

Mites (Acari) associated with peanut (*Arachis hypogaea*: Fabaceae) in Iran

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Abstract: A faunistic study of mites (Acari) associated with peanut (*Arachis hypogaea* L.) plant in Guilan province, northern Iran was carried out during 2022. Aerial parts of plant, soil and litter samples were collected from peanut fields in Guilan province. Mites were extracted by using Berlese funnel or direct examinations of plant materials under a stereomicroscope. Collected mites were cleared in lactic acid or Nesbitt's fluid and mounted in Hoyer's medium on microscopic slides. Totally, 34 species belonging to 26 different genera and 16 families were collected and identified. Except *Tetranychus urticae* (Koch) which had been previously reported from peanut fields, others 33 mite species are new records for mite's fauna associated with peanut fields in Iran. Collection information of identified species is provided.

Keywords: Arthropoda; pest mites; predatory mites; groundnut; Guilan.

1 Introduction

Peanut or groundnut (*Arachis hypogaea* L.: Fabaceae) is an important food crop and also one of the major contributors in world oilseed economy next to soybean, and canola. Groundnut is cultivated around the world in tropical, subtropical, and temperate countries lying between latitudes 40°N and 40°S (Sharma and Bhatnagar-Mathur, 2006). The world global groundnut production from the crop years 2016-2020 is approximately 46.4 million metric tons (MMT) (Anonymous, 2020). The area under peanut cultivation in Iran is 3000 hectares, of which 2814 hectares belong to Guilan province and the majority of cultivation in Guilan province belongs to Astaneh-ye Ashrafiyeh city (Afshar Mohammadian and Ebrahimi Nokande, 2016). Several arthropod species cause significant yield losses on field groundnut worldwide (Feakin, 1973; Smith and Barfield, 1982; Wightman and Amin, 1988; Edde, 2022). Spider mites (such as *Tetranychus urticae* (Koch) are economically important pests of groundnut (Edde, 2022). In Iran, only two-spotted spider mite

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(*T. urticae*) has been reported as a pest of peanuts in Guilan province (Mojib Haghdam, 2014a, b). The review of literatures shows that sufficient and appropriate studies have not been conducted to identify peanut insects and mites in Iran. The current study provides the possibility to improve the knowledge about the mites associated with peanut plantations as an important crop in Guilan province, northern Iran. This contribution is a necessary step to fulfil the perspective for filling the gaps in providing a precise complemented overview of overall arthropods collected from peanut plantations in Iran.

2 Materials and Methods

In this study mites were collected from plant foliage, soil and litter samples of peanut fields in Guilan province, northern Iran between May and September 2022. Each foliage sample contained 50 mites infected leaves. Each soil or litter sample contained about 2 kg that was taken from a depth of 15 cm. Thereafter, mites were extracted from samples by direct examinations of plant materials under a stereomicroscope or using Berlese funnel. Mite specimens were sorted and preserved in Ethanol 70 %. Eventually, specimens were cleared in lactic acid or Nesbitt's fluid and mounted permanently on microscope slides using Hoyer's medium. The mites were identified by the relevant taxonomic keys and papers (Ghilyarov and Bregetova, 1977; Karg, 1993; Mašán, 2001; Mašán, 2007; Hajizadeh et al., 2010; Moraes et al., 2016; Hajizadeh and Faraji, 2016; Hajizadeh and Joharchi, 2018; Hajizadeh and Hosseini, 2020). 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.

3 Results and Discussion

During the current faunistic study of mites associated with peanut fields in Guilan province, northern Iran, 34 species belonging to 26 genera and 16 families were collected and identified. An alphabetical list and detailed collection information of each identified species of mites associated with peanut fields in Guilan province, northern Iran, is provided. All the mite species except two spotted spider mite (*T. urticae*) are reported for the first time from Iran in association with the peanut plant.

Order: Mesostigmata.

Family: Digamasellidae.

. *Dendrolaelaps longiusculus* (Leitner, 1949) (Figure 1a).

Material examined: 1 ♀, Astaneh-ye Ashrafiyeh, Safra Basteh, 37°20'11"N, 49°58'23"E; collected from soil; July 24, 2022.

. *Dendrolaelaps saprophilus* (Huhta, 1982) (Figure. 1b).

Material examined: 1 ♀, Kiashahr, 37°24'10"N, 49°56'57"E; collected from soil; July 31, 2022.

. *Dendroseius vulgaris* (Ma, Ho and Wang, 2014) (Figure. 1c).

Material examined: 1 ♀, Astaneh-ye Ashrafiyeh, Tamchal, 37°18'21"N, 49°57'34"E; collected from soil; July 17, 2022.

Remark: Predaceous mites of family Digamasellidae are widespread in soil and decaying organic material, they feed on collembolans, nematodes, arthropod eggs and possibly fungi (Walter et al., 1988; Lindquist et al., 2009; Walter and Proctor, 2013).

Family Laelapidae.

. *Hypoaspisella linteyini* (Samšičák, 1964) (Figure 1d).

Material examined: 1 ♀, Astaneh-ye Ashrafiyeh, Estakher Bijar, 37°17'10"N, 49°57'02"E; July 15, 2022; 1 ♀, Astaneh-ye Ashrafiyeh, Abdullah Abad, 37°15'54"N, 49°54'53"E; July 6, 2022; collected from soil.

. *Cosmolaelaps vacua* (Michael, 1891) (Figure 1e).

Material examined: 2 ♀, Astaneh-ye Ashrafiyeh, Parkaposht, 37°18'09"N, 49°58'25"E; collected from soil; July 15, 2022.

Remark: Mites of family Laelapidae are free-living predators that inhabit soil and litters (Evans and Till, 1966; Lindquist et al., 2009).

Family Macrochelidae.

. *Glypholaspis confusa* (Foà, 1900) (Figure 1f).

Material examined: 1 ♀, Astaneh-ye Ashrafiyeh, Kashel, Azadmahalleh, 37°17'55"N, 49°56'51"E; collected from soil; June 28, 2022.

. *Macrocheles muscaedomesticae* (Scopoli, 1772) (Figure 1g).

Material examined: 1 ♀, Astaneh-ye Ashrafiyeh, Kashel, Azadmahalleh, 37°17'55"N, 49°56'51"E; June 28, 2022; 2 ♀, Astaneh-ye Ashrafiyeh, Lafut-e Bala, 37°18'13"N, 49°55'05"E; July 8, 2022; 1 ♀, Astaneh-ye Ashrafiyeh, 37°16'54"N, 49°56'26"E; July 13, 2022; all collected from soil.

. *Macrocheles merdarius* (Berlese, 1889) (Figure 1h).

Material examined: 2 ♀, Astaneh-ye Ashrafiyeh, Nabi Dehga, 37°20'53"N, 49°55'56"E; July 21, 2022; 1 ♀, Astaneh-ye Ashrafiyeh, Kashel, Azadmahalleh, 37°17'55"N, 49°56'51"E; June 28, 2022; 1 ♀, Astaneh-ye Ashrafiyeh, Salestan, 37°15'05"N, 49°55'16"E; July 3, 2022; all collected from soil.

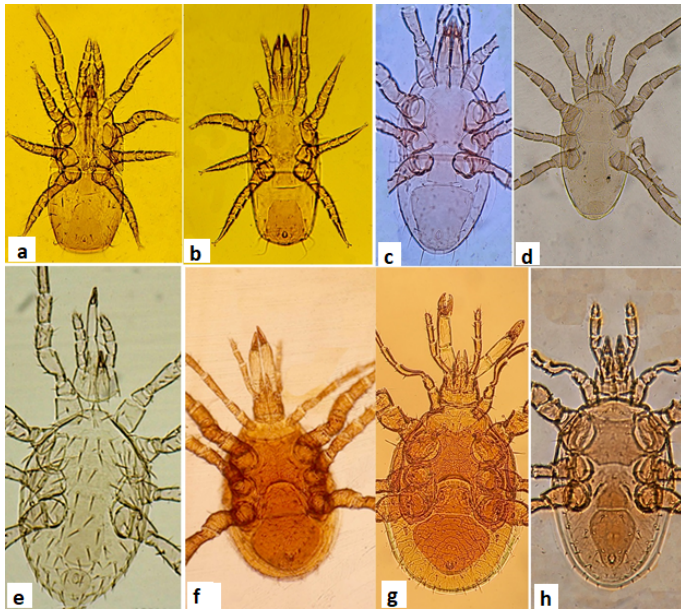


Figure 1: a, *Dendrolaelaps longiusculus* (Hirschmann, 1960); b, *Dendrolaelaps saprophilus* (Huhta, 1982); c, *Dendroseius vulgaris* (Ma, Ho and Wang, 2014); d, *Hypoaspisella linteyini* (Samšičák, 1964); e, *Cosmolaelaps vacua* (Michael, 1891); f, *Glyptholaspis confusa* (Foà, 1900); g, *Macrocheles muscaedomesticae* (Scopoli, 1772); h, *Macrocheles merdarius* (Berlese, 1889)

. *Macrocheles subbadius* (Berlese, 1904) (Figure 2a).

Material examined: 3 ♀, Astaneh-ye Ashrafiyeh, Lafut-e Bala, 37°18'13"N, 49°55'05"E; July 8, 2022; 4 ♀, Astaneh-ye Ashrafiyeh, Nabi Dehga, 37°20'53"N, 49°55'56"E; July 21, 2022; 4 ♀, Astaneh-ye Ashrafiyeh, Abdullah Abad, 37°15'54"N, 49°54'53"E; July 6, 2022; 2 ♀, Astaneh-ye Ashrafiyeh, Estakher Bijar, 37°17'10"N, 49°57'02"E; June 27, 2022; 1 ♀, Astaneh-ye Ashrafiyeh, Kashel, Azadmahalleh, 37°17'55"N, 49°56'51"E; June 28, 2022; 1 ♀, Astaneh-ye Ashrafiyeh, Salestan, 37°15'05"N, 49°55'16"E; July 3, 2022; 1 ♀, Astaneh-ye Ashrafiyeh, Safra Basteh, 37°20'11"N, 49°58'23"E; July 24, 2022; all collected from soil.

. *Macrocheles glaber* (Müller, 1860) (Figure 2b).

Material examined: 2 ♀, Astaneh-ye Ashrafiyeh, Lafut-e Bala, 37°18'13"N, 49°55'05"E; collected from soil; July 8, 2022.

. *Macrocheles peniculatus* (Berlese, 1918) (Figure 2c).

Material examined: 1 ♀, Astaneh-ye Ashrafiyeh, Salestan, 37°15'05"N, 49°55'16"E; July 3, 2022; 1 ♀, Astaneh-ye Ashrafiyeh, 37°16'54"N, 49°56'26"E; August 13, 2022; all collected from soil.

. *Macrocheles insignitus* (Berlese, 1918) (2d).

Material examined: 1 ♀, Kiashahr, 37°24'10"N, 49°56'57"E; collected from soil; July 31, 2022.

. *Macrocheles penicilliger* (Berlese, 1904) (2e).

Material examined: 1 ♀, Astaneh-ye Ashrafiyeh, 37°16'54"N, 49°56'26"E; collected from soil; June 26, 2022.

Remark: The family Macrochelidae includes members that frequent a wide range of terrestrial and aboveground substrates, including compost, manure, leaf litter, decaying wood, and stored foods. They include predators, fungivorous and pollen-feeding species (Halliday, 1997; Lindquist et al., 2009).

Family Macrodonychidae.

. *Macrodonychus bregetovaae* (Hirschmann, 1975) (2f).

Material examined: 3 ♀, Astaneh-ye Ashrafiyeh, Nabi Dehga, 37°20'53"N, 49°55'56"E; July 21, 2022; 3 ♀, Astaneh-ye Ashrafiyeh, Lafut-e Bala, 37°18'13"N, 49°55'05"E; July 8, 2022; 5 ♀, Astaneh-ye Ashrafiyeh, Tamchal, 37°18'21"N, 49°57'34"E; July 17, 2022; all collected from soil.

Family Ologamasidae.

. *Gamasiphis lanceolatus* (Karg, 1987) (2g).

Material examined: 1 ♀, Astaneh-ye Ashrafiyeh, Kashel, Azadmahalleh, 37°17'55"N, 49°56'51"E; collected from soil; June 28, 2022.

Remark: The family Ologamasidae is a large group of predatory mites encountered in soil, humus and compost (Lindquist et al., 2009).

Family Parholaspididae.

. *Neparholaspis arcuatus* (Petrova, 1977) (2h).

Material examined: 1 ♀, Astaneh-ye Ashrafiyeh, Kashel, Azadmahalleh, 37°17'55"N, 49°56'51"E; collected from soil; June 30, 2022.

Remark: The free-living predatory mites in the family Parholaspididae are found in various habitats such as soil, humus, litter, and dead wood (Quintero-Gutiérrez and Halliday, 2021).

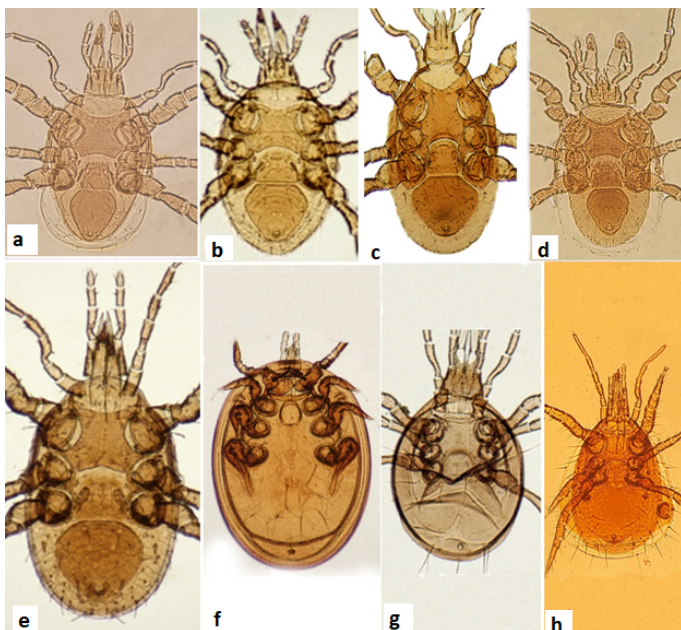


Figure 2: a, *Macrocheles subbadius* (Berlese, 1904); b, *Macrocheles glaber* (Müller, 1860); c, *Macrocheles peniculatus* (Berlese, 1918); d, *Macrocheles insignitus* (Berlese, 1918); e, *Macrocheles penicilliger* (Berlese, 1904); f, *Macrodonychus bregetovaae* (Hirschmann, 1975); g, *Gamasiphis lanceolatus* (Karg, 1987); h, *Neparholaspis arcuatus* (Petrova, 1977).

Family Phytoseiidae.

. *Phytoseiulus persimilis* (Athias-Henriot, 1957) (Figure 3a).

Material examined: 5 ♀, Astaneh-ye Ashrafiyeh, Salestan, 37°15'05"N, 49°55'16"E; July 3, 2022;

collected on peanut leaves infested with two spotted spider mite (*T. urticae*).

. *Neoseiulus barkeri* (Hughes, 1948) (Figure 3b).

Material examined: 10 ♀, Astaneh-ye Ashrafiyeh, Nabi Dehga, 37°20'53"N, 49°55'56"E; July 21, 2022; 2 ♀, Astaneh-ye Ashrafiyeh, Deh Sar, 37°20'19"N, 49°56'57"E; July 16, 2022; 2 ♀, Astaneh-ye Ashrafiyeh, Noqreh Deh, 37°20'53"N, 49°55'56"E; June 11, 2022; collected on peanut leaves infested with two spotted spider mite (*T. urticae*).

. *Transeius wainsteini* (Gomelaury, 1968) (Figure 3c).

Material examined: 2 ♀, Astaneh-ye Ashrafiyeh, Nabi Dehga, 37°20'53"N, 49°55'56"E; July 21, 2022; 2 ♀, Astaneh-ye Ashrafiyeh, Deh Sar, 37°20'19"N, 49°56'57"E; July 16, 2022; collected on peanut leaves infested with two spotted spider mite (*Tetranychus urticae*).

Remark: Phytoseiid mites are well-known for their value in biological control of phytophagous mites and small insects, such as thrips and whiteflies. They are considered to play an important ecological role under natural conditions (McMurtry et al., 2013; Wu et al., 2021).

Family Parasitidae.

. *Parasitus kempersi* (Oudemans, 1902) (Figure 3d).

Material examined: 2 ♀, 1 deutonymph, Astaneh-ye Ashrafiyeh, Salestan, 37°15'05"N, 49°55'16"E; collected from soil.

. *Parasitus mammillatus* (Berlese, 1905) (Figure 3e).

Material examined: 1 ♀, Astaneh-ye Ashrafiyeh, Lafut-e Bala, 37°18'13"N, 49°55'05"E; July 8, 2022; collected from soil.

. *Trachygamasus ambulacralis* (Willmann, 1949).

Material examined: 1 ♀, Astaneh-ye Ashrafiyeh, Estakher Bijar, 37°17'10"N, 49°57'02"E; July 15, 2022; collected from soil.

. *Gamasodes fimbriatus* (Karg, 1971) (Figure 3f).

Material examined: 1 ♀, Astaneh-ye Ashrafiyeh, Abdol Abad, 37°15'54"N, 49°54'53"E; June 25, 2022

Remark: Mites of the family Parasitidae are free living predators which can be found in soil, leaf litter, dung, compost, nests of birds or small mammals, and other similar habitats (Hrúzová and Fend'a, 2018).

Family Rhodacaridae.

. *Rhodacarellus iraniensis* (Castilho et al., 2012) (Figure 3g).

Material examined: 2 ♀, Kiashahr, 37°24'10"N, 49°56'57"E; collected from soil; July 31, 2022; collected from soil.

Remark: Mites of the family Rhodacaridae are widespread in soil and decaying organic matter. Species of this family have been observed to prey on nematodes, small insects, mites and springtails

(Lindquist et al., 2009; Castilho et al., 2012).

Family Trematuridae.

. *Nenteria stylifera* (Berlese, 1904) (Figure 3h).

Material examined: 12 ♀, Astaneh-ye Ashrafiyeh, Abdullah Abad, 37°15'54"N, 49°54'53"E; July 6, 2022; 10 ♀, 2 ♂; Astaneh-ye Ashrafiyeh, Kinchah, 37°20'12"N, 49°55'42"E; July 10, 2022; 9 ♀, Astaneh-ye Ashrafiyeh, Estakher Bijar, 37°17'10"N, 49°57'02"E; July 15, 2022; 8 ♀, Astaneh-ye Ashrafiyeh, Tamchal, 37°18'21"N, 49°57'34"E; July 17, 2022; 8 ♀, Astaneh-ye Ashrafiyeh, Salestan, 37°15'05"N, 49°55'16"E; July 3, 2022; 1 ♀, Astaneh-ye Ashrafiyeh, Safra Basteh, 37°20'11"N, 49°58'23"E; July 24, 2022; 7 ♀, Astaneh-ye Ashrafiyeh, Lafut-e Bala, 37°18'13"N, 49°55'05"E; July 8, 2022; 6 ♀, Astaneh-ye Ashrafiyeh, Kashel, Azadmahalleh, 37°17'55"N, 49°56'51"E; June 28, 2022; 7 ♀, Astaneh-ye Ashrafiyeh, Parkaposht, 37°18'09"N, 49°58'25"E; July 15, 2022; 6 ♀, Astaneh-ye Ashrafiyeh, Nabi Dehga, 37°20'53"N, 49°55'56"E; July 21, 2022; 5 ♀, Astaneh-ye Ashrafiyeh, Now Bijar Mahalleh, 37°23'25"N, 49°56'05"E; July 26, 2022; 4 ♀, Astaneh-ye Ashrafiyeh, Mohsenabad, 37°23'08"N, 49°54'34"E; July 19, 2022, all collected from soil.

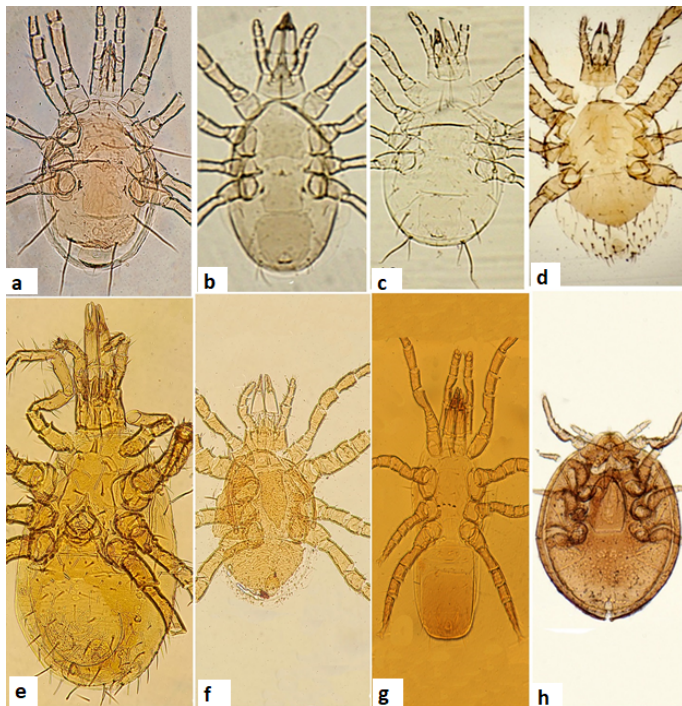


Figure 3: a, *Phytoseiulus persimilis* (Athias, Henriot, 1957); b, *Neoseiulus barkeri* (Hughes, 1948); c, *Transeius wainsteini* (Gomelauri, 1968); d, *Parasitus kempersi* (Oudemans, 1902); e, *Parasitus mammillatus* (Berlese, 1905); f, *Gamasodes fimbriatus* (Karg, 1971); g, *Rhodacarellus iraniensis* (Castilho et al., 2012); h, *Nenteria stylifera* (Berlese, 1904).

. *Nenteria bastanii* (Kazemi and Abolghasemi, 2016) (Figure 4a).

Material examined: 1 ♀, 1 ♂, Astaneh-ye Ashrafiyeh, Estakher Bijar, 37°17'10"N, 49°57'02"E; collected from soil; July 15, 2022.

Remark: The mites of suborder Uropodina include of family Trematuridae are the most ecologically diverse group of mites. They are free-living or associated with arthropods, mammals, or birds (Halliday, 2015).

Order Sarcoptiformes.

Cohort Astigmata.

Family Acaridae.

. *Rhizoglyphus robini* (Claparede, 1869) (Figure 4b).

Material examined: 10 ♀, Astaneh-ye Ashrafiyeh, Now Bijar Mahalleh, 37°23'37"N, 49°55'55"E; July 26, 2022; 2 ♀, Kiashahr, 37°24'10"N, 49°56'57"E; July 31, 2022; 2 ♀, Astaneh-ye Ashrafiyeh, Noqreh Deh, 37°20'53"N, 49°55'56"E; June 11, 2022; all collected from soil.

. *Sancassania mycophagus* (Méglin, 1874) (Figure 4c).

Material examined: 10 ♀, Kiashahr, 37°24'10"N, 49°56'57"E; July 31, 2022; collected from soil.

Remark: Mites of family Acaridae live in various habitats and have various diets. There are several acarid genera with cosmopolitan distributions, such as *Acarus* and *Rhizoglyphus*. There are also Acaridae which are pests of living plants, include the genus *Rhizoglyphus* as pests of plants with bulbs (Mullen and OConnor, 2019).

Order Trombidiformes.**Suborder Prostigmata.****Family Cunaxidae.**

. *Armscirus cerris* (Kalúz, 2009) (Figure 4d).

Material examined: 1 ♀, Kiashahr, 37°24'10"N, 49°56'57"E; July 31, 2022; collected from soil.

. *Coleoscirus buartsus* (Den Heyer, 1980) (Figure 4e).

Material examined: 1 ♀, Astaneh-ye Ashrafiyeh, Amshal, 37°14'56"N, 49°54'41"E; July 3, 2022; collected from soil.

Remark: Mites of Family Cunaxidae are generalist predators that attack small arthropods on diverse crops, in stored products and in litter. In the soil they feed on root-knot nematodes (*Meloidogyne* spp.), major pests of many crops (Gerson et al., 2003).

Family Tarsonemidae.

. *Polyphagotarsonemus latus* (Banks, 1904) (Figure 4f).

Material examined: Material examined: During the late spring of 2022, a large number of mite specimens were collected on young leaves and buds of peanut in different areas of Astaneh-ye Ashrafiyeh.

Remark: The broad mite, *P. latus* is one of the most injurious tarsonemid mites with different names, i.e. broad mite and yellow tea mite. It is distributed worldwide in the tropical and subtropical regions, attacking more than 60 plant families, feeding on plant juice and possibly injects toxic compounds in plant tissues (Abou-Awad et al., 2014).

Family Tetranychidae.

. *Tetranychus urticae* (Koch, 1836) (Figure 4g).

Material examined: During the late spring and summer of 2022, a large number of mite specimens were collected on young leaves of peanut in different areas of Astaneh-ye Ashrafiyeh.

Remark: Mites of family Tetranychidae or spider mites are the most important mites attacking plants. They occur on virtually every major food crop include of peanut and ornamental plant. *T. urticae* and *T. cinnabarinus* are the most important pests on economic plants (Zhang, 2003).

Family Trombidiidae.

. *Allotrombium pulvinum* (Ewing, 1917) (Figure 4h).

Material examined: 5 ♀, Astaneh-ye Ashrafiyeh, Noqreh Deh, 37°20'53"N, 49°55'56"E; June 11, 2022; 6 ♀, Astaneh-ye Ashrafiyeh, Salestan, 37°15'05"N, 49°55'16"E; July 3, 2022; all collected on leaves of peanut infested with aphids and spider mites.

Remark: Larvae of *A. pulvinum* are ectoparasites of aphids whereas deutonymphs and adults are free-living predators of aphids and spider mites (Saboori and Zhang, 1996).

Family Erythraeidae.

. *Abrolophus* sp.

Material examined: 6 ♀, Astaneh-ye Ashrafiyeh, Noqreh Deh, 37°20'53"N, 49°55'56"E; June 11, 2022; collected on leaves of peanut infested with aphids and spider mites.

. *Leptus* sp.

Material examined: 1 larva, Astaneh-ye Ashrafiyeh, Noqreh Deh, 37°20'53"N, 49°55'56"E; June 11, 2022; collected on leaves of peanut infested with aphids and spider mites.

Remark: Mites of family Erythraeidae in larval forms are parasitic on various other arthropods, for example insects, but the adults are free-living predators (Meyer and Ryke, 1959; Saboori et al., 2007).

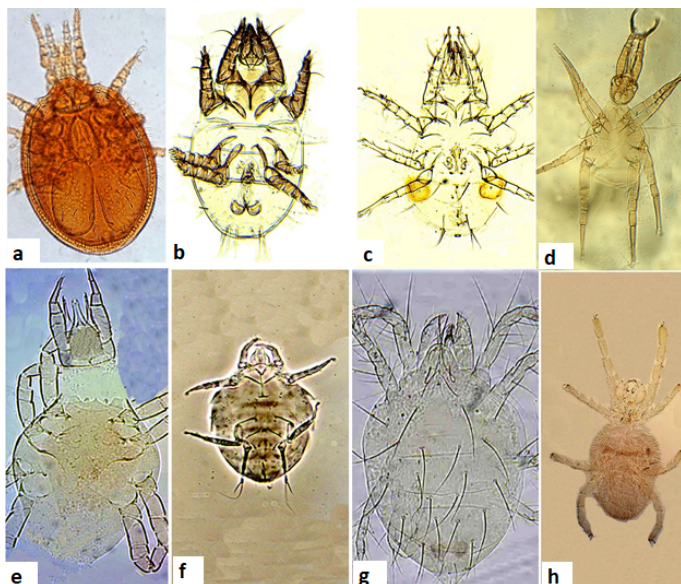


Figure 4: a, *Nenteria bastanii* (Kazemi and Abolghasemi, 2016); b, *Rhizoglyphus robini* (Claparede, 1869); c, *Caloglyphus mycophagus* (Mégnin, 1874); d, *Coleoscirus buartsus* (Den Heyer, 1980); e, *Armascirus cerris* (Kalúz, 2009); f, *Polyphagotarsonemus latus* (Banks, 1904); g, *Tetranychus urticae* (Koch, 1836); h, *Allotrombium pulvinum* (Ewing, 1917).

4 Conclusion

Based on the samples collected from peanut fields in Guilan province, during 2022 we found a rich fauna of mites, including of pest, predators and parasites species in association with peanut plant. The most important injurious species were the two-spotted spider mite (*T. urticae*), and yellow broad mite (*P. latus*). The less important damaging species were robine bulb mite, *R. robini* and *S. mycophagus*. The most important predatory mites on the leaves and branches of the peanut plant were from the Phytoseiidae (*N. barkeri*, *T. wainsteini*, *P. persimilis*, in order of their abundance), Trombidiidae (*A. pulvinum*) and Erythraeidae (*Abrolophus* sp., *Leptus* sp.) families. The most important predatory mites in soil were from the Macrochelidae (*G. confusa*, *M. muscaedomesticae*, *M. merdarius*, *M. glaber*, *M. peniculatus*, *M. insignitus*, *M. penicilliger*), Trematuridae (*N. stylifera*, *N. bastanii*), and Parasitidae (*P. kempersi*, *P. mammillatus*, *T. ambulacralis*, *G. fimbriatus*) families. Larvae of the families Trombidiidae and Erythraeidae are ectoparasites of pest insects such as aphids. Future studies should be conducted to determine the effectiveness of predatory mite species and use of them in biological control of peanut arthropod pests (mites and insects). Anyway, protective measures are needed to protect beneficial organisms such as predatory mites and beneficial insects in peanut fields of Iran.

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Conflict of interests

The authors declare that there are no conflict of interest

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