Typhlodromus (*Anthoseius*) *bagdasarjani* Wainstein & Arutunjan (Acari: Phytoseiidae) as Dominant Species of Predatory Mite with an Introduction to Tydeoid Mites in Karaj

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Submission: 17 October 2018 Revised: 21 July 2019 Accepted: 31 July 2019

ABSTRACT

Karaj is considered as one of the most important area containing of many crop fields and orchards. There was a necessity to identify mites Fauna as a first step of the IPM strategy. This, study conducted in the significant parts of this area during 2014–2015. The samples were collected from ten regions of Karaj over 25 species of plants by beating, shaking shoots or foliage of various plants over a white tray. Mites were observed under a stereo microscope, preserved into 70% ethanol vials and finally mounted on microscope slides using Hoyer's medium. The most dominant species were: (i) the Phytoseiidae species: *Typhlodromus* (*Anthoseius*) *bagdasarjani* Wainstein and Arutunjan (ii) the family of Iolinidae consisted of one species including (*Neopronematus rapidus* (Kuznetzov) and three species of the family Tydeidae (*Pronematus* spp., *Tydeus* spp. and *Brachytydeus* spp.) are reported in Alborz Province (Karaj, Iran). Simultaneously, the families Iolinidae, Tetranychidae and Phytoseiidae were populated respectively as the furthest to lowest frequency of occurrence in this region.

Keywords: Phytoseiidae, tydeoid mites, density, Karaj, Iran

Thai J. Agric. Sci. (2019) Vol. 52(3): 152−160

INTRODUCTION

Predators of the family phytoseiidae are largely considered for the biological control of mite and small insect pests in diverse cropping systems (Chant and McMurtry, 1994; McMurtry and Croft, 1997). This family has received considerable attention in the last 50 years for their role as biological control agents (Gnanvossou *et al*., 2003). Species of the mentioned family feed on Tetranychidae and Eriophydae (Acari: Prostigmata) (Karg *et al*., 1987; Sabelis, 1996; Ferragut *et al*., 2008; Momen, 2010) with a well-known capacity to control mites mainly tetranychids (Easterbrook *et al*., 2001; Colfer *et al*., 2004). Phytoseiid species are reported from Iran (Khalil-Manesh, 1973; Sepasgozarian, 1977; Kamali *et al*., 2001; Rahmani *et al*., 2006; Faraji *et al*., 2007; Ueckermann *et al.,* 2009; Asali-Fayaz *et al.,* 2010; Arbabi *et al*., 2011; Hajizadeh and Nazari, 2012; Ostovan *et al*., 2012) and it is consisted of more than 70 species (Rahmani *et al*., 2010). For instance, Asali-Fayaz *et al.* (2012) reported and re-described some species of the family Phytoseiidae with newly recorded *Typhlodromus* (*Anthoseius*) *tamaricis* (Kolodochka) in Ardebil. It has been collected 21 species from six genera in the western and north western of Iran by Asali-Fayaz and Khanjani (2012) moreover, by Panahi-Laeen *et al*. (2014) with five genera in fruit orchards from Razavi-Khorasan Province. Tydeoidea a super-family of Prostigmata is widespread all over the world. These mites are considered as omnivorous and feed on pollen, plants,

nematodes, eggs of arachnids, fungus and other mites (Walter, 1987). *Tydeus caudatus* (Dugès) may control the grape eriophyid mite, *Colomerus vitis* (Pagenstecher) (Gerson *et al.*, 2003). Also, *Tydeus caryae* Khanjani and Ueckermann was observed feeding on *Aceria tristriata* (Nalepa) (Khanjani and Ueckermann, 2003). Furthermore, the other important species such as *Brachytydeus* Thor from Serbia, Spain (two species) and Poland (three species) has been detected (Kazmierski, 2008; 2009) as well, three species: *Typhlodromus*, *Tydeus* and *Pronematus* on cotton fields from Gorgan, Iran has been reported (Forghani, 2005). Therefore, identification, distribution with knowledge of the mites (tydeoid/phytoseiid**)** role in different agricultural ecosystems may help us to a better management of insects and arachnids. So, this preliminary study aimed at investigating the occurrence and species diversity of the most important plant-inhabiting mites which may be considered in the IPM processes.

MATERIALS AND METHODS

Karaj is located in 51°0'30" longitude and 35°48'45" latitude that altitude and the mean of annual rainfall are 1297 m.a.s.l. and 243 mm respectively. Moreover, the mean of annual temperature is 14.1ºC. The study carried out during two years (2014–2015) and sampling conducted every week from March to November from different regions of Karaj, including Kamal Shahr, Mohammad Shahr, Ziba Dasht, Mahdasht, Kalak, Chaman, Markaz Amozesh-Keshavarzi, Agh-Tappeh, Pour-kashani and Meshkin Dasht. Samples were collected from leaves and foliage in different parts of orchards, crop fields and weeds. In the lab, mites were isolated by beating or shaking shoots or foliage of various plants such as apple (*Malus domestica*), Japanese quince (*Chaenomeles japonica*), grape (*Vitis vinifera*), almond (*Prunus dulcis*), black plum (*Syzygium cumini*), gold drops plum (*Prunus domestica)*, peach (*Prunus persica*), apricot (*Prunus armeniaca*), mulberry (*Morus nigra*)*,* cherry (*Prunus avium*), fig (*Ficus carica*), greengage (*Prunus domestica*), walnut (*Juglans regia*), plane tree (*Platanus* sp.), strawberry (*Fragaria ananassa*), safflower (*Carthamus tinctorius*), rose (*Rosa* sp.), cucumber (*Cucumis sativus*), cucurbit plant (*Cucurbita* sp.), pepper (*Piper nigrum*), goosefoot (*Chenopodium* sp.) and creeping thistle (*Cirsium arvense*) over a white tray. The mites were checked under a stereo-microscope, preserved in 70% ethanol and finally mounted on microscope slides using Hoyer's medium (Krantz and Walter, 2009). Almost 1,500 mounted slides were prepared for identification using reliable identification keys.

Table 1 Density of mites species collected in Karaj, Iran

Group	Family	Mean ± SE 2014*	Mean ± SE 2015*	Mean ± SD Average**	% Total density
Prostigmata	Iolinidae	51.55 ± 3.41^{a}	46.33 ± 3.42^{a}	48.94 ± 10.31^{A}	84.25
Prostigmata	Tydeidae	2.88 ± 0.53^{d}	2.00 ± 0.53^{d}	2.44 ± 1.61^{D}	3.32
Prostigmata	Tetranychidae	20.77 ± 2.25^{b}	17.33 ± 2.25^{b}	19.05 ± 6.79^{B}	34.03
Mesostigmata	Phytoseiidae	5.77 ± 0.46^{c}	5.33 ± 0.46^{c}	5.55 ± 1.38^{C}	9.29
Prostigmata	Tenuipalpidae	2.33 ± 0.32^{d}	2.22 ± 0.32^{d}	2.27 ± 0.95^{D}	3.71
Prostigmata	Cheyletidae	1.55 ± 0.30^{e}	1.11 ± 0.30^{e}	1.33 ± 0.90^{E}	2.43
Mesostigmata	Ameroseidae	0.66 ± 0.20^{f}	0.55 ± 0.20^{f}	0.61 ± 0.60^{F}	0.92
Prostigmata	Coligonellidae	0.22 ± 0.14^{f}	0.22 ± 0.14^{f}	0.22 ± 0.42^{F}	0.23
Prostigmata	Tarsonemidae	0.11 ± 0.11^{f}	0.11 ± 0.11^{f}	0.11 ± 0.32^{F}	0.11
Prostigmata	Stigmaeidae	0.11 ± 0.11^{f}	0.11 ± 0.11^{f}	0.11 ± 0.32^{F}	0.11
Prostigmata	Camerobiidae	0.11 ± 0.11^{f}	0.11 ± 0.11^{f}	0.11 ± 0.32^{F}	0.11
Prostigmata	Erythraeidae	0.11 ± 0.11^{f}	0.11 ± 0.11^{f}	0.11 ± 0.32^{F}	0.11
Oribatida	Oribatidae	0.11 ± 0.11^{f}	0.11 ± 0.11^{f}	0.11 ± 0.32^{F}	0.11

Note: Means followed by different letters within a column are significantly different at the 0.05 level (LSD test). (* : N = 9), (** : N = 18)

RESULTS AND DISCUSSION

In a total of 13 families of mites were collected in Karaj region, among them the Iolinidae clarified the utmost population (Table 1). The family Tetranychidae had the high frequency of occurrence on three subsequent hosts: bean, egg-plant and cucumber, which were found in Markaz Amozesh-Keshavarzi area with the most population (Figure 1). The mean family of Phytoseiides population for the two years showed that *Typhlodromus* (*Athoseius*) *bagdasarjani* was the dominant Phytoseiid species (45.5%) in this region in comparison with the other ones: *Neoseiulus bicaudus* (Wainstein) (2%), *Paraseiulus talbii* (Athias-Henriot) (0.5%) and *Typhlodromus* spp. (2%) (Table 2). It was determined entirely clear populations on *Neopronematus rapidus* (Kuznetzov 1972) (Iolinidae) and Tydeidae with three species of *Pronematus* spp., *Tydeus* spp. and *Brachytydeus* spp. The consequences assigned *N. rapidus* is the abundant species in this group (Table 3)**.** In addition, the species *Pronematus* spp. was detected on Gourd to a high degree of the density, whereas *N. rapidus* was collected from tomato at the top abundance of population. On the whole, the super-family Tydoeidea (Iolionidae and Tydeidae) clarified utmost density on walnut in Markaz Amozesh- Keshavarzi. The distribution of host plants and the density of tydeoid mites are shown in Table 3.

Table 2 List of phytoseiid species with their density, distributions and host plants in Karaj, Iran

Year	Species	density%	Areas	Hosts
2014	*Typhlodromus* (*A.*) *bagdasarjani*	46	Ziba-dasht, Markaze Amoozesh Keshavarzi, Pourkashani, Meshkin dasht	apple, Japanese quince, grapes, almonds, black plum, gold drops plum, peach, apricot, berry, sweet-cherry, fig, greengage, walnut, plane tree, strawberry, safflower, rose, cucumber, cucurbit plant, pepper, goosefoot, pear,
	Neoseiulus bicaudus	2		
	Paraseiulus talbii	1		
	Typhlodromus spp.	3		
2015	*T.* (*A.*) *bagdasarjani*	45		
	Neoseiulus bicaudus	2		
	Typhlodromus spp.	1		

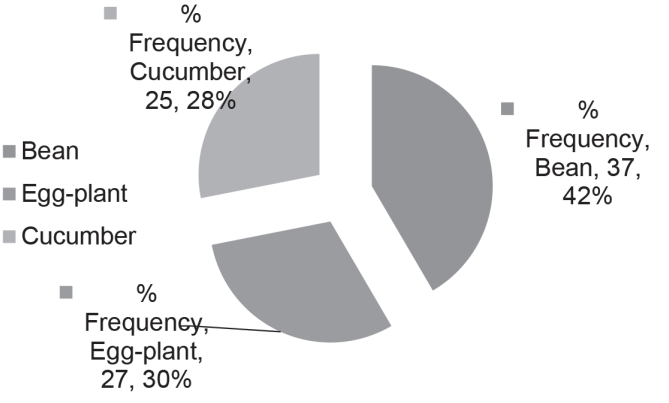

Figure 1 Most density of the species of Tetranychidae on different hosts in Markaz Amoozesh-Keshavarzi, Karaj, Iran

The study shows a large number of plant-inhabiting mites (Acari: Mesostigmata, Prostigmata, Oribatida) which at least some species may consider as an important necessity in crop management. In general, mite species may feeds on different hosts with changes of range population. At this work was presented some families of three groups of mites (Table 1) and among them, three families revealed the most population. The family Iolinidae (among total collected mites) demonstrated the highest density and the destructive mites were mainly related to the family Tetranychidae showed the second position. Species of this family further were associated with bean, egg-plant and cucumber plants subsequently. In this regard, number of Phytoseiidae mites were assigned averagely and had the third level. Probably, a close relation between Tetranychidae (prey and destructive mites) with Phytoseiidae (predatory mites) may be presumed. Similar consequences emphasize this matter. On one hand, the phytoseiid mites had a good distribution in various parts of Iran (Asali-Fayaz *et al.*, 2010; Arbabi *et al.,* 2011; Asali-Fayaz and Khanjani, 2012; Asali-Fayaz *et al.,* 2012), on the other hand reasonable population for Tetranychidae has been adapted with the phytoseiid mite predators (Brandenburg and Kennedy, 1987; Forghani, 2005; Demirel and Kabuk, 2008). On the whole, the scope of current work includes complementary identification of phytoseiid and Tydeoid mites. Our results, clarified *N. rapidus* was populated on different plants especially tomato by more frequency despite the fact that *Pronematus* spp. *Tydeus* spp. and *Brachytydeus* spp. showed less populations at the same area (Table 3). It seems that condition for *N. rapidus* had suitable adaptation to this area as it was mentioned by Jeppson *et al.* (1975). Concerning *Tydeus calabrus* (Castagnoli, 1984) was recorded in Razavi Khorasan (Iran) also, *Neopronematus sepasgosariani* Sadeghi, Łaniecka and Kaźmierski, *N. lundqvisti* Sadeghi, Łaniecka and Kaźmierski and *Tydeus darekiwani* Sadeghi, Łaniecka and Kaźmierski were reported as the other collections subsequently (Sadeghi *et al.*, 2012). Furthermore, Darbemamieh *et al.* (2015) recorded *Neopronematus kamalii* Darbemamieh and Hajiqanbar on apricot with the other species *N. solani* (Laniecka and Kazmierski, 2013) on potato and *N. rapidus* (Kuznetzov, 1972), *N. sepasgosariani* (Sadeghi *et al.*, 2012), *N. lundqvisti* (Sadeghi *et al.*, 2012) and *N. neglectus* (Kuznetzov, 1972) from Kermanshah in Iran. In the Phytoseiidae family, we assumed *Typhlodromus (Athoseius) bagdasarjani* with remarkable occurrence and distribution on different hosts in Karaj, while *N. bicaudus*, *P. talbii* and *Typhlodromus* spp. were perceived at low values. Respect to this, Asali-Fayaz *et al.* (2013) referred *T. bagdasarjani* is very common on crops in western and south western of Iran and on apple and almond orchards (Asali-Fayaz *et al.*, 2011).

Table 3 List of tydoeid species with their densities, host plants and distributions in Karaj, Iran

Year	Species	Mean ± SE	Hosts	Area
*2014	*Neopronematus rapidus*	25.44 ± 2.04[a]	Tomato, Mallow, Melon, Green-bean, Walnut,	Ziba-dasht, Markaze Amoozesh Keshavarzi, Pourkashani, Mohammad Shahr, Chaman,Mahdasht
2014	*Pronematus* spp.	23.33 ± 1.55[b]	Gourd, Rose, Almond, Apricot, Berry, Grap, Blach-berry, Walnut	Ziba-dasht, Markaze Amoozesh Keshavarzi, Pourkashani, Meshkin dasht,Mohammad Shahr

Table 3 Continue

Year	Species	Mean ± SE	Hosts	Area
2014	*Tydeus* spp.	1.55 ± 0.38^{c}	Sunflower, cedar, Black-berry, Black-prune, Mallow, Rose, Gourd, Pepper, Egg-plant, Fig	Markaze Amoozesh Keshavarzi, Mohammad Shahr, Chaman,Mahdasht,Kalak
2014	*Brachytydeus* spp.	0.44 ± 0.20^{d}	Mallow, Egg-plant, Spearmint,	Ziba-dasht, Markaze Amoozesh Keshavarzi, Chaman
*2015	*Neopronematus rapidus*	22.77 ± 2.04^{a}		
2015	*Pronematus* spp.	23.11 ± 1.55^{b}		
2015	*Tydeus* spp.	2.22 ± 0.38^{c}		
2015	*Brachytydeus* spp.	0.66 ± 0.20^{d}		
**2014–2015	*Neopronematus rapidus*	24.11 ± 6.04^{A}		
2014–2015	*Pronematus* spp.	23.16 ± 4.52^{B}		
2014–2015	*Tydeus* spp.	1.89 ± 1.18^{C}		
2014–2015	*Brachytydeus* spp.	0.55 ± 0.61^{D}		

Note: Means followed by different letters within a column are significantly different at the 0.05 level (LSD test). * : N = 9, ** : N = 18; Mean ± SD

The other species of Phytoseiidae were found in different places or /and distinctive circumstances may affect on their appearances and frequencies (Asali-Fayaz *et al.*, 2010; Rahmani *et al.,* 2010; Jafari *et al.*, 2011; Panahi Laeen *et al.*, 2014) even all over the world (Tixier *et al.*, 2010; Denmark and Evans, 2011; Hernandes *et al.,* 2011). This family is considered as one of the most important groups of natural enemies throughout the world especially, in Iran in as much as some literatures have pointed their frequencies on various insect or mite pests (Khanjani and Haddad-Irani-Nejad, 2006; Khanjani *et al.*, 2010). As a result, the current study was the first to estimate and identify tydeoid and phytoseiid mites in this area. It provides direction for future researches on partial of evaluating the performance of Tydeoidea and the efficiency of Phytoseiidae as natural enemies of pests in fields and orchards in Karaj under variable environmental conditions. These results may be considered as initially process to manage crop system.

CONCLUSION

Therefore, Iolinidae family had the most population mites. Family of Tetranychidae showed the high abundance on bean, egg-plant and cucumber in Markaz Amozesh-Keshavarzi. *Typhlodromus* (*Anthoseius*) *bagdasarjani* was dominant phytoseiid species in different parts of Karaj. There were four species of *Neopronematus rapidus* (Iolinidae), *Pronematus* sp., *Tydeus* sp. and *Brachytydeus* sp. (Tydeidae). The superfamily Tydeoidea clarified utmost density on walnut in Markaz Amozesh-Keshavarzi.

ACKNOWLEDGEMENTS

I would like to express my sincere appreciation to Prof. E.A. Ueckermann (Plant Protection Institute, South Africa) for identification of tydeid mites in this study, Dr. Bahman Asali-Fayaz (Bualisina University of Hamadan, Iran) and Mr. Seyed Hassan Mossavi (Deputy for Husbandry of Tehran Province) for their co-operation.

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