



A survey on Apoidea bees (Insecta: Hymenoptera) and their associated mites in Fars Province, Iran

Setare Kiani Bakiani¹, Alireza Monfared^{1*}, Hamidreza Hajiqaanbar² and Shahrzad Azhari¹

¹ Department of Plant Protection, Faculty of Agriculture, Yasouj University, P. O. Box: 75918-74831, Yasouj, Iran.

² Department of Entomology, Faculty of Agriculture, Tarbiat Modares University, 14115-336, Tehran, Iran.

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ABSTRACT. In this research 52 species of bees (Hymenoptera: Apoidea) have been reported from the northeastern Fars province, of which the species of *Hylaeus punctus* Förster and *Hoplitis leucomelana* Kirby were new records for Iran fauna. Among the material examined, there were 11 species of Apidae, 19 species of Halictidae, 1 species of Andrenidae, 4 species of Colletidae and 17 species of Megachilidae. Phoretic mites belonging to four genera *Parapygmephorus*, *Vidia*, *Imparipes* and *Anoetus* were associated with halictid and megachilid bees. Among associated mites with collected bees *Imparipes burgeri* Ebermann & Jagersbacher-Baumann belonging to the family Scutacaridae was new for Iran fauna and Asia. We also collected five new mite species for science. These species were belong to the genera *Parapygmephorus* (1 species), *Vidia* (1 species), and *Anoetus* (3 species) of the families Neopygmephoridae, Winterschmidtidae and Anoetidae respectively that will be described elsewhere. All specimens are deposited in the Iranian Pollinator Insects Collection of Yasouj University.

Key words: Anoetidae, Neopygmephoridae, Phoretic mite, Pollinator bees, Scutacaridae, Winterschmidtidae.

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Introduction

Bees are the most important pollinators worldwide especially because of their foraging behavior and floral constancy (Almanza 2007). The province of Fars which is having an arid to semiarid climate has a rich fauna of the bees on various agricultural crops. Izadi *et al.* (1997) have recorded 35 species of Apoidea bees from northern Fars province. Taghavi *et al.* (2008) studied *Bombus* species diversity

in Tehran and Qazvin provinces in Central Elburz. They collected a total of 11 species of the genus *Bombus* and found that 8 species in two regions had ecological similarity. In a previous study in this province, Khodaparast and Monfared (2012) reported 177 bee species which mostly were wild bees' species. Some researchers interested in crops pollination have been indicated that just about 15% of world's crops are pollinated by a few

Corresponding author: Alireza Monfared, E-mail: amonfared@yu.ac.ir

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managed bee species, e.g. *A. mellifera* and *Bombus* spp., while the rest are pollinated by unmanaged solitary bees and other pollinator organisms and environmental factors (Almanza 2007). The superfamily Apoidea are the well-known pollinators mostly for their relationships with flowering plants. According to current usage Apoidea is a monophyletic group composed of both the sphecid wasps and the true bees called Apiformes or Anthophila (Michener 2007). This superfamily includes seven families which six families of Apidae, Andrenidae, Colletidae, Megachilidae, Halictidae and Melittidae are cosmopolitan and distributed in vast geographical regions while Stenotritidae restricted only to Australia. There are above mentioned six families of apoids in Iran. Previously, during examination of specimens of bees collected from this province severe infestation to mites was observed.

Therefore it seemed that study of these mites would be resulted to find kinds of relationships between these two animals. Mites and bees have co-existed since the Cretaceous, and there is evidence of a close relationship between some taxa, probably resulting from a co-evolutionary process (Klimov *et al.* 2007). Numerous mite species use hymenopterous insects as phoretic hosts (e.g. Fain *et al.* 1999).

Bee-mite associations are well known but poorly understood (e.g. Fain *et al.* 1999; Fain and Pauly 2001; Walter *et al.* 2002). The taxonomical and biological information about these mites are poorly studied in most parts of the world. There is a need for more investigations and taxonomical studies on these mites (Hajiqanbar 2011). In this survey, we collected bees and examined them for associated mites from northeastern Fars province. Also, we recorded floral choice of bees.

Material and methods

Bees and associated mites were collected from suburban areas and mountainous regions of northeastern Fars Province from last June 2013 to early July 2014. We considered all specimens of Apoidea except honeybees. Sampling locations were recorded by Garmin eTrix Hc GPS. Bees were collected by insect net. Following sampling bees were killed with ethyl acetate and later pinned in laboratory. Mites were collected from their bees' hosts under an Olympus SZX 10 stereo-microscope, cleared in Nesbitt's fluid and mounted in Fauremedium. All identified species were deposited in the "Iranian pollinator Insects - Collection", of Plant Protection Department at the Faculty of Agriculture, Yasouj University, Yasouj, Iran (IPIC-YU). Also, floral choice visited by bee species from each locality were collected and identified. New record of bees for Iranian fauna is indicated with an asterisk.

Results

Collected bees species, floral choice families and associated mites species are mentioned in Tables 1 to 2.

Collected bees: Bees collected represent five families, eighth subfamilies, nine tribes and 20 genera. The number of related species is shown in Table 1. The most frequent and diverse bee's genera with nine, six, six and three species, respectively, were belonged to *Halictus*, *Lasioglossum*, *Osmia* and *Bombus*. Among families, Halictidae, with 19 collected species had the highest frequency of bees species in this study.

Family: Andrenidae,
Subfamily: Andreninae

Andrena fuscosa Erichson, 1835

Material examined: Fars province, Sepidan, Sarbast, 2043m, 25.IV.2014, 1 ♀, pinned (IPIC-YU).

General distribution: North Africa, Southern and Central Europe, Western and Eastern Asia (Michener 2007; Ascher and Pickering 2016).

Host plant associations: *Vicia* sp. (Fabaceae), *Medicago sativa* (Fabaceae), *Lepidium draba* (Brassicaceae).

Family: Apidae

Subfamily: Apinae, **Tribe:** Ancylini

Tarsalia ancyliformis Popov, 1935

Material examined: Fars province, Shiraz, Ghasre ghomshe, 1860m, 21.VII.2013, 1 ♀, pinned (IPIC-YU).

General distribution: Sardinia, Turkey, Iran, Tajikistan, Turkmenistan and Israel (Ascher and Pickering 2016).

Host plant associations: *Astragalus* sp. (Fabaceae).

Tarsalia hirtipes Morawitz, 1895

Material examined: Fars province, Shiraz, Ghasre ghomshe, 1860m, 21.VII.2013, 1 ♀, pinned (IPIC-YU).

General distribution: Central Asia (Turkmenistan, Uzbekistan, Tajikistan) but occurs westward to Iran, Turkey, and the islands of Cyprus and Sardinia, and southward to Sudan (Michener 2007; Ascher and Pickering 2016).

Host plant associations: *Astragalus* sp. (Fabaceae).

Family: Apidae

Subfamily: Apinae, **Tribe:** Bombini

Bombus (Thoracobombus) armeniacus Radoszkowski, 1877

Material examined: Fars province, Sepidan, Poladkaf complex, 2500m, 17.VI.2013, 6 ♀♀, pinned (IPIC-YU).

General distribution: Bulgaria, Yugoslavia, Greece, Poland, Russia and Iran (Aytekin *et al.* 2002; Ascher and Pickering 2016).

Host plant associations: *Sophora* sp. (Fabaceae), *Euphorbia* sp. (Euphorbiaceae), *Salvia* sp. (Lamiaceae), *Vicia* sp. (Fabaceae), *Silybum* sp. (Asteraceae).

Table 1. List of bees collected in northeastern Fars Province, Iran.

Family	Subfamily	Tribe	Genus	Number of Species
Apidae	Apinae	Bombini	<i>Bombus</i>	3
		Eucerini	<i>Eucera</i>	3
			<i>Tetraloniella</i>	3
Andrenidae	Nomadinae	Ancylini	<i>Tarsalia</i>	2
	Andreninae		<i>Andrena</i>	1
Colletidae	Colletinae	Colletini	<i>Colletes</i>	2
	Hylaeinae		<i>Hylaeus</i>	2
Halictidae	Halictinae	Halictini	<i>Halictus</i>	9
			<i>Lasioglossum</i>	6
	Nomiinae		<i>Nomiapis</i>	2
			<i>Pseudapis</i>	2
Megachilidae	Megachilinae	Osmiini	<i>Heriades</i>	1
			<i>Hoplitis</i>	2
			<i>Osmia</i>	6
			<i>Lithurgus</i>	2
		Lithurgini		
		Megachilini	<i>Coelioxys</i>	1
		Anthidiini	<i>Afranthidium</i>	1
			<i>Anthidium</i>	2
			<i>Anthidiellum</i>	1
			<i>Pseudoanthidium</i>	1

***Bombus (Sibiricobombus) niveatus* Kriechbaumer, 1870**

Material examined: Fars province, Sepidan, Dashte Saran, 2420m, 10.VII.2013, 6 ♀♀, pinned (IPIC-YU).

General distribution: Europe, Eastern Asia (Aytekin and Cagatay 2003; Ascher and Pickering 2016).

Host plant associations: *Euphorbia* L. (Euphorbiaceae), *Salvia* sp. (Lamiaceae), *Vicia* sp. (Fabaceae), *Silybum* sp. (Asteraceae).

***Bombus (Thoracobombus) zonatus* Smith, 1854**

Material examined: Fars province, Sepidan, 2250m, 27.VII.2013, 3♀♀, pinned (IPIC-YU).

General distribution: Russia, Iran, Turkey, Romania, Ukraine and Germany (Aytekin and Cagatay 2003; Ascher and Pickering 2016).

Host plant associations: *Sophora* sp. (Fabaceae), *Euphorbia* L. (Euphorbiaceae), *Salvia* sp. (Lamiaceae), *Vicia* sp. (Fabaceae), *Silybum* sp. (Asteraceae).

Family: Apidae

Subfamily: Apinae, **Tribe:** Eucerini

***Eucera (Heterocera) clypeata* Erichson, 1835**

Material examined: Fars province, Shiraz, Golestan town, 1937m, 30.VI.2013, 1♀; Sepidan, Sarbast, 2043m, 19.VII. 2013, 2♀♀, pinned (IPIC-YU).

General distribution: Croatia, Tunisia, Algeria, Europe and Eastern Asia (Ascher and Pickering 2016).

Host plant associations: *Lepidium draba* (Brassicaceae), *Astragalus* sp. (Fabaceae), *Taraxacum officinale* (Asteraceae), *Carthamus lanatus* (Asteraceae), *Cichorium* sp. (Asteraceae).

***Eucera (Pteneucera) nigrifacies* Lepeletier, 1841**

Material examined: Fars province, Sepidan, Sarbast, 2043m, 21.VI.2013, 3 ♂♂, pinned (IPIC-YU).

General distribution: Jordan, Iran, Azerbaijan, Turkey, Tunisia, Morocco and Europe (Michener 2007; Ascher and Pickering 2016).

Host plant associations: *Lepidium draba* (Brassicaceae), *Taraxacum officinale* (Asteraceae), *Medicago sativa* (Fabaceae) and *Cichorium* sp. (Asteraceae).

***Eucera major* Risch, 1997**

(Subgenus is not determined for this species in taxonomy.)

Material examined: Fars province, Sepidan, Kahkran, 2400m, 12.VII.2013, 2 ♀♀, pinned (IPIC-YU).

General distribution: Holarctic, Jordan, Iran, Azerbaijan, Turkey (Michener 2007; Ascher and Pickering 2016).

Host plant associations: *Lepidium draba* (Brassicaceae) and *Euphorbia* L. (Euphorbiaceae).

***Tetraloniella glauca* Fabricius, 1775**

Material examined: Fars province, Shiraz, Ghasreghomshe, 1860m, 21.VII.2013, 6♀♀, pinned (IPIC-YU).

General distribution: Iran, Iraq, Turkey, Cyprus and Bergama (Ascher and Pickering 2016).

Host plant associations: *Astragalus* sp. (Fabaceae), *Carthamus lanatus* (Asteraceae).

***Tetraloniella menthae* Risch, 1997**

Material examined: Fars province, Sepidan, 2250m, 27.VII.2013, 5 ♀♀, pinned (IPIC-YU).

General distribution: Iran, Iraq and Turkey (Ascher and Pickering 2016).

Host plant associations: *Sophora* sp. (Fabaceae), *Euphorbia* L. (Euphorbiaceae), *Salvia* sp. (Lamiaceae), *Vicia* sp. (Fabaceae), *Silybum* sp. (Asteraceae).

***Tetraloniella (Glazunovia) nigriceps*
(Morawitz, 1895)**

Material examined: Fars province, Sepidan, Dashte Saran, 2420m, 10.VII.2013, 6 ♀♀, pinned (IPIC-YU).

General distribution: Afghanistan, Turkey, Iran, Tajikistan and Turkmenistan (Michener 2007; Ascher and Pickering 2016).

Host plant associations: *Euphorbia* L. (Euphorbiaceae), *Salvia* sp. (Lamiaceae), *Vicia* sp. (Fabaceae), *Silybum* sp. (Asteraceae).

Family: Colletidae

Subfamily: Colletinae, **Tribe:** Colletini

***Colletes bidentulus* Noskiewicz, 1936**

Material examined: Fars province, Shiraz, Sarmor, 1900m, 28.VII.2013, 2 ♂♂, pinned (IPIC-YU).

General distribution: Azerbaijan, Turkey, Iran, Uzbekistan and Tajikistan (Ascher and Pickering 2016).

Host plant associations: *Astragalus* sp. (Fabaceae), *Vicia* sp. (Fabaceae), *Medicago sativa* (Fabaceae).

***Colletes ottomanus* Noskiewicz, 1958**

Material examined: Fars province, Shiraz, Golestan town, 1937m, 30.VI.2013 and Shiraz, Ghasreghomshe, 1860m, 21.VII.2013, 1 ♂, 1 ♀, pinned (IPIC-YU).

General distribution: Azerbaijan, Turkey, Iran, Uzbekistan and Tajikistan (Ascher and Pickering 2016).

Host plant associations: *Astragalus* sp. (Fabaceae), *Carthamus lanatus* (Asteraceae).

Family: Colletidae

Subfamily: Hylaeinae

***Hylaeus (Dentigera) intermedius* Förster, 1871**

Material examined: Fars province, Sepidan, Tarbiat badani complex, 2500m, 17.VI.2013, 1♀, 1♂, pinned (IPIC-YU).

General distribution: Lebanon, Iran, Russia and Europe (Ascher and Pickering 2016).

Host plant associations: *Sophora* sp. (Fabaceae), *Euphorbia* sp. (Euphorbiaceae), *Salvia* sp. (Lamiaceae).

***Hylaeus punctus** Förster, 1871**

Material examined: Fars province, Sepidan, Tarbiat badani complex, 2500m, 17.VI.2013, 1♀, pinned (IPIC-YU).

General distribution: Lebanon, Greece, Croatia, Italy and Turkey (Ascher and Pickering 2016).

Host plant associations: *Sophora* sp. (Fabaceae), *Euphorbia* L. (Euphorbiaceae), *Salvia* sp. (Lamiaceae).

Family: Halictidae

Subfamily: Halictinae, **Tribe:** Halictini

***Halictus (Halictus) brunnescens* Eversmann, 1852**

Material examined: Fars province, Sepidan, Dashte Saran, 2420m, 10.VII.2013 and Sepidan, Sarbast, 2043m, 19.VII.2013, 2♀♀, pinned (IPIC-YU).

General distribution: Europe to Eastern Asia (Nadimi 2016; Ascher and Pickering 2016).

Host plant associations: *Sophora* sp. (Fabaceae), *Euphorbia* L. (Euphorbiaceae), *Salvia* sp. (Lamiaceae).

***Halictus (Seladonia) cephalicus* Morawitz, 1873**

Material examined: Fars province, Sepidan, 2250m, 27.VII.2013, Kamfiroz, 1850m, 31.VIII.2013, Shiraz Golestan town, 1937m, 29.VIII.2013 and Sepidan, Sarbast, 2043m, 2.IX.2013, 8♀♀, pinned (IPIC-YU).

General distribution: Eastern Europe to central Asia (Nadimi 2016; Ascher and Pickering 2016).

Host plant associations: *Astragalus* sp. (Fabaceae), *Vicia* sp. (Fabaceae), *Medicago sativa* (Fabaceae), *Lepidium draba* (Brassicaceae), *Mentha pulegium* (Lamiaceae), *Taraxacum officinale* (Asteraceae), *Oryza* sp. (Poaceae), *Silybum* sp. (Asteraceae), *Cichorium* sp.

(Asteraceae), *Portulaca* sp. (Portulacaceae), *Capsicum* sp. (Solanaceae).

***Halictus (Seladonia) lucidipennis* Smith, 1853**

Material examined: Fars province, Sepidan, Sarbast, 2043m, 4.VIII.2013 and Shiraz, Golestan town, 1937m, 29.VIII.2013, 5 ♀♀, pinned (IPIC-YU).

General distribution: Norway, Eastern and South of Asia and North and Central of Africa (Ascher and Pickering 2016).

Host plant associations: *Vicia* sp. (Fabaceae), *Medicago sativa* (Fabaceae), *Lepidium draba* (Brassicaceae), *Astragalus* sp. (Fabaceae), *Cichorium* sp. (Asteraceae), *Portulaca* sp. (Portulacaceae), *Capsicum* sp. (Solanaceae).

***Halictus (Halictus) patellatus* Morawitz, 1873**

Material examined: Fars province, Sepidan, 2250m, 27.VII.2013, 2 ♀♀, pinned (IPIC-YU).

General distribution: Eastern and South of Europe and Eastern of Asia.

Host plant associations: *Vicia* sp. (Fabaceae), *Mentha pulegium* (Lamiaceae), *Silybum* sp. (Asteraceae).

***Halictus (Halictus) resurgens* Nurse, 1903**

Material examined: Fars province, Kamfiroz, 1850m, 31.VIII.2013 and Shiraz, Sarmor, 1900m, 28.VII.2013, 3 ♂♂, 1 ♀, pinned (IPIC-YU).

General distribution: Europe to eastern Asia (Nadimi 2016 Ascher and Pickering 2016).

Host plant associations: *Astragalus* sp. (Fabaceae), *Vicia* sp. (Fabaceae), *Medicago sativa* (Fabaceae), *Oryza* sp. (Poaceae).

***Halictus (Seladonia) subauratoides* Blüthgen, 1926**

Material examined: Fars province, Sepidan, Sarbast, 2043m, 2.IX.2013, 1 ♀, pinned (IPIC-YU).

General distribution: Europe to East Asia (Ascher and Pickering 2016).

Host plant associations: *Vicia* sp. (Fabaceae), *Medicago sativa* (Fabaceae), *Lepidium draba* (Brassicaceae).

***Halictus (Halictus) submodernus* Blüthgen, 1936**

Material examined: Fars province, Shiraz, Ghasreghomshe, 1860m, 21.VII.2013 and Sepidan, 2250m, 27.VII.2013, 3 ♀♀, pinned (IPIC-YU).

General distribution: Turkey and Iran (Ascher and Pickering 2016).

Host plant associations: *Vicia* sp. (Fabaceae), *Mentha pulegium* (Lamiaceae), *Astragalus* sp. (Fabaceae), *Carthamus lanatus* (Asteraceae), *Silybum* sp. (Asteraceae).

***Halictus (Halictus) tetrazonianellus* Strand, 1909**

Material examined: Fars province, Sepidan, Sarbast, 2043m, 4.VIII.2013, 2 ♀♀, pinned (IPIC-YU).

General distribution: South of Europe and Eastern of Asia (Ascher and Pickering, 2016).

Host plant associations: *Vicia* sp. (Fabaceae), *Medicago sativa* (Fabaceae), *Lepidium draba* (Brassicaceae), *Cichorium* sp. (Asteraceae).

***Halictus (Vestitohalictus) tuberculatus* Blüthgen, 1925**

Material examined: Fars province, Sepidan, Tarbiatbadani complex, 2500m, 17.VI.2013 and Sepidan, 2250m, 27.VII.2013, 1 ♀, 1 ♂, pinned (IPIC-YU).

General distribution: Iran, Turkey and Ukraine (Ascher and Pickering 2016).

Host plant associations: *Sophora* sp. (Fabaceae), *Euphorbia* L. (Euphorbiaceae), *Salvia* sp. (Lamiaceae), *Vicia* sp. (Fabaceae), *Medicago sativa* (Fabaceae), *Lepidium draba* (Brassicaceae), *Silybum* sp. (Asteraceae).

***Lasioglossum (Lasioglossum) aegyptiellum*
Strand, 1909**

Material examined: Fars province, Shiraz Golestan town, 1937m, 30.VI.2013, Sepidan, 2250m, 27.VII.2013 and Shiraz, Ghasreghomshe, 1860m, 21.VII.2013, 3 ♀♀, pinned (IPIC-YU).

General distribution: Europe to Middle East, North Africa (Nadimi 2016; Güler *et al.* 2011; Ascher and Pickering 2016).

Host plant associations: *Vicia* sp. (Fabaceae), *Mentha pulegium* (Lamiaceae), *Astragalus* sp. (Fabaceae), *M. sativa* (Fabaceae), *Lepidium draba* (Brassicaceae), *Carthamus lanatus* (Asteraceae).

***Lasioglossum (Lasioglossum) discum*
Smith, 1853**

Material examined: Fars province, Shiraz, Ghasreghomshe, 1860m, 21.VII.2013 and Shiraz, Sarmor, 1900m, 28.VII.2013, 2 ♀♀, pinned (IPIC-YU).

General distribution: Europe to central Asia, North Africa (Nadimi 2016; Ascher and Pickering 2016).

Host plant associations: *Astragalus* sp. (Fabaceae), *Carthamus lanatus* (Asteraceae), *Vicia* sp. (Fabaceae), *M. sativa* (Fabaceae).

***Lasioglossum (Evylaeus) chlypeiferellum*
Strand, 1909**

Material examined: Fars province, Shiraz Golestan town, 1937m, 29.VIII.2013, 1 ♀

General distribution: Mongolia, Tajikistan, Afghanistan, Iran, Cyprus, Greece and Croatia (Ascher and Pickering 2016).

Host plant associations: *Portulaca* sp. (Portulacaceae), *Capsicum* sp. (Solanaceae).

***Lasioglossum (Evylaeus) malachurum* Kirby, 1802**

Material examined: Fars province, Sepidan, Sarbast, 2043m, 12.IV.2013, 4.VII.2013 and Shiraz, Sarmor, 1900m, 28.VII.2013, 2 ♀♀, 2 ♂♂, pinned (IPIC-YU).

General distribution: Europe to Middle East, North Africa (Nadimi 2016; Güler *et al.* 2011; Ascher and Pickering 2016).

Host plant associations: *Vicia* sp. (Fabaceae), *Medicago sativa* (Fabaceae), *Lepidium draba* (Brassicaceae), *Astragalus* sp. (Fabaceae).

***Lasioglossum (Evylaeus) mesosclerum*
Pérez, 1903**

Material examined: Fars province, Sepidan, Sarbast, 2043m, 16.IX.2013, 1 ♀, pinned (IPIC-YU).

General distribution: Eastern and Southern Europe and Eastern Asia (Ascher and Pickering 2016).

Host plant associations: *Vicia* sp. (Fabaceae), *Medicago sativa* (Fabaceae), *Lepidium draba* (Brassicaceae).

***Lasioglossum (Evylaeus) villosulum*
Kirby, 1802**

Material examined: Fars province, Sepidan, Sarbast, 2043m, 12.IV.2013 and 4.VII.2013, 2 ♀♀, pinned (IPIC-YU).

General distribution: Europe and Eastern and South of Asia (Ascher and Pickering 2016).

Host plant associations: *Vicia* sp. (Fabaceae), *Medicago sativa* (Fabaceae), *Lepidium draba* (Brassicaceae).

Family: Halictidae**Subfamily: Nomiinae*****Nomiapis (Nomiapis) bispinosa* Brullé, 1832**

Material examined: Fars province, Shiraz, Ghasreghomshe, 1860m, 21.VII.2013 and Shiraz, Sarmor, 1900m, 28.VII.2013, 3 ♂♂, 1 ♀, pinned (IPIC-YU).

General distribution: Europe to Eastern Asia, North Africa (Nadimi 2016; Ascher and Pickering 2016).

Host plant associations: *Astragalus* sp. (Fabaceae), *Carthamus lanatus* (Asteraceae), *Vicia* sp. (Fabaceae), *M. sativa* (Fabaceae).

***Nomiapis (Nomiapis) diversipes* Latreille, 1806**

Material examined: Fars province, Sepidan, Sarbast, 2043m, 21.VI.2013, 4.VIII.2013, 2.IX.2013 and 16.IX.2013, Shiraz, Sarmor, 1900m, 28.VII.2013, Shiraz Golestan town, 1937m, 30.VI.2013, Sepidan, Dashte Saran, 2420m, 10.VII.2013 and Sepidan, 2250m, 27.VII.2013, 6 ♂♂, 10 ♀♀, pinned (IPIC-YU).

General distribution: Europe to Eastern Asia (Nadimi 2016; Ascher and Pickering 2016).

Host plant associations: *Vicia* sp. (Fabaceae), *Medicago sativa* (Fabaceae), *Lepidium draba* (Brassicaceae), *Silybum* sp. (Asteraceae), *Cichorium* sp. (Asteraceae).

Pseudapis (Pseudapis) sp. A

Material examined: Fars province, Shiraz, Ghasreghomshe, 1860m, 21.VII.2013, 1 ♀, pinned (IPIC-YU).

Host plant associations: *Astragalus* sp. (Fabaceae).

Pseudapis (Pseudapis) sp. B

Material examined: Fars province, Sepidan, Kahkran, 2400m, 12.VII.2013, 1 ♀, pinned (IPIC-YU).

Host plant associations: *Lepidium draba* (Brassicaceae), *Euphorbia* L. (Euphorbiaceae).

Family: Megachilidae

Subfamily: Megachilinae, **Tribe:** Osmini

***Heriades clavicornis* Morawitz, 1875**

Material examined: Fars province, Shiraz, Sadra, 1800m, 18.V.2014, 1 ♂, pinned (IPIC-YU).

General distribution: Russia, Tajikistan, Iran, Armenia, Jordan, Turkey and Greece (Ascher and Pickering 2016).

Host plant associations: *Astragalus* sp. (Fabaceae), *Carthamus lanatus* (Asteraceae).

***Hoplitis leucomelana* Kirby, 1802**

Material examined: Fars province, Kamfiroz, 1850m, 31.VIII.2013, 2 ♀♀, pinned (IPIC-YU).

General distribution: Russia, China, Mongolia, Tajikistan, Kazakhstan, Georgia, Iran and Europe (Ascher and Pickering 2016).

Host plant associations: *Astragalus* sp. (Fabaceae), *Oryza* sp. (Poaceae).

***Hoplitis uncaticornis* Stanek, 1969**

Material examined: Fars province, Shiraz, Sadra, 1800m, 18.V.2014, 1 ♂, pinned (IPIC-YU).

General distribution: Tajikistan, Kazakhstan, Georgia, Iran and Europe (Ascher and Pickering 2016).

Host plant associations: *Astragalus* sp. (Fabaceae), *Carthamus lanatus* (Asteraceae).

***Osmia brevicornis* Fabricius, 1798**

Material examined: Fars province, Sepidan, Sarbast, 2043m, 25.IV.2014 and 2.V.2014, 6 ♀♀, pinned (IPIC-YU).

General distribution: Kazakhstan, Uzbekistan, Afghanistan, Iran and Europe (Ascher and Pickering 2016).

Host plant associations: *Vicia* sp. (Fabaceae), *Medicago sativa* (Fabaceae), *Lepidium draba* (Brassicaceae).

***Osmia caerulescens* Linnaeus, 1758**

Material examined: Fars province, Sepidan, Sarbast, 2043m, 4.VIII.2013, 11.IV.2014, 25.IV.2014 and 2.V.2014, 1 ♀, 3 ♂♂, pinned (IPIC-YU).

General distribution: USA, Canada, Russia, New Zealand, India, Kazakhstan, Iran and Europe (Ascher and Pickering 2016).

Host plant associations: *Vicia* sp. (Fabaceae), *Medicago sativa* (Fabaceae), *Lepidium draba* (Brassicaceae).

***Osmia difficilis* Morawitz, 1875**

Material examined: Fars province, Sepidan, Kahkran, 2400m, 16.V.2014, 1 ♀, pinned (IPIC-YU).

General distribution: Russia, Iran, Tajikistan, Turkey and Israel (Ascher and Pickering 2016).

Host plant associations: *Lepidium draba* (Brassicaceae), *Euphorbia* L. (Euphorbiaceae).

***Osmia dives* Mocsáry, 1877**

Material examined: Fars province, Shiraz, Anjireh, 1800m, 21.V.2014, 2 ♀♀, pinned (IPIC-YU).

General distribution: Kyrgyzstan, Turkmenistan, Iran, Cyprus, Greece and Hungary (Ascher and Pickering 2016).

Host plant associations: *Astragalus* sp. (Fabaceae), *Carthamus lanatus* (Asteraceae).

***Osmia fasciata* Latreille, 1811**

Material examined: Fars province, Shiraz, Derak, 2100m, 28.V.2014, 2 ♀♀, pinned (IPIC-YU).

General distribution: India, Pakistan, Afghanistan, Uzbekistan, Iran and Syria (Ascher and Pickering 2016).

Host plant associations: *Astragalus* sp. (Fabaceae), *Carthamus lanatus* (Asteraceae).

***Osmia nigrohirta* Friese, 1899**

Material examined: Fars province, Sepidan, Tarbiat badani complex, 2500m, 17.VI.2013, 2 ♀♀, pinned (IPIC-YU).

General distribution: Iran, Lebanon, Turkey, Greece and Macedonia (Ascher and Pickering 2016).

Host plant associations: *Sophora* sp. (Fabaceae), *Euphorbia* L. (Euphorbiaceae), *Salvia* sp. (Lamiaceae).

Family: Megachilidae

Subfamily: Megachilinae, **Tribe:** Lithurgini

***Lithurgus chrysurus* Fonscolombe**

Material examined: Fars province, Sepidan, Kahkran, 2400m, 5.VII.2013 and

12.VII.2013, 2500m, 17.VI.2013, 1 ♀, 1 ♂, pinned (IPIC-YU).

General distribution: USA, Iran, European Russia, Morocco and Europe (Ascher and Pickering 2016).

Host plant associations: *Lepidium draba* (Brassicaceae), *Euphorbia* L. (Euphorbiaceae).

***Lithurgus tibialis* Morawitz, 1875**

Material examined: Fars province, Sepidan, Kahkran, 2400m, 12.VII.2013, 1 ♂, pinned (IPIC-YU).

General distribution: Portugal, United Arab Emirates, Turkey, Greece, Italy, Iran, Pakistan and Uzbekistan (Ascher and Pickering 2016).

Host plant associations: *Lepidium draba* (Brassicaceae), *Euphorbia* L. (Euphorbiaceae).

Family: Megachilidae

Subfamily: Megachilinae, **Tribe:** Megachilini

***Coelioxys caudata* Spinola, 1838**

Material examined: Fars province, Shiraz, Ghasre ghomshe, 1860m, 21.VII.2013, 1 ♀, pinned (IPIC-YU).

General distribution: Morocco, Spain, France, Italy, Greece, Romania, Iran, Turkmenistan, Kyrgyzstan, China (Ascher and Pickering 2016).

Host plant associations: *Astragalus* sp. (Fabaceae), *Carthamus lanatus* (Asteraceae).

Family: Megachilidae

Subfamily: Megachilinae, **Tribe:** Anthidiini

***Afranthidium carduele* Morawitz, 1876**

Material examined: Fars province, Shiraz, Derak, 2100m, 28.V.2014, 1 ♀, 1 ♂, pinned (IPIC-YU).

General distribution: Spain, Greece, Turkey, Iran, Afghanistan and Tajikistan (Ascher and Pickering 2016).

Host plant associations: *Astragalus* sp. (Fabaceae), *Carthamus lanatus* (Asteraceae).

***Anthidium anguliventre* Morawitz, 1888**

Material examined: Fars province, Shiraz, Ghasre ghomshe, 1860m, 21.VII.2013, 2 ♂♂, pinned (IPIC-YU).

General distribution: Oman, Jordan, Turkey, Iran, Pakistan, Turkmenistan, Kyrgyzstan and Kazakhstan (Ascher and Pickering 2016).

Host plant associations: *Astragalus* sp. (Fabaceae), *Carthamus lanatus* (Asteraceae).

***Anthidium taeniatum* Latreille, 1809**

Material examined: Fars province, Sepidan, Sarbast, 2043m, 16.IX.2013, 1 ♂, pinned (IPIC-YU).

General distribution: Algeria, Spain, Tunisia, France, Croatia, Greece, Iran, Israel and Turkmenistan (Ascher and Pickering 2016).

Host plant associations: *Vicia* sp. (Fabaceae), *Medicago sativa* (Fabaceae), *Lepidium draba* (Brassicaceae).

***Anthidiellum strigatum* Panzer, 1805**

Material examined: Fars province, Shiraz, Derak, 2100m, 28.V.2014, 1 ♂, pinned (IPIC-YU).

General distribution: Morocco, Tunisia, Europe, Iran, Turkmenistan, Tajikistan, Kazakhstan, Russia and Korea (Ascher and Pickering 2016).

Host plant associations: *Astragalus* sp. (Fabaceae), *Carthamus lanatus* (Asteraceae).

***Pseudoanthidium scapulare* Latreille, 1809**

Material examined: Fars province, Shiraz, Ghasre ghomshe, 1860m, 21.VII.2013, 2 ♂♂, pinned (IPIC-YU).

General distribution: Algeria, Spain, France and Iran (Ascher and Pickering 2016).

Host plant associations: *Astragalus* sp. (Fabaceae), *Carthamus lanatus* (Asteraceae).

Identified mites

Phoretic mites collected on bees represent 2 orders, 4 families, 4 genera and 7 species. Five species are new to science that will be described elsewhere and *Imparipes burgeri* Ebermann & Jagersbacher-Baumann is new for Asia (Table 2). The family Halictidae showed highest amount of frequency of 7.3 Percent (Fig. 1). The genus *Halictus* had highest percent of frequency (Fig. 2).

Table 2. List of phoretic mites on bees (Hymenoptera: Apoidea).

Order	Family	Species	Host
Trombidiformes	Scutacaridae	<i>Imparipes burgeri</i> Ebermann & Jagersbacher-Baumann	<i>L. clypeiferellum</i>
	Neopygmephoridae	<i>Parapygmephorus magnisetosus</i> Khaustov & Zaliznaya	<i>H. resurgens</i>
		<i>Parapygmephorus</i> sp. 1	<i>H. resurgens</i>
Sarcoptiformes	Winterschmidtidae	<i>Vidia</i> sp.	<i>Megachile</i> sp.
	Anoetidae	<i>Anoetus</i> sp. 1	<i>H. patellatus</i>
		<i>Anoetus</i> sp. 2	<i>H. resurgens</i>
		<i>Anoetus</i> sp. 3	<i>N. diversipes</i>

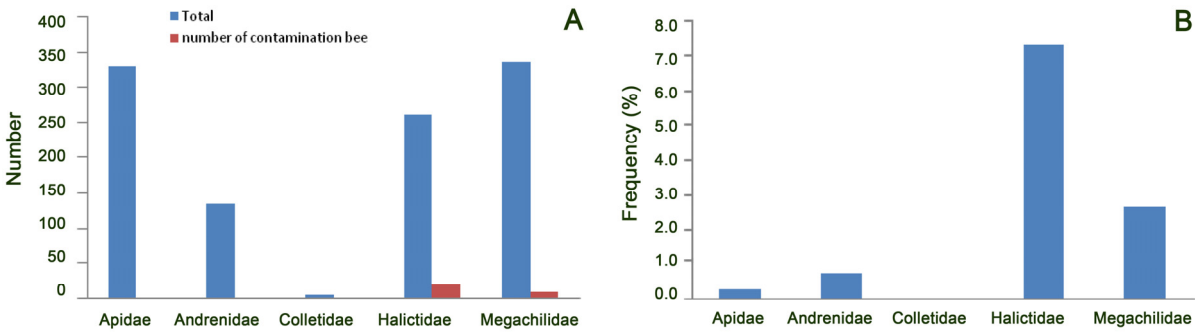


Figure 1. Total number of bees in different families and their contamination rate by mites (A). Frequency of different families of bees associated with mites (B).

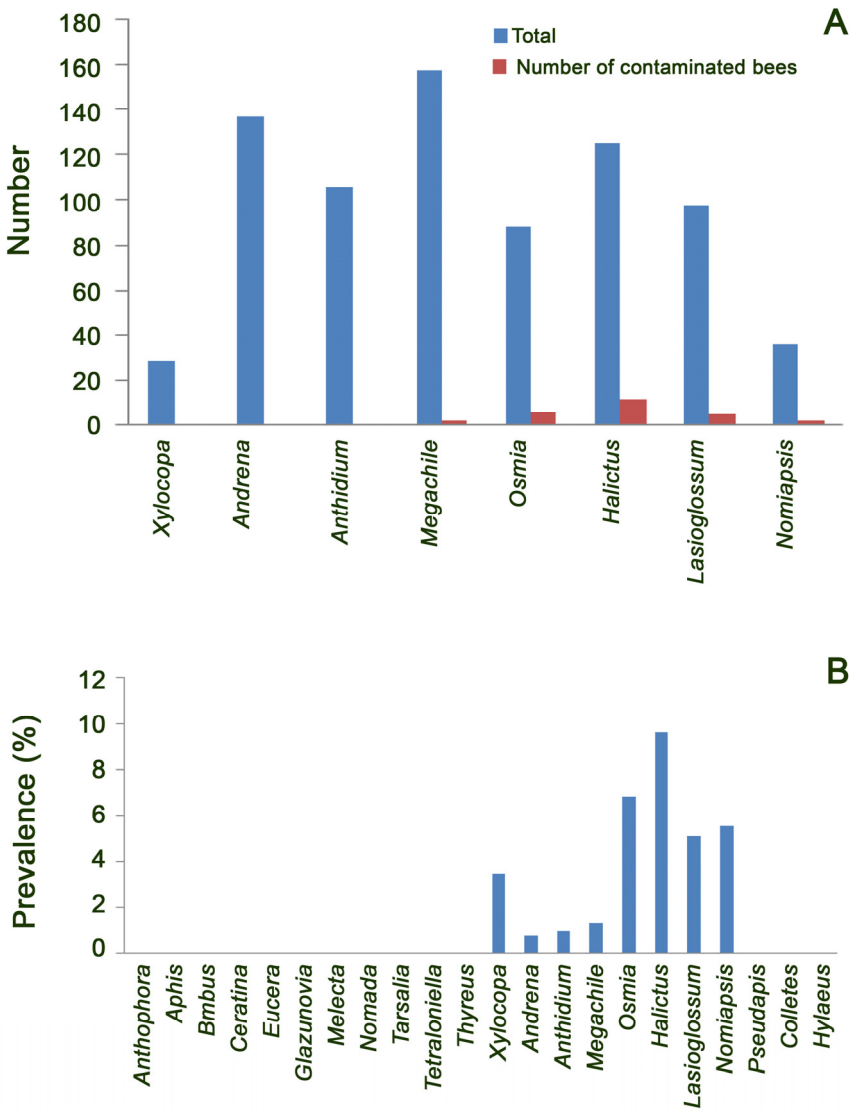


Figure 2. Total number of bees in different genera and their contamination rate by mites, (A). Frequency percents of different bees' genera associated with mites, (B).

Discussion

Among the bee families were collected from northern Fars, the most frequent species were respectively, belonging to Megachilidae, Apidae and Halictidae, but most frequent bees associated with mites was belong to halictid bees. There are considerable recorded halictid bees members associated with mites in different parts of the worlds (O'Connor, 2016). In Iran, Hajiqanbar *et al.* (2011), recorded a new species of the genus *Parapygmephorus* Cross, 1965 phoretic on *Halictus quadricinctus* (Fabricius, 1776) (Halictidae). In the present study, 1086 specimens of Apoidea from various parts of Northeastern Fars Province including cities, villages, and counties were collected. Species of five families were identified representing 52 species.

Based on specialist of bees identifications and compare to Ascher and Pickering (2016), we found two new records for the Iranian fauna. During lately decade, studies on Iranian bees have been developed: for example, Monfared *et al.* (2007), by collecting specimens from 20 provinces in a more vast area than what previous researchers studied, revised and cleared that at least 34 species of the genus *Bombus* exist in Iran. Taghavi *et al.* (2008), studied *Bombus* species diversity in Tehran and Qazvin provinces in Central Elburz. They collected a total of 11 species of the genus *Bombus* and detected that at least 8 species in the two regions were similar.

In this study we found three species of the genus *Bombus* (i.e. *Bombus niveatus*, *Bombus zonatus* and *Bombus*

armeniacus) from Sepidan. Khodaparast and Monfared (2012) reported 177 bee species from the Fars Province, Iran. In this survey, they reported 91 new records for Iran fauna, and seven new species for science. Among these, 56 species belonged to Apidae, 49 species of Halictidae, 39 species of Megachilidae, 31 species of Andrenidae, one species of Melittidae and one species from Colletidae. Four species of Apidae, 14 of Halictidae and five species of Megachilidae are similar with this study. Khodaparast & Monfared (2013) published a taxonomic study on 14 species of four genera of the tribe Osmiini in Fars province. We found nine species from this tribe that one species is similar to this study. Also, Khodaparast & Monfared (2013) in an independent work published a taxonomic study on 26 species of the tribe Eucerini from Fars province that 19 species were new for the fauna of Iran. We reported six species of this tribe that three species are similar. Nadimi *et al.* (2013) studied on cleptoparasite *Coelioxys* bees in northern Iran and recorded a total of 11 species of which 6 species were new for the fauna of Iran. We also found *Coelioxys caudate* in this study. Lately, Safi, *et al.* (2016) recorded some species of Halictidae (Hymenoptera: Apoidea) from Gorgan county, northern Iran. At present not any comprehensive study on bees associated mites in Iran. Khaustov and Zaloznaya (2011) found *Parapygmephorus magnisetosus* Khaustov et Zaloznaya phoretic on *Halictus sexcinctus* (Fabricius) and *Osmia rufa* (Linnaeus) from Ukraine. We collected this species on *Halictus resurgens*.

Ebermann *et al.* (2013) reported *Imparipes burgeri* of the 45 host species belonging to ground-nesting host's apoid bees from different parts of Europe. We found this species on *Lasioglossum clypeiferellum* that was new for Asia. Woodring (1970) separated five species of *Anoetus* on beetles of the family Scolytidae and also reported (1973) *Anoetus vexarus* associated with *Lasioglossum quadrinotatus* (Kirby). We found three new species of *Anoetus* on *Halictus patellatus*, *H. resurgens* and *Nomiapis diversipes*.

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بررسی زنبورهای بالاخانواده Apoidea (Insecta: Hymenoptera) و کنه‌های مرتبط با آنها در استان فارس، ایران

ستاره کیانی بکیانی^۱، علیرضا منفرد^{۱*}، حمیدرضا حاجی‌قنبر^۲ و شهرزاد ازهاری^۱

۱ گروه گیاه‌پزشکی، دانشکده کشاورزی، دانشگاه یاسوج، ص. پ. ۷۴۸۳۱-۷۵۹۱۸، یاسوج، ایران.

۲ گروه حشره‌شناسی کشاورزی، دانشکده کشاورزی، دانشگاه تربیت مدرس، ص. پ. ۱۴۱۱۵-۳۳۶، تهران، ایران.

* پست الکترونیکی نویسنده مسئول مکاتبه: amonfared@yu.ac.ir

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چکیده: در این تحقیق ۵۲ گونه از زنبورهای گرده‌افشان بالاخانواده Apoidea از شمال شرقی استان فارس گزارش شد که گونه‌های *Hylaeus punctus* Förster و *Hoplitis leucomelana* Kirby رکوردهای جدید برای فون ایران بودند. در میان نمونه‌های مورد بررسی، ۱۱ گونه Apidae، ۱۹ گونه Halictidae، یک گونه Andrenidae، چهار گونه Colletidae و ۱۷ گونه از Megachilidae وجود داشت. کنه‌های فوریتیک متعلق به چهارجنس *Vidia*، *Parapygmephorus*، *Imparipes* و *Anoetus* با زنبورهای خانواده Halictidae و Megachilidae همراه بودند. در میان کنه‌های مرتبط با زنبورهای گرده‌افشان جمع‌آوری شده، کنه *Imparipes burgeri* Ebermann & Jagersbacher-Baumann متعلق به خانواده Scutacaridae برای فون ایران و آسیا جدید بود. همچنین پنج گونه کنه جدید برای دنیای علم جمع‌آوری و شناسایی شدند. این گونه‌ها از جنس‌های *Parapygmephorus* (یک گونه)، *Vidia* (یک گونه) و *Anoetus* (سه گونه) و به ترتیب متعلق به خانواده‌های Neopygmephoridae، Winterschmidtidae و Anoetidae بودند که در جای دیگری توصیف خواهند شد. تمام نمونه‌ها در «کلکسیون حشرات گرده‌افشان ایران» در دانشگاه یاسوج نگهداری می‌شوند.

واژگان کلیدی: زنبورهای گرده‌افشان، Anoetidae، Neopygmephoridae، Winterschmidtidae و Scutacaridae، Phoretic mites.