JBS
Research Article

Journal of Biological Studies

eISSN: 2209-2560

V. 8, N. 2:147-161, 2025

https://doi.org/ 10.62400/jbs.v8i2.14733

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

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Received 06 March 2025 | Accepted 28 May 2025 | Published 01 June 2025

Abstract

An extensive survey was carried out during 2022-2023 for the collection and identification of insects associated with the peanut (*Arachis hypogaea* L.) plant in Guilan province, North of Iran. A total of 36 species belonging to 35 genera and 12 families were collected and identified. Among the identified species, 22 are predators (beneficial) and 14 are pests (harmful). Considering the species spectrum, the order Hemiptera has been reported as the most prevalent insect order with 17 species followed by Coleoptera with 13 species, Lepidoptera with three species, Thysanoptera with two species and Diptera with one species. Among the identified insects, *Macroscytus brunneus* (Fabricius) is newly recorded for the insect fauna of Iran and 33 species are reported from Iran for the first time in association with peanut plants. An alphabetic list of the identified insect species and collection information has been provided.

Keywords: Guilan, groundnut, arthropods, pest, beneficial insects

1. Introduction

The peanut (*Arachis hypogaea* L.: Fabaceae), also known as the groundnut is an important legume crop grown mainly for its edible seeds. Peanut is also one of the major contributors to the world oilseed economy next to soybean, and canola. It is widely grown in the tropics and subtropics by small and large commercial producers, both as grain legumes and as an oil crop (Sharma and Bhatnagar-Mathur, 2006). Groundnuts are grown on 3.27 million hectares of land worldwide, world production of shelled peanuts in 2020 was 54 million tonnes, led by China with 34% of the total (FAOSTAT, 2021). The area under peanut cultivation in Iran is 3000 hectares, of which 2814 hectares are in Guilan province, with most of the cultivation concentrated in Astaneh-ye Ashrafiyeh city (Afshar Mohammadian and Ebrahimi Nokande, 2016). Arthropods associated with peanut plants can be categorized into two groups: harmful and beneficial. Several arthropod species cause significant yield losses on field groundnuts worldwide (Feakin, 1973; Smith and Barfield, 1982; Wightman and Amin, 1988; Edde, 2022). In Iran, only cotton bollworm *Helicoverpa armigera* (Hübner) and beet armyworm *Spodoptera exigua* (Hübner) have been reported as insect pests of peanuts in Guilan province (Mojib Haghgadam, 2014a, b). Some injurious and beneficial mite species associated with peanut plantations were recorded in Iran (Askari *et al.*, 2023). The literature review shows that sufficient and appropriate studies have not been conducted to identify peanut insects in

Iran. The current study provides the possibility to improve the knowledge about the insects associated with peanut plantations as an important crop in Guilan province, northern Iran.

2. Materials and Methods

In order to collection and identification of insects associated with groundnut plants in Guilan province, sampling was done during 2022 - 2023. Insects were collected using insect nets, light traps, pitfall traps, and direct observation. The insect samples were transferred to the laboratory and examined under a stereomicroscope. Microscopic slides were prepared from the small insects such as aphids and thrips. The small insects were cleared by KOH 10% or Nesbitt's fluid and mounted on microscopic slides using Hoyer's medium. Middle size insects such as bugs and ladybugs were mounted on cardboard points. Large insects such as ground beetles and moths were pinned by insect needles. The insects were identified using valid identification keys available in relevant books and scientific articles (Gordon, 1985; Lindroth 1985, 1986; Linnavuori and Hosseini, 2000; Yamada and Hirowatari, 2003; Hajizadeh *et al.*, 2003; Hackston, 2019; Allegro *et al.*, 2022; Saber Hamishegi *et al.*, 2024a, 2024b). For final confirmation, some samples were sent to relevant specialists. All collected insects are deposited in the collection of the Entomology laboratory in the Department of Plant Protection, Faculty of Agricultural Sciences, University of Guilan, Rasht.

3. Results and Discussion

During this study, a total of 36 species, 35 genera and 12 families were identified as insects associated with groundnut plants in Guilan province, northern Iran. Among the identified species, 22 species are predators (beneficial) and 14 species are pests (harmful) (Table 1). An alphabetic list of the identified species and their collection information is provided. Among the identified insects, *Macroscytus brunneus* (Fabricius) is new for Iran insect's fauna and 33 species are reported from Iran for the first time in association with peanut plants.

Table 1. Classification of identified species according to their ecological role

Predator species	Order & Family	Pest species	Order & Family
Brachinus crepitans	Coleoptera, Carabidae	*Epilachna chrysomelina*	Coleoptera, Coccinellidae
Pseudoophonus griseus	Coleoptera, Carabidae	*Cydnus aterrimus*	Hemiptera, Cydnidae
Adalia bipunctata	Coleoptera, Coccinellidae	*Macroscytus brunneus*	Hemiptera, Cydnidae
Coccinella septempunctata	Coleoptera, Coccinellidae	*Adelphocoris ticinensis*	Hemiptera, Miridae
Harmonia axyridis	Coleoptera, Coccinellidae	*Creontiades pallidus*	Hemiptera, Miridae
Hippodamia variegata	Coleoptera, Coccinellidae	*Dolycoris penicillatus*	Hemiptera, Pentatomidae
Nephus quadrimaculatus	Coleoptera, Coccinellidae	*Eysarcoris ventralis*	Hemiptera, Pentatomidae
Propylea quatuordecimpunctata	Coleoptera, Coccinellidae	*Nezara viridula*	Hemiptera, Pentatomidae
Scymnus apetzi	Coleoptera, Coccinellidae	*Pyrrhocoris apterus*	Hemiptera, Pyrrhocoridae
Scymnus rubromaculatus	Coleoptera, Coccinellidae	*Aphis faba*	Hemiptera, Aphidae
Serangium montazerii	Coleoptera, Coccinellidae	*Thrips tabaci*	Thysanoptera, Thripidae
Stethorus gilvifrons	Coleoptera, Coccinellidae	*Helicoverpa armigera*	Lepidoptera, Noctuidae
Amphiareus obscuriceps	Hemiptera, Anthocoridae	*Plusia festucae*	Lepidoptera, Noctuidae

Predator species	Order & Family	Pest species	Order & Family
Orius minutus	Hemiptera, Anthocoridae	*Spodoptera exigua*	Lepidoptera, Noctuidae
Geocoris pubescens	Hemiptera, Geocoridae		
Campylomma diversicorne	Hemiptera, Miridae		
Deraeocoris lutescens	Hemiptera, Miridae		
Macrolophus pygmaeus	Hemiptera, Miridae		
Pilophorus confuses	Hemiptera, Miridae		
Andrallus spinidens	Hemiptera, Pentatomidae		
Scolothrips sexmaculatus	Thysanoptera, Thripidae		
Feltiella acarisuga	Diptera, Cecidomyiidae		

List of species and their collection information

Order: Coleoptera

Family: Carabidae

Brachinus crepitans (Linnaeus, 1758) (Figure 1)

Material examined: Two beetles, Astaneh-ye Ashrayeh, Amshal, 37°14'56"N, 49°54'41"E, July 3, 2022, collected from light trap; two beetles, Astaneh-ye Ashrayeh, Nazok Sara, 37°19'40"N, 49°56'11"E, July 12, 2022; 2 beetles, Astaneh-ye Ashrayeh, Kashel, Azadmahalleh, 37°17'55"N, 49°56'51"E, June 28, 2022, collected by light trap.

Pseudoophonus griseus (Panzer, 1796) (Figure 2)

Material examined: One beetle, Astaneh-ye Ashrafiyeh, Amshal, 37°14'56"N, 49°54'41"E, July 3, 2022; two beetles, Astaneh-ye Ashrafiyeh, Nazoksara, 37°19'40"N, 49°56'11"E, July 12, 2022; three beetles, Astaneh-ye Ashrafiyeh, Kashel, Azadmahalleh, 37°17'55"N, 49°56'51"E, June 29, 2023, collected by pitfall trap.

Remark: Carabidae is one of the largest families among the beetles. Members of this family live mostly in the soil, hence they are known as ground beetles (Hangay and Zborowski, 2010). The carabids (Coleoptera: Carabidae) are recognized as polyphagous predators and important natural enemies of insect pests and play an important role in agricultural ecosystems by hunting a wide range of pests, including aphids, butterfly larvae, beetle larvae, mites and springtails. They have also been used effectively to control snails and slugs in the greenhouses (Kromp, 1999). *Brachinus crepitans* and *Pseudoophonus griseus* recorded from northern provinces (Guilan and Mazandaran) in Iran (Azadbakhsh and Nozari, 2015; Salari, 2012).

Family Coccinellidae

Adalia bipunctata (Linnaeus, 1758) (Figure 3)

Material examined: Five beetles, Astaneh-ye Ashrafiyeh, Nazoksara, 37°19'40"N, 49°56'11"E, July 12, 2022; three beetles, Astaneh-ye Ashrafiyeh, 37°16'49"N, 49°56'28"E, August 13, 2023; six beeles, Astaneh-ye Ashrafiyeh, Noqreh Deh, 37°20'53"N, 49°55'56"E, June 11, 2023; collected on peanut leaves infested with two spotted spider mite and aphids by insect net.

Coccinella septempunctata (Linnaeus,1758) (Figure 4)

Material examined: Ten beetles, Astaneh-ye Ashrafiyeh, Noqreh Deh, 37°20'53"N, 49°55'56"E, June 11, 2023; 15 beetles, Astaneh-ye Ashrafiyeh, Lafut-e Bala, 37°18'13"N,

49°55'05"E, July 8, 2022; collected on peanut leaves infested with two spotted spider mite and aphids by insect net.

Epilachna chrysomelina (Fabricius, 1787) (Figure 5)

Material examined: Five beetles, Astaneh-ye Ashrafiyeh, Nazoksara, 37°19'40"N, 49°56'11"E, July 12, 2023; 10 beetles, Astaneh-ye Ashrafiyeh, Now Bijar Mahalleh, 37°23'25"N, 49°56'05"E, July 26, 2022; collected on peanut leaves by insect net.

Harmonia axyridis (Pallas,1773) (Figure 6)

Material examined: Ten beetles, Astaneh-ye Ashrafiyeh, Noqreh Deh, 37°20'53"N, 49°55'56"E, June 11, 2023; 10 beetles, Astaneh-ye Ashrafiyeh, Abdullah Abad, 37°15'54"N, 49°54'53"E, July 6, 2022; five beetles, Astaneh-ye Ashrafiyeh, Lafut-e Bala, 37°18'13"N, 49°55'05"E, July 8, 2022; six beetles, Astaneh-ye Ashrafiyeh, Kashel, Azadmahalleh, 37°17'55"N, 49°56'51"E, June 28, 2022; eight beetles, Astaneh-ye Ashrafiyeh, Tamchal, 37°18'21"N, 49°57'34"E, July 17, 2022; seven beetles, Astaneh-ye Ashrafiyeh, 37°16'49"N, 49°56'28"E, August 13, 2023; four beetles, Kiashahr, 37°24'10"N, 49°56'57"E, July 31, 2022; five beetles, Astaneh-ye Ashrafiyeh, Deh Sar, 37°20'19"N, 49°56'57"E, July 16, 2023, collected on peanut leaves infested with aphids by insect net or by light trap.

Hippodamia variegata (Goeze, 1777) (Figure7)

Material examined: Ten beetles, Astaneh-ye Ashrafiyeh , Nazok Sara, 37°19'40"N, 49°56'11"E, July 12, 2022; 15 beetles, Astaneh-ye Ashrafiyeh, Noqreh Deh, 37°20'53"N, 49°55'56"E, June 11, 2023; collected on peanut leaves infested with two-spotted spider mite and aphids by insect net.

Nephus quadrimaculatus (Herbst, 1783) (Figure 8)

Material examined: Five beetles, Astaneh-ye Ashrafiyeh, Tamchal, 37°18'21"N, 49°57'34"E, July 17, 2022; collected on peanut leaves infested with aphids by insect net.

Propylea quatuordecimpunctata (Linnaeus,1758) (Figure 9)

Material examined: Five beetles, Astaneh-ye Ashrafiyeh, Nazoksara, 37°19'40"N, 49°56'11"E, July 12, 2022; four beetles, Astaneh-ye Ashrafiyeh, Salestan, 37°15'05"N, 49°55'16"E, July 3, 2022; two beetles, Astaneh-ye Ashrafiyeh, 37°16'49"N, 49°56'28"E, August 13, 2023; three beetles, Astaneh-ye Ashrafiyeh, Tamchal, 37°18'21"N, 49°57'34"E, July 18, 2023; six beetles, Kiashahr, 37°24'10"N, 49°56'57"E, July 31, 2022; collected on peanut leaves infested with two-spotted spider mite and aphids by insect net.

Scymnus apetzi (Mulsant, 1846) (Figure 10)

Material examined: Ten beetles, Astaneh-ye Ashrafiyeh, Noqreh Deh, 37°20'53"N, 49°55'56"E, June 11, 2023; collected on peanut leaves infested with two-spotted spider mites and aphids by insect net.

Scymnus rubromaculatus (Goeze, 1778) (Figure 11)

Material examined: Five beetles, Kiashahr, 37°24'10"N, 49°56'57"E, July 31, 2022; 2 beetles, Astaneh-ye Ashrafiyeh, Noqreh Deh, 37°20'53"N, 49°55'56"E, June 11, 2023; collected on peanut leaves infested with two-spotted spider mite and aphids by insect net.

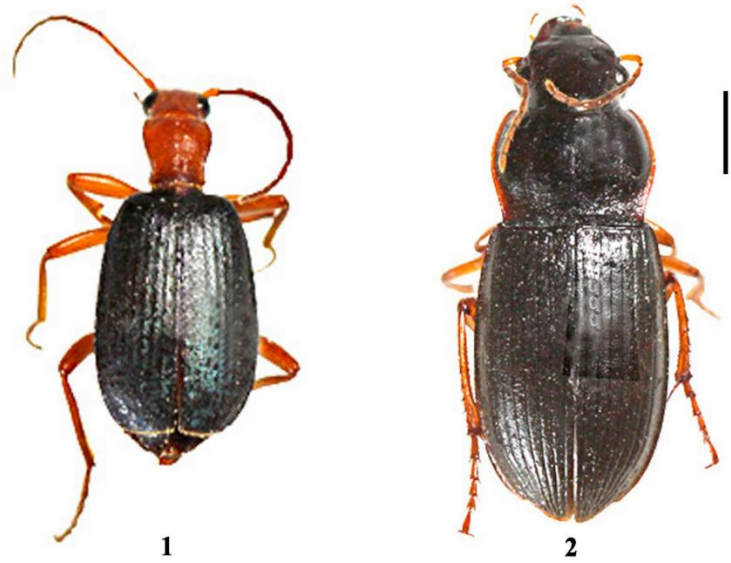
Serangium montazerii Fürsch, 1995 (Figure 12)

Material examined: Four beetles, Astaneh-ye Ashrafiyeh, Noqreh Deh, 37°20'53"N, 49°55'56"E, June 11, 2023; collected on peanut leaves infested with two spotted spider mite and aphids by insect net.

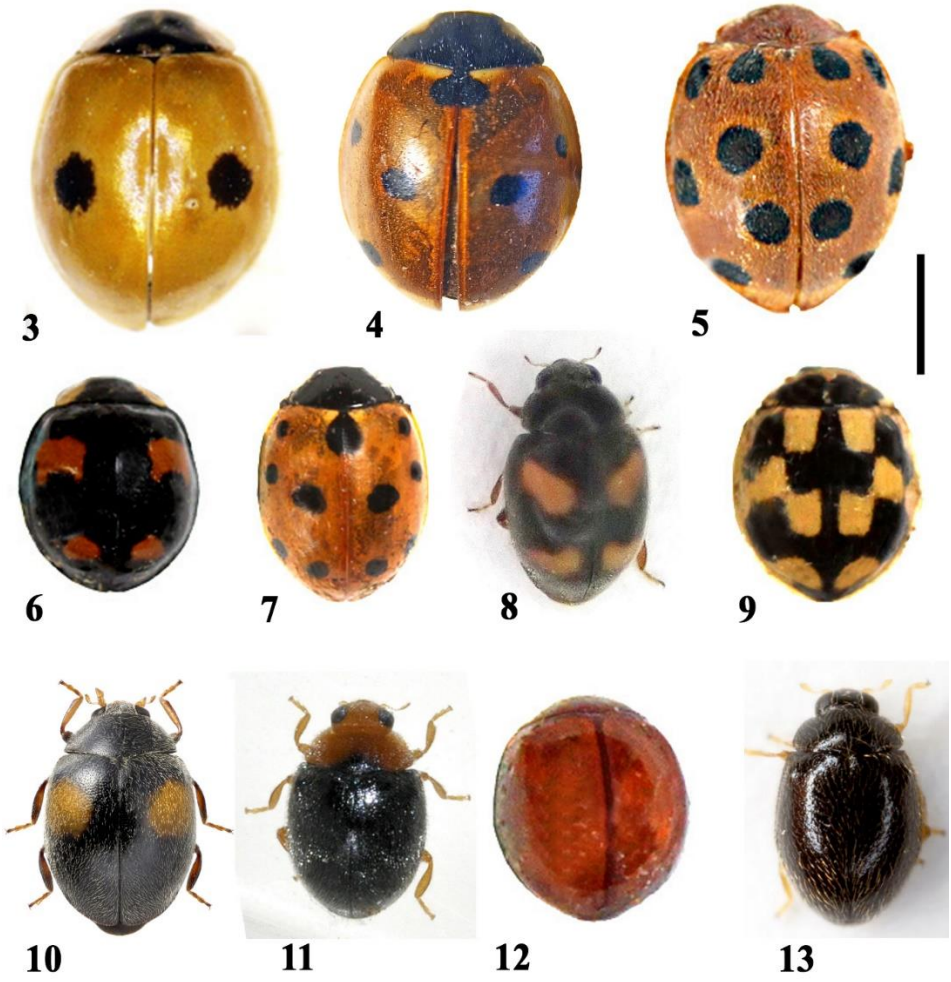
Stethours gilvifrons (Mulsant, 1850) (Figure 13)

Material examined: Five beetles, Astaneh-ye Ashrafiyeh, Noqreh Deh, 37°20'53"N, 49°55'56"E, June 11, 2023; 10 beetles, Astaneh-ye Ashrafiyeh, Deh Sar, 37°20'19"N, 49°56'57"E, July 16, 2022, six beetles, Astaneh-ye Ashrafiyeh, Tamchal, 37°18'21"N, 49°57'34"E, July 17, 2022; collected on peanut leaves infested with two-spotted spider mite by insect net.

Remark: Coccinellidae is a family with the largest number of species within the superfamily Coccinelloidea. Most species of the family are predators, a few species, such as *Epilachna chrysomelina*, are herbivorous (Giorgi *et al.* 2009). Predator species of this family feeding mainly on different groups of insects such as aphids (Aphididae), soft scales (Coccidae), armored scales (Diaspididae), mealybugs (Pseudococcidae), whiteflies (Aleyrodidae), psyllids (Psyllidae), thrips (Thysanoptera), moth eggs (Lepidoptera) and other insect groups. Other favorite prey includes spider mites (Arachnida: Acari: Tetranychidae), (Giorgi *et al.* 2009; Hodek *et al.*, 2012). Although ladybugs are important natural enemies of harmful plant pests, no significant study has been done regarding their identification and use in peanut plantations in Iran. It is expected that in the future, with more studies, beneficial ladybugs will be used effectively in peanut plantations in Iran to control insect and mite pests.



Figures 1-2. 1. *Brachinus crepitans*, 2. *Pseudoophonus griseus*. Scale bar 1.5 mm for 1, 2.4 mm for 2.



Figures 3-13. 3. *Adalia bipunctata*, 4. *Coccinella septempunctata*, 5. *Epilachna chrysomelina*, 6. *Harmonia axyridis*, 7. *Hippodamia variegate*, 8. *Nephus quadrimaculatus*, 9. *Propylea quatuordecimpunctata*, 10. *Scymnus apetzi*, 11. *Scymnus rubromaculatus*, 12. *Serangium montazerii*, 13. *Stethours gilvifrons*. Scale bar 2.7 mm for 3, 1.4 mm for 4, 5.3 mm for 5, 1 mm for 6, 1.6 mm for 7, 3.3 mm for 8, 2 mm for 9, 3.2 mm for 10, 3.7 mm for 11, 4.1 mm for 12, 6 mm for 13.

Order Hemiptera

Family Anthocoridae

Amphiareus obscuriceps (Poppius, 1909) (Figure 14)

Material examined: Four bugs, Astaneh-ye Ashrafiyeh, Abdullah Abad, 37°15'54"N, 49°54'53"E, July 6, 2022; collected by light trap.

Orius minutus (Linnaeus, 1785) (Figure 15)

Material examined: Ten bugs, Astaneh-ye Ashrafiyeh, Abdullah Abad, 37°15'54"N, 49°54'53"E, July 6, 2022; five bugs, Astaneh-ye Ashrafiyeh, 37°16'49"N, 49°56'28"E, August 13, 2023; six bugs, Astaneh-ye Ashrafiyeh , Nazok Sara, 37°19'40"N, 49°56'11"E, July 12, 2022; four bugs, Astaneh-ye Ashrafiyeh, Deh Sar, 37°20'19"N, 49°56'57"E, July 16, 2023; three bugs, Astaneh-ye Ashrafiyeh, Nabi Dehga, 37°20'53"N, 49°55'56"E, July 21, 2022; collected on peanut leaves infested with two spotted spider mite and aphids by insect net.

Remark: Most species of the family Anthocoridae are predaceous, they feed on other small soft-bodied arthropods in both nymphs and adult stages. Anthocorids are beneficial as biological control agents. Although it is possible that some anthocorids feed on plant material, but mostly feed on other small soft-bodied arthropods (Lattin, 1999; Horton, 2008). For example, *Orius insidiosus* is often released in greenhouses against mites and thrips. Previously *Amphiareus obscuriceps was* recorded from Guilan provinces in Iran, this species feeds on small arthropods, probably including psocids, thrips, etc. (Linnavuori & Hosseini, 2000). This is the first record of this species in peanut plantations of Iran.

Family Cydnidae

Cydnus aterrimus (Foster, 1771) (Figure 16)

Material examined: Ten bugs, Astaneh-ye Ashrafiyeh , Kashel, Azadmahalleh, 37°17'55"N, 49°56'51"E, June 28, 2022; five bugs, Astaneh-ye Ashrafiyeh, Abdullah Abad, 37°15'54"N, 49°54'53"E, July 6, 2022; collected by pitfall trap.

Macroscytus brunneus (Fabricius, 1803) (Figure 17)

Material examined: Ten bugs, Astaneh-ye Ashrafiyeh, Tamchal, 37°18'21"N, 49°57'34"E, July 17, 2022; five bugs, Astaneh-ye Ashrafiyeh, Now Bijar Mahalleh, 37°23'25"N, 49°56'05"E, July 26, 2022; collected by pitfall trap.

Remark: Cydnidae bugs are known as burrowing bugs or burrower bugs. As the common name would suggest, many members of the family live in soil, they burrow into soil using their heads and forelegs. Several species are known as agricultural pests, some species feed on peanuts. Injury occurs from direct feeding on peanut kernel by nymphs and adults (Chapin and Thomas, 2003).

Family Geocoridae

Geocoris pubescens (Jakovlev, 1871) (Figure 18)

Material examined: Five bugs, Astaneh-ye Ashrafiyeh, Tamchal, 37°18'21"N, 49°57'34"E, July 17, 2022; Astaneh-ye Ashrafiyeh, Noqreh Deh, 37°20'53"N, 49°55'56"E, June 11, 2023; collected by light trap.

Remark: Geocoridae bugs known as big-eyed bugs are important predators of mites, insect eggs, and small insects. Geocorids are found in a wide variety of habitats, including fields, gardens, and turf grass. G*eocoris pubescens* is predator and feeds on mites and insects (Chau, 2019).

Family Miridae

Adelphocoris ticinensis (Meyer-Dur, 1843) (Figure 19)

Material examined: Five bugs, Astaneh-ye Ashrafiyeh, 37°16'49"N, 49°56'28"E, August 13, 2023; six bugs, Astaneh-ye Ashrafiyeh, Abdullah Abad, 37°15'54"N, 49°54'53"E, July 6, 2022; collected by light trap.

Campylomma diversicorne (Reuter,1878) (Figure 20)

Material examined: Four bugs, Astaneh-ye Ashrafiyeh, Abdullah Abad, 37°15'54"N, 49°54'53"E, July 6, 2022; collected by light trap.

Creontiades pallidus (Rambur, 1839*)* (Figure 21)

Material examined: Five bugs, Astaneh-ye Ashrafiyeh, 37°16'49"N, 49°56'28"E, August 13, 2023; collected by light trap.

Deraeocoris lutescens (Schilling, 1837) (Figure 22)

Material examined: Five bugs, Astaneh-ye Ashrafiyeh, Tamchal, 37°18'21"N, 49°57'34"E, July 17, 2022; collected by light trap.

Macrolophus pygmaeus (Rambur, 1839) (Figure 23)

Material examined: Three bugs, Astaneh-ye Ashrafiyeh, Abdullah Abad, 37°15'54"N, 49°54'53"E, July 6, 2022; collected by light trap.

Pilophorus confusus (Kirschbaum, 1856) (Figure 24)

Material examined: Five bugs, Astaneh-ye Ashrafiyeh, Abdullah Abad, 37°15'54"N, 49°54'53"E, July 6, 2022; collected by light trap.

Remark: The family Miridae known as plant bugs are the most abundant in the order Hemiptera. They are generally spotted feeding on plants or perching on a leaf. Certain species of this family are herbivore and others are predaceous (Wheeler, 2001). Among the collected species in this study *Macrolophus pygmaeus*, *Pilophorus confusus*, *Deraeocoris lutescens* and *Campylomma diversicorne* are predators. *Adelphocoris ticinensis* and *Creontiades pallidus* are herbivorous and are known as pests.

Family Pentatomidae

Andrallus spinidens (Fabricius, 1787) (Figure 25)

Material examined: Five bugs, Astaneh-ye Ashrafiyeh , Nazok Sara, 37°19'40"N, 49°56'11"E, July 12, 2022; collected by insect net.

Dolycoris penicillatus (Horvath, 1904) (Figure 26)

Material examined: Five bugs, Astaneh-ye Ashrafiyeh , Nazok Sara, 37°19'40"N, 49°56'11"E, July 12, 2022; collected by insect net.

Eysarcoris ventralis (Westwood, 1837) (Figure 27)

Material examined: Ten bugs, Astaneh-ye Ashrafiyeh, Abdullah Abad, 37°15'54"N, 49°54'53"E, six bugs, July 6, 2022; Astaneh-ye Ashrafiyeh, Tamchal, 37°18'21"N, 49°57'34"E, July 17, 2022; collected by light trap.

Nezara viridula (Linnaeus, 1758) (Figure 28)

Material examined: Ten bugs, Astaneh-ye Ashrafiyeh , Kashel, Azadmahalleh, 37°17'55"N, 49°56'51"E; June 28, 2022; Astaneh-ye Ashrafiyeh, Noqreh Deh, 37°20'53"N, 49°55'56"E;

June 11, 2023; 10 bugs Astaneh-ye Ashrafiyeh, Nabi Dehga, 37°20'53"N, 49°55'56"E; July 21, 2022; collected on peanut leaves by insect net and light trap.

Remark: Pentatomidae is the largest family in the superfamily Pentatomoidea, and contains over 4700 species. Most of the pentatomids are phytophagous, including several species which are severe pests on agricultural crops. However, some species are predatory and may be considered beneficial (Trplehorn and Johnson, 2005). Among the collected species in this study, *Andrallus spinidens* is a predator but *Dolycoris penicillatus*, *Eysarcoris ventralis* and *Nezara viridula* are herbivorous and are known as pests.

Family Pyrrhocoridae

Pyrrhocoris apterus (Linnaeus, 1758) (Figure 29)

Material examined: Ten bugs, Astaneh-ye Ashrafiyeh, Nazok Sara, 37°19'40"N, 49°56'11"E, July 12, 2022; collected on peanut leaves by insect net or by light trap.

Remark: *Pyrrhocoris apterus* feeds on seeds from a wide range of plants but typically causes little plant damage (Gardiner, 2022).

Family Aphidae

Aphis faba (Scopoli, 1763) (Figure 30)

Material examined: A large number of aphids on infested leaves were collected, Astaneh-ye Ashrafiyeh, Nabi Dehga, 37°20'53"N, 49°55'56"E, July 21, 2022; collected infected leaves by hand.

Remark: *Aphis fabae* is one of the most important pests of many cultivated crops, as well as numerous wild and ornamental plant species. Its wide host range includes more than 200 host plant species throughout the world (Akca *et al.*, 2015).

Order Thysanoptera

Family Thripidae

Scolothrips sexmaculatus (Pergande, 1891) (Figure 31)

Material examined: A large number of predatory thrips were collected on spider mite-infested leaves from different places, Astaneh-ye Ashrafiyeh, Estakher Bijar, 37°17'10"N, 49°57'02"E, July 15, 2022; Astaneh-ye Ashrafiyeh, Salestan, 37°15'05"N, 49°55'16"E, July 3, 2023; Astaneh-ye Ashrafiyeh, Abdullah Abad, 37°15'54"N, 49°54'53"E, six bugs, July 6, 2022; Astaneh-ye Ashrafiyeh , Nazok Sara, 37°19'40"N, 49°56'11"E, July 12, 2022; Astaneh-ye Ashrafiyeh, Deh Sar, 37°20'19"N, 49°56'57"E, July 16, 2023; Astaneh-ye Ashrafiyeh, Deh Sar, 37°20'19"N, 49°56'57"E, July 16, 2023; collected infected leaves by spider mites by hand.

Thrips tabaci (Linnaeus, 1758) (Figure 32)

Material examined: A large number of *Thrips tabaci* were collected on infested leaves from different places, Astaneh-ye Ashrafiyeh , Amshal, 37°14'56"N, 49°54'41"E, July 3, 2022; Astaneh-ye Ashrafiyeh, Salestan, 37°15'05"N, 49°55'16"E, July 3, 2023; leaves infested with spider mites were collected by hand.

Remark: Family Thripidae is the largest family of thrips, with over 290 genera and over 2000 species. Many species of this family are pests, but a few, such as *Scolothrips sexmaculatus*, are predators (Mirabbalou, 2018).

Order Diptera

Family Cecidomyiidae

Feltiella acarisuga (Vallot, 1827) (Figure 33)

Material examined: A large number of predatory midge larvae were collected on spider mites infested leaves, Astaneh-ye Ashrafiyeh, Kashel Azadsara, 37°17′42″N 49°55′45″E, June 28, 2022; collected on infested leaves with spider mites.

Remark: *Feltiella acarisuga* is an effective and common beneficial predatory gall midges species that feeds on various species of spider mites (Topakci, 2022).

Order Lepidoptera

Family Noctuidae

Helicoverpa armigera (Hübner, 1808) (Figure 34)

Material examined: Ten moths, Astaneh-ye Ashrafiyeh, Noqreh Deh, 37°20'53"N, 49°55'56"E, June 11, 2023; collected by light trap.

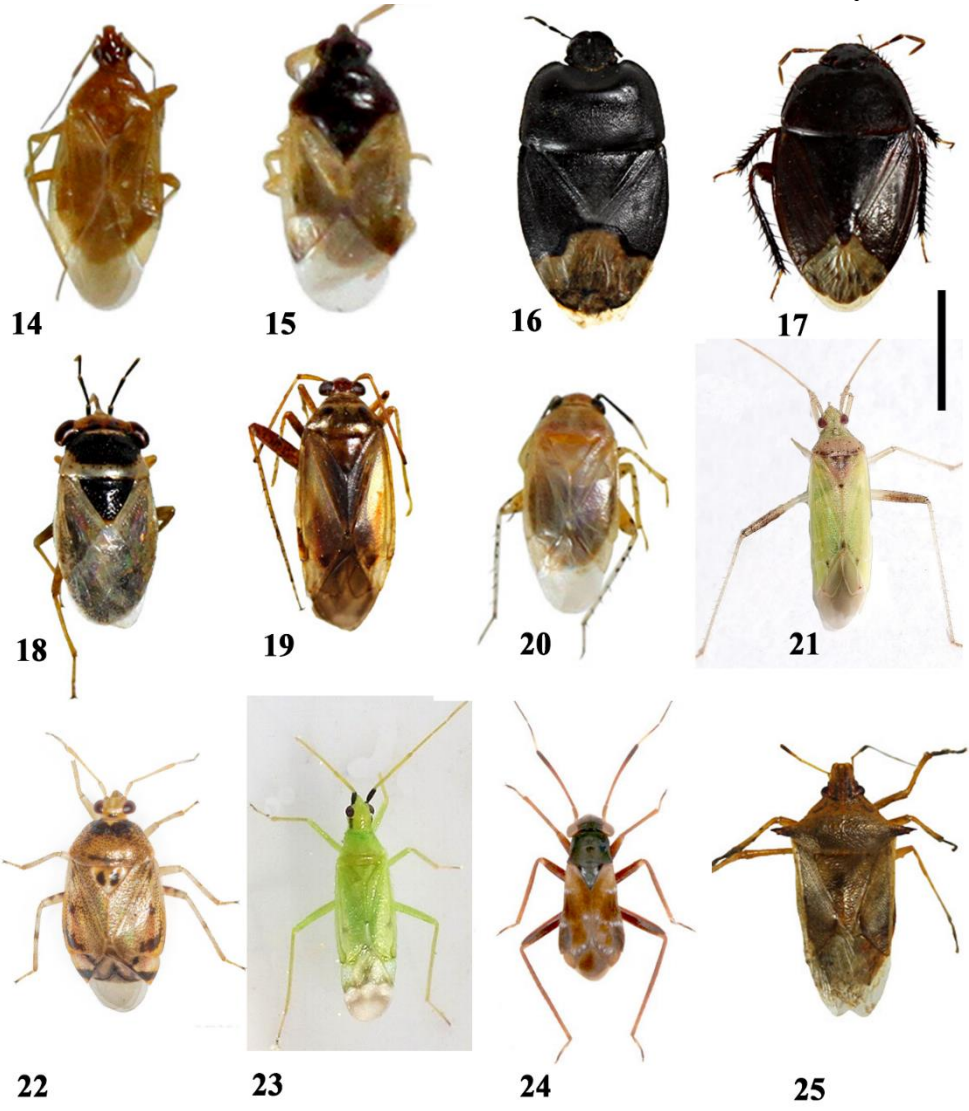
Spodoptera exigua (Hübner, 1808) (Figure 35)

Material examined: Nine moths, Astaneh-ye Ashrafiyeh, Noqreh Deh, 37°20'53"N, 49°55'56"E, June 11, 2023; collected by light trap.

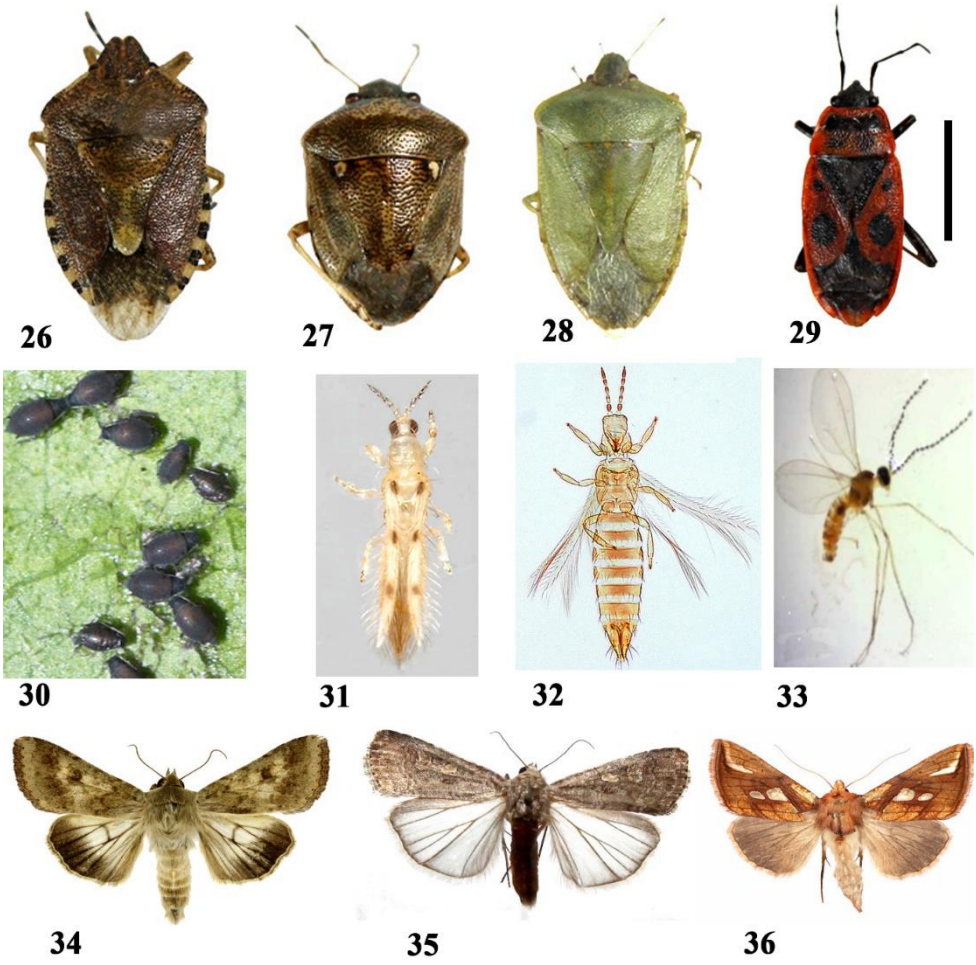
Plusia festucae (Linnaeus, 1875) (Figure 36)

Material examined: Five moths, Astaneh-ye Ashrafiyeh, Noqreh Deh, 37°20'53"N, 49°55'56"E, June 11, 2023; collected by light trap.

Remark: Many species of the family Noctuidae are considered an agricultural pest around the world. Their larvae are typically known as "cutworms" or "armyworms" due to enormous swarms that destroy crops, orchards and gardens every year (Kitching & Rawlins, 1999).



Figures 14-25. 14. *Amphiareus obscuriceps*, 15. *Orius minutus*, 16. *Cydnus aterrimus*, 17. *Macroscytus brunneus*, 18. *Geocoris pubescens*, 19. *Adelphocoris ticinensis*, 20. *Campylomma diversicornis*, 21. *Creontiades pallidus*, 22. *Deraeocoris lutescens*, 23. *Macrolophus pygmaeus*, 24. *Pilophorus confuses*, 25. *Andrallus spinidens*. Scale bar 3.2 mm for 14, 4.8 mm for 15, 0/9 mm for 16, 1.1 mm for 17, 1.7 mm for 18, 1.2 mm for 19, 3.4 mm for 20, 1 mm for 21, 1.8 mm for 22, 2.6 mm for 23, 1.3 mm for 24, 0.7 mm for 25.



Figures 26-36. 26. *Dolycoris penicillatus*, 27. *Eysarcoris ventralis*, 28. *Nezara viridula*, 29. *Pyrrhocoris apterus*, 30. *Aphis fabae*, 31. *Scolothrips sexmaculatus*, 32. *Thrips tabaci*, 33. *Feltiella acarisuga*, 34. *Helicoverpa armigera*, 35. *Spodoptera exigua*, 36. *Plusia festucae*. Scale bar 1 mm for 26, 1.6 mm for 27, 1.1 mm for 28, 0.8 mm for 29, 1.2 mm for 30, 6 mm for 31, 6.3 mm for 32, 3 mm for 33, 0.3 mm for 34, 0.4 mm for 35, 0.4 mm for 36.

4. Conclusion

The insects identified in this study can be classified into two pests and beneficial groups. The beetles of the families Caradidae and Cocinellidae (except for *Epilachna chrysomelina* which is herbivorous) are predators and beneficial. These predatory beetles feed on different groups of insect pests such as aphids, scale insects, mealybugs, whiteflies, psyllids, thrips, eggs and larvae of moths and injurious mites (Kromp, 1999; Giorgi *et al.* 2009; Hodek *et al.*, 2012). The bugs of the families Anthocoridae and Geocoridae, some species of the family Miridae (such as *Macrolophus pygmaeus*, *Pilophorus confuses*, *Deraeocoris lutescens Campylomma*

diversicorne), and a few species of the family Pentatomidae (such as *Andrallus spinidens*) are predators and feed on different insect and mite pest species (Lattin, 1999; Wheeler, 2001; Chau, 2019). Other bugs and aphids are herbivores and feed on the sap of leaves, stems, and seeds of plants (Chapin and Thomas, 2003; Akca et al., 2015; Gardiner, 2022). Many species of thrips are pests, but a few, such as *Scolothrips sexmaculatus*, are predators (Mirabbalou, 2018). Predatory gall midge *Feltiella acarisuga* feeds on various species of spider mites (Topakci, 2022). Most species of the family Noctuidae are considered as worldwide agricultural pest, every year they cause significant damage to a variety of crops (Kitching & Rawlins, 1999). With further studies in the future, beneficial insect species identified in this study can be used for the control of insect and mite pest species in the peanut fields of Iran.

Acknowledgements

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

Conflict of interests

The authors affirm that they have no competing interests to disclose.

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