

# Predatory mites associated with eriophyid mites (Acari: Eriophyidae) on privet bushes in Guilan province Iran

Jalil Hajizadeh\* and Reza Hosseini

Department of Plant Protection, Faculty of Agricultural Sciences, University of Guilan, Rasht, Iran

\*Corresponding author email: hajizadeh@guilan.ac.ir

Received 22 May 2023 | Accepted 26 June 2023 | Published 30 June 2023

## Abstract

A faunistic study was carried out for identification of predatory mites associated with injurious eriophyid mites of privet bushes in Guilan province, Northern Iran during 2023. In total six predatory mite's species belonging to two families, Phytoseiidae and Stigmaeidae were collected and identified. The predatory mite *Agistemus duzzguesae* Koç, Çobanoğlu & Madanlar is reported for first time from Iran. Collection information and dominances (%) of identified predatory mite's species are provided.

**Keywords:** *Ligustrum vulgare*, Injurious mites, Phytoseiidae, Stigmaeidae, Natural enemies

## 1. Introduction

The eriophyid mites are important pests of ornamental plants and can cause different damages such as gall, leaf curling, rusting, browning, blister and bud deformation on host plants and sometimes they can transfer virus diseases to plants (Jeppson et al., 1975; Westphal and Manson, 1996; Baker et al., 1996; Vacante, 2016). During spring of 2023, a severe damage of eriophyid mites was observed on the privet shrubs in Rasht, the capital city of Guilan province, Iran. The damage symptoms include deformity of terminal buds, browning of leaves, rusting of leaves surface, severe leaf twisting, spooning of leaves, and reducing of plant growth (Hajizadeh and Hosseini, 2023). So far, two species of eriophyid mites associated with privet shrubs, namely *Aculus ligustri* (Keifer) and *Aceria ligustri* (Keifer) have been reported from Guilan province, Northern Iran (Hajizadeh and Hosseini, 2003a, b; 2023). In the previous surveys, it was found that both species are present together on two abundant species of the hedge privet including common or hedge privet (*Ligustrum ovalifolium*), local privet or Mandarache (*Ligustrum vulgare*) and cause similar damage on them. These mites overwinter in the form of deutogyne female inside the buds of privet and lay eggs in the buds at the end of winter, then spring form of mites or protogynes are transferred to the leaves. The activity of the mite on privet starts from early spring and continues until summer (Hajizadeh and Hosseini, 2003a, b; 2023). Due to lack of research about identification of predatory mite's fauna associated with privet bushes, especially predator mites that feed on

injurious eriophyid mites, current study was conducted to identify these useful mites. The results of this study can be useful in biological and integrated pest control programs for control of harmful eriophyid mites associated with privet shrub in future.

## 2. Materials and methods

In this study predatory mites associated with privet eriophyid mites were collected from plant foliage of privet bushes from Rasht, Guilan province, Northern Iran during 2023. Each foliage sample contained about 100 leaves and buds of privet bushes heavily infested to eriophyid mites (Figure 1). Mites were extracted from foliage samples using Berlese funnel or direct examinations of plant materials under a stereomicroscope. Mites specimens were sorted and preserved in Ethanol 70%. Eventually, specimens were cleared in Nesbitt's fluid and mounted on microscope slides using Hoyer's medium. The mites were identified by the relevant taxonomic keys and papers (Stathakis *et al.*, 2014; Hajizadeh and Faraji, 2016). For precise inspection of morphological characters of prepared specimens, a compound microscope equipped with differential interference contrast and phase contrast optical system and a drawing tube (Olympus BX51, Olympus Optical Co., Ltd, Tokyo, Japan) was used. The voucher specimens of each species were preserved as slide-mounted specimens and are present in Acarology Laboratory, Department of Plant Protection, Faculty of Agricultural Sciences at University of Guilan, Rasht Iran.

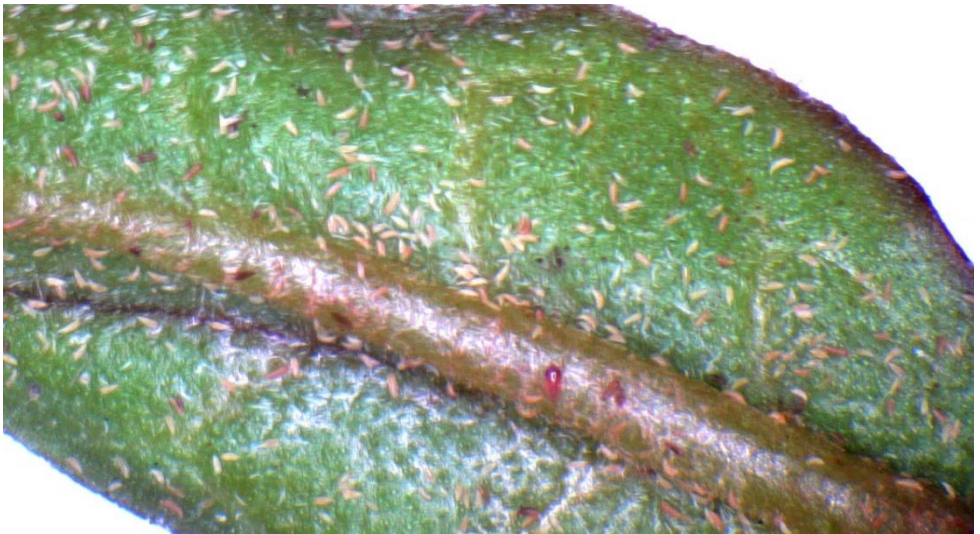


Figure 1. Infected leaf of privet bush with eriophyid mites.

## 3. Results & Discussion

During current faunistic study for predatory mites associated with privet eriophyid mites in Guilan province, Northern Iran, six species belonging to six genera and two families were collected and identified. The predatory mite *Agistemus duzgunesae* Koç, Çobanoğlu & Madanlar is reported for first time from Iran. Dominance (%) of predatory mite's species collected in this study according to the preserved slides collection is shown in figure 2. In

addition, detailed collection information of each identified species of predatory mites associated with privet eriophyid mites is provided.

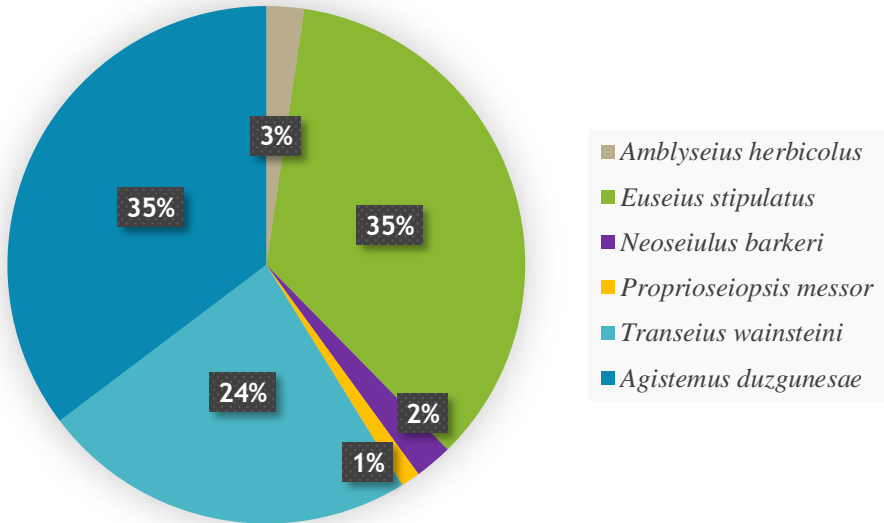


Figure 2. Percentage of predatory mite's species associated with privet eriophyid mites in Guilan province Iran, based on samples collected in 2023.

### Family Phytoseiidae

#### *Amblyseius herbicolus* (Chant, 1959) (Figure 3A)

Material examined: 2 (♀♀), Rasht, University of Guilan campus, 37° 11' 44" N 49° 38' 30" E, 28 m, collected on privet leaves infested with eriophyid mites, May, 2023.

Remark: *Amblyseius herbicolus* has a wide distribution range in Guilan province of Iran. This predatory mite is one of the most abundant phytoseiid species in Guilan province and collected on fifty species of plants infected with tetranychid mites, eriophid mites and sap-sucking insects (Hajizadeh *et al.*, 2002; Hajizadeh, 2007; Hajizadeh and Nazari, 2012; Ghasemi and Hajizadeh, 2020; Navran and Hajizadeh, 2021). According to some laboratory studies in Iran, *A. herbicolus* is potential predator for controlling injurious mites such as *Tetranychus urticae* (Notghi Moghadam *et al.*, 2010).

#### *Euseius stipulatus* (Athias-Henriot, 1960) (Figure 3C, D)

Material examined: 10 (♀♀) and 2 (♂♂), Rasht, University of Guilan campus, 37° 11' 44" N 49° 38' 30" E, 28 m, collected on privet leaves infested with eriophyid mites, May, 2023; 10 (♀♀) and 1 (♂), Lahijan, 37°12'0"N, 50°0'0"E, 94m, collected on privet leaves infested with privet rust mites, June, 2023; 5 (♀♀) and 2 (♂♂), Astaneh-ye Ashrayeh, 37°20'11"N, 49°58'23"E, 3m, collected on privet leaves infested with privet rust mites, May, 2023.

Remark: *Euseius stipulatus* feed on various thrips and mites and immature stages of scale insects, it also feed on pollen and sap (Abad-Moyano *et al.*, 2010). Population of this predatory mite has increased in recent years in the north of Iran. It is feared that this species will replace the native phytoseiid species in northern Iran (Ghasemi and Hajizadeh, 2020; Navran and Hajizadeh, 2021).

Material examined: 2 (♀♀), Rasht, University of Guilan campus, 37° 11' 44" N 49° 38' 30" E, 28 m, collected on privet leaves infested with eriophyid mites, May, 2023.

Remark: The predatory mite, *Neoseiulus barkeri*, is a commercially produced biological control agent and generalist predator applied in vegetable greenhouse and fruit orchards (Jafari *et al.* 2012, Li *et al.* 2017). This predatory mite is recorded from Guilan province on different plant species infested with tetranychid and eriophyid mites and sap-sucking insects (Hajizadeh, 2007; Ghasemi and Hajizadeh, 2020; Navran and Hajizadeh, 2021; Askari *et al.*, 2023).

*Proprioseiopsis messor* (Wainstein, 1960) (Figure 3E)

Material examined: 1 (♀), Rasht, University of Guilan campus, 37° 11' 44" N 49° 38' 30" E, 28 m, collected on privet leaves infested with eriophyid mites, May, 2023.

Remark: This predatory mite is recorded from Guilan province on olive and citrus trees infested with tetranychid and eriophyid mites (Hajizadeh & Nazari, 2012; Mahjoori *et al.*, 2015).

*Transeius wainsteini* (Gomelauri, 1968) (Figure 3F)

Material examined: 8 (♀♀) and 2 (♂♂), Rasht, University of Guilan campus, 37° 11' 44" N 49° 38' 30" E, 28 m, collected on privet leaves infested with eriophyid mites, April and May, 2023; 5 (♀♀) and 1 (♂), Lahijan, 37°12'0"N, 50°0'0"E, 94m, collected on privet leaves infested with privet rust mites, June, 2023; 4 (♀♀), Astaneh-ye Ashrayeh, 37°20'11"N, 49°58'23"E, 3m, collected on privet leaves infested with privet rust mites, May, 2023.

Remark: *Transeius wainsteini* has wide distribution range in Northern provinces (Guilan, Mazandaran and Golestan provinces) of Iran (Daneshvar, 1990; Faraji *et al.*, 2007; Hajizadeh, 2007). This predatory mite is one of the most abundant phytoseiid species in Guilan province and collected on fifty species of plants infected with tetranychid mites, eriophyid mites and sap-sucking insects (such as armored scales, thrips, whiteflies and psyllids) (Hajizadeh *et al.*, 2002; Hajizadeh, 2007; Hajizadeh and Nazari, 2012; Ghasemi and Hajizadeh, 2020; Navran and Hajizadeh, 2021). 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).

### Family Stigmaeidae

*Agistemus duzguesae* Koç, Çobanoğlu & Madanlar (Figure 4)

*Agistemus duzguesae* Koç *et al.* 2005: 121.

Diagnosis characteristics of female: All measurements are given in micrometers (µm).

Body oval; natural color yellow; length of body including gnathosoma 380 (370-410), length of body excluding gnathosoma 282 (240- 310); width of body 206 (200-220); idiosoma with seven shields; prodorsal and central hysterosomal shields with polygonal reticulations (Figure 4A, B); dorsal setae of idiosoma barbed and tapered towards the end; prodorsal shield with three pairs of setae (vi, ve and sci), one pair of eyes and one pair of postocular organ (Figure 4F); aggenital shield divided medially, each side with two setae *ag1* and *ag2* (Figure 4G); coxa IV with one seta; femur I with four setae; genu I with 2+1κ; tibia IV with four setae; tarsus I with 11+1ω; tarsus IV with seven setae; subcapitulum with two pairs of adoral setae *ro1* and *ro2* and two pairs of subcapitular setae, *m* and *n* (Figure 4D); chelicerae free, length of movable digit 36 (34-38) (Figures 4E).

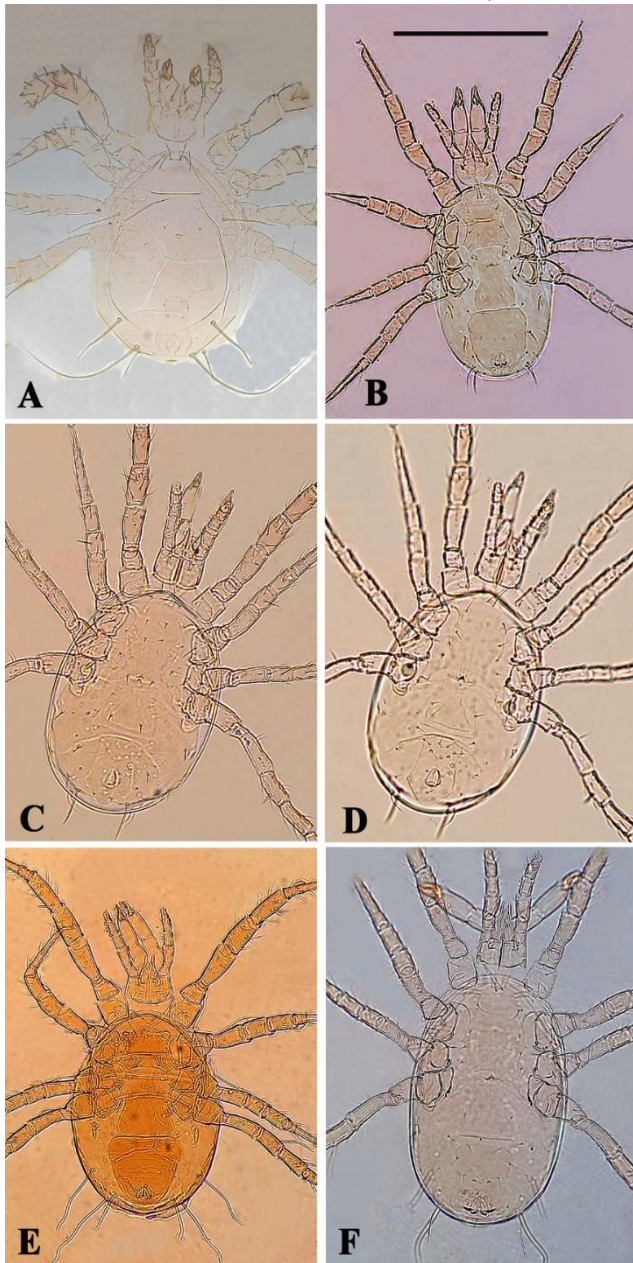


Figure 3. A. *Amblyseius herbicolus*; B. *Neoseiulus barkeri*; C & D. *Euseius stipulatus*; E. *Proprioseiopsis messor*; F. *Transeius wainsteini*. Scale bar = 260  $\mu\text{m}$  for A; 300  $\mu\text{m}$  for B; 250  $\mu\text{m}$  for C & D; 240  $\mu\text{m}$  for E; 230  $\mu\text{m}$  for F.

Material examined: 30 (♀♀), Rasht, University of Guilan campus, 37° 11' 44" N 49° 38' 30" E, 28 m, collected on privet leaves infested with eriophyid mites, April and May, 2023. Distribution. Turkey (Koç et al. 2005), Greece (Stathakis et al., 2014) and Iran (this study). The *Agistemus duzguesae* collected on various plants from Turkey and Greece but prey mite species related with this predatory species not recorded from these countries.

Remarks: Mites of family Stigmaeidae live on plants and in the soil, often feeding on the eggs and sessile forms of Tetranychidae, Tenuipalpidae, Eriophyidae and other mites that infest commercial crops in many parts of the world. A few species prey on scale insects or parasitise flies (Gerson et al. 2003; Fan and Flechtmann, 2015).

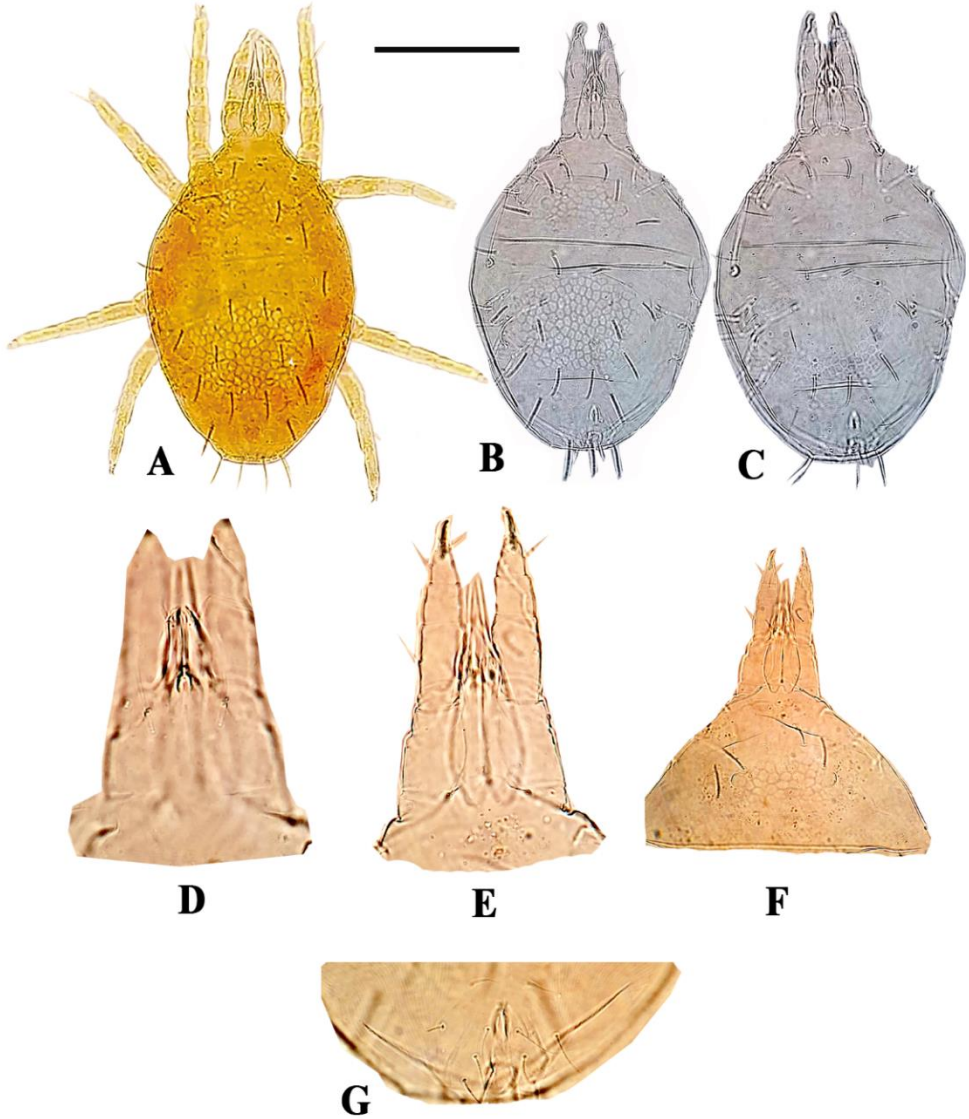


Figure 4. *Agistemus duzgunesae* (female). A & B. Dorsal view; C. Ventral view; D. Subcapitulum; E. Gnathosoma; F. Prodorsal shield; G. Anogenital region (ventral view). Scale bar = 130  $\mu\text{m}$  for A, B, C; 30  $\mu\text{m}$  for D, E; 80  $\mu\text{m}$  for F; G not scaled.

## Conclusions

The purpose of this study is identification and introduction of predatory mite's species associated with injurious eriophyid mites of privet bushes in Guilan province, Northern Iran.

It is expected that the results of this study will be useful for future Iranian researchers, especially for biological and integrated pest control program of injurious eriophyid mites of privet bushes in Iran.

## Acknowledgments

We would like to thank the reviewers for their valuable comments and suggestions to improve paper quality.

## Conflict of interests

The authors have no conflict of interest to declare.

## References

- Abad-Moyano, R., Urbaneja, A., Hoffmann, D., & Schausberger, P. (2010). Effects of *Euseius stipulatus* on establishment and efficacy in spider mite suppression of *Neoseiulus californicus* and *Phytoseiulus persimilis* in clementine. *Exper. Appl. Acaro.*, 50, 329-341.
- Askari, M., Hajizadeh, J., & Hosseini, R. (2023). Mites (Acari) associated with peanut (*Arachis hypogaea*: Fabaceae) in Iran. *J. Biol. Stu.*, 5(6), 760-773.
- Athias-Henriot, C. (1960). Nouveaux Amblyseius d' Algerie (Parasitiformes, Phytoseiidae). *Acarologia*, 2, 288-299.
- Baker, E.W., Kono, T., & Amrine, JR. J.W., Delfinado Baker M. & Stasny, T. A. (1996). Eriophyoid mites of United States. Indira Publishing House, W. Bloomfield, MI. 394 pp.
- Chant, D.A. (1959). Phytoseiid mites (Acarina: Phytoseiidae). Part I. Bionomics of seven species in southeastern England. Part II. A taxonomic review of the family Phytoseiidae, with descriptions of thirty-eight new species. *The Canadian Entomologist, Supplement* 12, 1-166.
- Daneshvar, H. (1990). Studies on the structure and bionomics of *Typhlodromips caspiensis* (Acari: Phytoseiidae) in North Iran. *Appl. Entom. Phyto.*, 57(1,2), 21-34.
- Fan, Q.H. & Flechtmann, C.H. (2015). Stigmaeidae. In: *Prospects for biological control of plant feeding mites and other harmful organisms*. Springer, Cham, pp. 185-206.
- Faraji, F., Hajizadeh, J., Ueckermann, E.A., Kamali, K., & McMurtry J.A. (2007). Two new records for Iranian phytoseiid mites with synonymy and keys to the species of *Typhloseiulus* Chant and McMurtry and Phytoseiidae in Iran (Acari: Mesostigmata). *Int. J. Acarol.*, 33, 231-239.
- Gerson, U., Smiley, R.L., & Ochoa, R. (2003). *Mites (Acari) for pest control*. John Wiley & Sons, pp. 1-558.
- Ghasemi, A., & Hajizadeh, J. (2020). Mites of superfamily Phytoseioidea (Acari: Mesostigmata) of greenhouses in Rasht County, northern Iran, with new record of a species and an identification key. *J. Entomol. Soc. Iran*, 39(4), 459-477.
- Gomelaury, L.A. (1968). Three new species of mites of the family Phytoseiidae in southern Georgia. *Bulletin of the Academy of Sciences of the Georgian SSR, Zoology and Parasitology*, 52(2), 515-520. [in Russian]
- Hajizadeh, J. (2007). Phytoseiid mites Fauna of Guilan province, part II: Subfamilies Amblyseiinae Muma and Phytoseiinae Berlese (Acari: Phytoseiidae). *Agricultural Research*, 7(1), 7-25. (In Persian with English summary).

- Hajizadeh, J., & Faraji, F. (2016). Identification guide and diagnosis key for predatory mites of the family Phytoseiidae of Iran. ACECR of Guilan province Press, Rasht, Iran, pp. 1-164. (In Persian language).
- Hajizadeh, J., & Hosseini, R. (2003a). Introducing of privet rust mite *Aculus ligustri* (Acar.: Eriophyidae) and its some biological aspect in Guilan province. Iranian J. For. Ran. Prot. Res., 1(1), 25-36.
- Hajizadeh, J., & Hosseini, R. (2003b). Introduction of *Aceria ligustri* (Keifer) (Acari: Eriophyidae) on privet from Guilan Province. Abstract book of second applied scientific seminar on flowers and ornamental plants of Iran, Mahalat. P. 2.
- Hajizadeh J., & Nazari, M. (2012). A checklist and key for the phytoseiid mites (Acari: Phytoseiidae) of citrus orchards in Iran, with a new record for Iranian phytoseiid mites. Syst. Appl. Acarol., 17, 388-396.
- Hajizadeh, J., & Hosseini, R. (2023). Damage of Eriophyid mites (Acari: Eriophyidae) on privet bushes in Guilan province. Pla. Pes.Res., 13(1), 63-68.
- Hajizadeh, J., Hosseini, R., & McMurtry J.A. (2002). Phytoseiid mites (Acari: Phytoseiidae) associated with eriophyid mites (Acari: Eriophyidae) in Guilan province of Iran. Inte. J. Acarol, 28, 373-378.
- Hughes, A.M. (1948). The mites associated with stored food products. Ministry of Agriculture and Fisheries, H. M. Stationary Office, London, 168 pp.
- Jafari, S., Fathipour, Y., Faraji, F., & M. Bagheri. (2010). Demographic response to constant temperatures in *Neoseiulus barkeri* (Phytoseiidae) fed on *Tetranychus urticae* (Tetranychidae). Syst. Appl. Acarol, 15, 83-99.
- Jeppson, L. R., Keifer H. H., & Baker E. W. (1975). Mites injurious to economic plants. Univ. of California Press, USA, 614 pp.
- Koç, K., Çobanoğlu, S., & Madanlar, N. (2005). *Agistemus duzgunesae* sp n. (Acari, Stigmaeidae) from Turkey. Biologia, 60 (2), 121-124.
- Li, Y.Y., Liu, M.X., Zhou, H.W., Tian, C.B., Zhang, G.H., Liu, Y.Q., Liu, H., & Wang, J.J. (2017). Evaluation of *Neoseiulus barkeri* (Acari: Phytoseiidae) for control of *Eotetranychus kankitus* (Acari: Tetranychidae). J. Eco. Entomol., 110(3), 903-914.
- Mahjooori, M., Hajizadeh, J., & Abbasii Mzhdehi. M. R. (2015). A checklist and a key for the phytoseiid and blattisociid mites (Acari: Phytoseioidea) associated with olive orchards in Guilan province Iran. Entomofauna, 36 (30), 97-108.
- Navran A. H., & Hajizadeh, J. (2021). Predator and parasite mites associated with aphids and scale insects in Guilan province of Iran. J. Biol. Stu., 4(3), 151-166.
- Notghi Moghadam, B.A., Hajizadeh, J., Jalali Sendi, J., & Rafatifard, M. (2010). Influence of three diets on development and oviposition of the predatory mite, *Amblyseius herbicolus* (Acari: Phytoseiidae) under laboratory conditions (in Persian with English summary). J. Entomol. Soc. Iran, 30 (1), 51-68
- Rafatifard, M., Hajizadeh, J., & Arbabi M. (2004). Biology of *Typhlodromips caspiensis* (Acari: Phytoseiidae) under laboratory condition (in Persian with English summery). J. Entomol. Soc. Iran, 24 (1), 49-65.
- Sthakakis, T., Kapaxidi, E., & Papadoulis, G. (2014). A new record and a new species of the genus *Agistemus Summers* (Acari: Stigmaeidae) from Greece. Zootaxa, 3780, 153-170.
- Vacante, V. (2016). The handbook of mites of economic plants, identification, bio-ecology and control. CABI, Oxford shire, UK. 890 pp.



- Wainstein, B.A. (1960). New species and subspecies of the genus *Typhlodromus* Scheuten (Parasitiformes, Phytoseiidae) of the USSR fauna. *Zool. Zh.*, 39, 683-690. [in Russian]
- Westphal, E., & Manson, D.C.M. (1996). Feeding effects on host plants: Gall formation and other distortions. In: Linquist, E. E., Sabelis, M. W. & Bruuin, J. (Eds.). *Eriophyoid mites-their biology, natural enemies and control*. Elsevier Sci. Pub., Amsterdam, pp. 231-242.