection records

Order Trombidiformes

Suborder Prostigmata

Family Erythreidae ROBINEAU-DESVOIDY, 1828

Genus *Erythraeus* LATREILLE, 1806

Erythraeus ueckermanni SABOORI et al., 2004

Material examined: Iran, Guilan province, Rasht, 4 m, 37°16'51"N, 49°34'59"E, 2 larvae, May 29, 2015, June 22, 2015; collected on crown vetch [*Coronilla varia* (L.)] flower.

Family Trombididae LEACH, 1815

Genus *Allotrombium* BERLESE, 1912

Allotrombium pulvinum EWING, 1917

Material examined: Iran, Guilan province, Rasht, 4 m, 37°16'51"N, 49°34'59"E, 15 larvae & 2 adult, May 27, 2015, May 31, 2015, June 16, 2015, June 17, 2015; collected on raspberry (*Rubus idaeus* L.), slender deutzia (*Deutzia gracilis* 'Nikko'), Crown vetch (*Securigera varia* L.), miniature rose (*Rosa hybrida* L.), Japanese tree lilac [*Syringe reticulata* (Blume)], lantana (*Lantana camara* L.), treasure flower (*Gazania splendens* L.), oleander (*Nerium oleander* L.), field bindweed (*Convolvulus arvensis*), greater burnet saxifrage (*Pimpinella major*) flowers; Vajargah, -10 m, 37° 02' 27" N, 50° 24' 31" E, 1 larva, May 29, 2015, collected on miniature rose (*Rosa hybrida* L.) flower; Anzali, -26 m, 37°28'22"N 49°27'44"E, 1 larva, May 27, 2015, collected on dog rose (*Rosa canina* L.) flower; Kelachay, -20 m, 37°04'18"N 50°23'57"E, 7 larvae, June 4, 2015; collected on miniature rose (*Rosa hybrida* L.), Chinese wisteria [*Wisteria sinensis* (Sims)], cleavers (*Galium aparine* L.) flowers.

Remark: *Allotrombium pulvinum* was first reported in Iran on various plant species such as citrus, mulberry, apple and walnut by ZHANG & FARAJI (1994). Biology of *A. pulvinum* was studied in the laboratory and field condition in Iran (SABOORI & ZHANG, 1996). Larvae of this species are ectoparasites of aphids whereas deutonymphs and adults are free-living predators of aphids and spider mites. Wide occurrence and abundance of *A. pulvinum* in Iran are the traits that make this species a good candidate as a biocontrol agent (SABOORI & ZHANG, 1996, SABOORI & HAKIMITABAR, 2013).

Allotrombium triticium ZHANG, 1995

Material examined: Iran, Guilan province, Vajargah, -10 m, 37° 02' 27" N, 50° 24' 31" E, 1 larva, May 29, 2015, collected on miniature rose (*Rosa hybrida* L.) flower.

Family Tetranychidae DONNADIEU, 1875

Genus *Tetranychus* DUFOUR, 1832

Tetranychus urticae KOCH, 1836

Material examined: Iran, Guilan province, Rasht, 4 m, 37°16'51"N, 49°34'59"E, 5 ♀♀ and 2 ♂♂, May 25, 2015, June 4, 2015, collected on scottish bluebell (*Campanula rotundifolia* L.), yellow horn poppy (*Glaucium flavum* CRANTZ) flowers; Kelachay, -20 m, 37°04'18"N 50°23'57"E, 5 ♀♀, June 4, 2015, collected on miniature rose (*Rosa hybrida* L.) flower.

Genus *Panonychus* YOKOYAMA, 1929

***Panonychus ulmi* KOCH, 1836**

Material examined: Iran, Guilan province, Kelachay, -20 m, 37°04'18"N 50°23'57"E, 1 ♀, June 4, 2015, collected on miniature rose (*Rosa hybrida* L.) flower.

Family Tydeidae ANDRE, 1979

Genus *Tydeus* KOCH, 1836

***Tydeus Kochi* OUDEMANS, 1928**

Material examined: Iran, Guilan province, Rasht, 4 m, 37°16'51"N, 49°34'59"E, 3 ♀♀, June 16, 2015, June 17, 2015, collected on lantana (*Lantana camara* L.), red sesbania (*Sesbania punicea* (Cav.) Benth.) flowers.

***Tydeus californicus* (BANKS, 1904)**

Material examined: Iran, Guilan province, Rasht, 4 m, 37°16'51"N, 49°34'59"E, 1 ♀, June 17, 2015, collected on red sesbania [*Sesbania punicea* (Cav.) Benth.] flower; Kelachay, -20 m, 37°04'18"N 50°23'57"E, 2 ♀♀, June 4, 2015, collected on miniature rose (*Rosa hybrida* L.), oleander (*Nerium oleander* L.) flowers.

Family Raphignatidae KRAMER, 1877

***Raphignatus* DUGES, 1834**

***Raphignatus gracilis* (RACK, 1962)**

Material examined: Iran, Guilan province, Rasht, 4 m, 37°16'51"N, 49°34'59"E, 1 ♀, June 17, 2015, collected on oleander (*Nerium oleander* L.) flower; Kelachay, -20 m, 37°04'18"N 50°23'57"E, 4 ♀♀, June 4, 2015, collected on miniature rose (*Rosa hybrida* L.), Chinese wisteria [*Wisteria sinensis* (Sims)], Persian Lilac (*Melia azedarach* L.) flowers.

Order Mesostigmata

Family Blattisocidae GARMAN, 1948

Genus *Blattisocius* KEEGAN, 1944

***Blattisocius keegani* FOX, 1947**

Material examined: Iran, Guilan province, Rasht, 4 m, 37°16'51"N, 49°34'59"E, 1 ♀, June 16, 2015, collected on, white petunia [*Petunia axillaris* (Lam.)] flower.

***Blattisocius tarsalis* (BERLESE, 1918)**

Material examined: Iran, Guilan province, Kelachay, -20 m, 37°04'18"N 50°23'57"E, 1 ♀, June 4, 2015, collected on cleavers (*Galium aparine* L.) flower.

Family Phytoseidae BERLESE, 1916

Genus *Amblyseius* BERLESE, 1914

***Amblyseius herbicolus* CHANT, 1959**

Material examined: Iran, Guilan province, Rasht, 4 m, 37°16'51"N, 49°34'59"E, 1 ♀, May 27, 2015, collected on raspberry (*Rubus idaeus* L.), Kelachay, -20 m, 37°04'18"N 50°23'57"E, 7 ♀♀, June 4, 2015, collected on miniature rose (*Rosa hybrida* L.), Persian Lilac (*Melia azedarach* L.), oleander (*Nerium oleander* L.), johnswort (*Hypericum perforatum* L.) flowers.

R e m a r k : *Amblyseius herbicolus* has wide distribution range in Guilan Province of Iran. It was the most abundant phytoseiid species in citrus orchards of Guilan Province (HAJIZADEH & NAZARI 2012). According to some laboratory studies in Iran, *A. herbicolus* is potential predators for controlling spider mites such as *T. urticae* (NOTGHI MOGHADAM et al. 2010). Examples for actual use of *Amblyseius herbicolus* in citrus orchards for biological control of mites harmful to citrus exist in other countries (CHIU & LO 1985; ARGOV et al. 2002).

Genus *Transeius* CHANT & MCMURTRY, 2004

***Transeius wainsteini* (GOMELAURI, 1968)**

M a t e r i a l e x a m i n e d : Iran, Guilan province, Rasht, 4 m, 37°16'51"N, 49°34'59"E, 9 ♀♀, June 16, 2015, June 17, 2015, collected on Japanese tree lilac [*Syringe reticulata* (Blume)], miniature rose (*Rosa hybrida* L.), lantana (*Lantana camara* L.), treasure flower (*Gazania splendens* L.), red sesbania [*Sesbania punicea* (Cav.) Benth.], Iberian knapweed (*Centaurea iberica* Trevir. ex Spreng.), trumpet creeper [*Campsis grandiflora* (Thunberg)], Chinese wisteria [*Wisteria sinensis* (Sims)] flowers; Fuman (37° 13' 48" N, 49° 17' 24" E), -3 m, 7 ♀♀, May 30, 2015, collected on geranium (*Pelargonium hortorum* Bailey), lemon [*Citrus limon* (L.)] flowers; Kelachay, -20 m, 37°04'18"N 50°23'57"E, 5 ♀♀, June 4, 2015, collected on oleander (*Nerium oleander* L.), Persian Lilac (*Melia azedarach* L.), miniature rose (*Rosa hybrida* L.), cleavers (*Galium aparine* L.) flowers.

R e m a r k : *Transeius wainsteini* has wide distribution range in Northern Provinces (Guilan, Mazandaran and Golestan) of Iran (DANESHVAR 1990). Laboratory studies showed good potential of this predatory mite for control of injurious mites such as citrus red mite, *Panonychus citri* and two spotted spider mite, *Tetranychus urticae* (DANESHVAR 1990; RAFATIFARD et al. 2004).

Order S a r c o p t i f o r m e s

Cohort A s t i g m a t a

Family A c a r i d a e O U D E M A N S, 1904

Genus *Tyrophagus* O U D E M A N S, 1924

***Tyrophagus putrescentiae* (SCHRANK, 1781)**

M a t e r i a l e x a m i n e d : Iran, Guilan province, Kelachay, -20 m, 37°04'18"N 50°23'57"E, 3 ♀♀, June 4, 2015, collected on oleander (*Nerium oleander* L.) flowers.

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