# A FAUNISTIC SURVEY ON MEGACHILIDAE (HYMENOPTERA: APOIDEA) FROM NORTHERN IRAN

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ABSTRACT: The fauna of Megachilidae (Hymenoptera) from Golestan and Mazandaran provinces (Northern Iran) is studied in this paper. Totally 24 species of the subfamily Megachilinae from 8 genera and 4 tribes (Anthidiini, Lithurgini, Megachilini, Osmiini) were collected and identified. Four species *Coelioxys* (*Coelioxys*) *aurolimbata* Förster, 1853, *Hoplitis* (*Hoplitis*) *adunca* (Panzer, 1798), *Megachile* (*Eutricharaea*) *apicalis* Spinola, 1808 and *Megachile* (*Megachile*) *pilicrus* Morawitz, 1878 are new records for the fauna of Iran.

KEY WORDS: Hymenoptera, Megachilidae, fauna, new record, distribution, Iran

Megachilidae (Hymenoptera) with more than 4000 described species worldwide (Michener, 2007) is a large family of specialized, morphologically rather uniform bees found in a wide diversity of habitats on all continents except Antarctica, ranging from lowland tropical rain forests to deserts to alpine environments (Litman et al., 2011). The front wings without exception have got two marginal cells, and the stigma is small. The pollen-collecting scopa of all nonparasitica females is located on the abdominal sterna (Stephen et al., 1969; Özbek & van der Zanden, 1992). It has been reported that some species belonging to the Megachilidae are effective pollinators in some plants (Bosch & Blas, 1994; Vicens & Bosch, 2000). These solitary bees are both ecologically and economically relevant; they include many pollinators of natural, urban and agricultural vegetation (Gonzalez et al., 2012). Furthermore, it has been reported that the Megachilidae species can be used as a commercial species when a decrease is observed in the primary pollinator belonging to the other family (Richards, 1997; Güler & Çağatay, 2006).

The fauna of Iranian Megachilidae has been studied rather well and several papers were published by Popov (1967), Esmaili & Rastegar (1974), Warncke (1981), Ebadi (1995), Talebi et al. (1995), Modarres Awal (1997), Izadi et al. (1998, 1999, 2000, 2004, 2006), Karimpour et al. (2002), Engel (2006), Tavakkoli et al. (2010), Khaghaninia et al. (2010), Khodaparast et al. (2011), Monfared & Khodaparast (2012), Rasekh Adel et al. (2012a,b,c), Salehi Sarbijan et al. (2012), Soraya Mohtat et al. (2012), Keshtkar et al. (2012, 2015), Khodaparast & Monfared (2012, 2013), Monfared et al. (2012), and Nadimi et al. (2013a,b, 2014). The aim of this research is faunistic survey on Megachilidae of Golestan and Mazandaran provinces (Northern Iran).

Golestan province (36.8393°N 54.4444°E) is located in the north of Iran and south of the Caspian Sea. Geographically, Golestan is divided into two sections, the plains and the mountains of the Alborz range. In the eastern Alborz section, the mountains have a north-easterly aspect and gradually decrease in height. The

highest point of the province is Shavar - 3945 m above sea level. The climate of Golestan is temperate for most of the year.

Mazandaran province (36.5656°N 53.0588°E) is located on the southern coast of the Caspian Sea. Mazandaran province is geographically divided into two parts: the coastal plains, and the mountainous areas. The Alborz Mountain Range surrounds the coastal strip and plains of the Caspian Sea. Given the climatic changes and varying rates of rainfall in different parts of Mazandaran province, this region has a variety of climates, including the mild and humid climate of Caspian shoreline and the moderate and cold climate of mountainous regions. The western and central plains of the province, up to the northern foothills of Alborz Mountain Range, experience the mild climate of the Caspian region. The province contains a moderate, subtropical climate with an average temperature of 25 °C in summer and about 8 °C in winter.

## MATERIALS AND METHODS

The specimens of this research were collected by sweeping net and Malaise traps from some regions of northern Iran (Golestan and Mazandaran provinces). The collected specimens were placed in ordinary paper envelopes after being killed with cyanid, and then placed in a desiccator to prepare them for morphological study. The materials were pinned and labeled according to current taxonomic rules and were examined with a stereomicroscope. For the determination of the genera and species, the keys developed by Osychnyuk et al. (1978), Dorn & Weber (1988), Warncke (1980, 1992), Banaszak & Romasenko (1998), Scheuchl (2006), Michener (2007) and Amiet et al. (2004) were used. Classification of the different taxa follows Michener (2007). Names of the valid genera within tribes, and valid species names are listed alphabetically within genera.

## RESULTS

Totally 24 species from 8 genera of Megachilidae (*Anthidium* Fabricius, *Chelostoma* Latreille, *Coelioxys* Latreille, *Haetosmia* Popov, *Hoplitis* Klug, *Lithurgus* Berthold, *Megachile* Latreille, and *Osmia* Panzer) were collected from some regions of Northern Iran. Four species *Coelioxys* (*Coelioxys*) *aurolimbata* Förster, 1853, *Hoplitis* (*Hoplitis*) *adunca* (Panzer, 1798), *Megachile* (*Eutricharaea*) *apicalis* Spinola, 1808 and *Megachile* (*Megachile*) *pilicrus* Morawitz, 1878 are new records for the fauna of Iran. The list of species with distributional data is given below alphabetically.

### Family Megachilidae Latreille, 1802
### Subfamily Megachilinae Latreille, 1802
### Tribe Anthidiini Ashmead, 1899
### Genus *Anthidium* Fabricius, 1805
### *Anthidium* (*Anthidium*) *florentinum* (Fabricius, 1775)

**Material examined:** Golestan province, Minudasht, 37°10′N 55°30′E, 2♀♀, 1♂, October 2012. Mazandaran province, Sari, 36°30′N 53°30′E, 1♀, June 2013. **Distribution in Iran:** Alborz (Talebi et al., 1995), East Azarbaijan (Khaghaninia et al., 2010), Fars (Izadi et al., 1998, 1999; Khodaparast et al., 2011; Khodaparast & Monfared, 2012; Keshtkar et al., 2012), Golestan, Tehran (Esmaili & Rastegar, 1974), Guilan (Tavakkoli et al., 2010), Khorasan (Rasekh Adel et al., 2012b,c), Kuhguiloyeh & Boyerahmad (Monfared et al., 2012), West Azarbaijan (Karimpour et al., 2002). **General distribution:** Asia Minor, Caucasus, Central Asian part of the former USSR, South and Central Europe, Siberia, Syria (Banaszak & Romasenko, 1998), Iran (Warncke, 1980), USA (Comba & Comba, 1991). **Plant**

**association:** Polylectic (Fabaceae and Lamiaceae) (Banaszak & Romasenko, 1998), *Medicago sativa* (Fabaceae), *Euphorbia* (Euphorbiaceae), *Epilobium hirsutum* (Onagraceae) (Khodaparast & Monfared, 2012). **Comments:** This species was collected from alfalfa and onion fields, and is a dominant species in alfalfa fields (Rasekh Adel et al., 2012b,c).

**Tribe Lithurgini Newman, 1834**

**Genus *Lithurgus* Berthold, 1827**

***Lithurgus cornutus* (Fabricius, 1787)**

**Material examined:** Golestan province, Kalaleh, 37°43′N 55°49′E, 1♀, October 2012. **Distribution in Iran:** East Azarbaijan (Khaghaninia et al., 2010), Kuhguiloyeh & Boyerahmad (Monfared et al., 2012). **General distribution:** Iran (Warncke, 1981), Asia Minor, Caucasus, Kazakhstan, North Africa, South, East and Central Europe (Banaszak & Romasenko, 1998), China, Greece, Hungary, Italy, Japan, Morocco, Romania, Taiwan, Turkey, the former USSR, former Yugoslavia (van den Zanden, 1986). **Plant association:** Oligolectic (Asteraceae) (Banaszak & Romasenko, 1998; Güler & Sorkun, 2007).

**Tribe Megachilini Latreille, 1802**

**Genus *Coelioxys* Latreille, 1809**

***Coelioxys* (*Coelioxys*) *aurolimbata* Förster, 1853**

**Material examined:** Mazandaran province, Savadkooh, 36°05′N 52°55′E, 1♂, August 2014. **New record for Iran. General distribution:** Caucasus, Central Asian part of the former USSR, Europe, North Africa, Turkey (Banaszak & Romasenko, 1998).

**Genus *Megachile* Latreille, 1802**

***Megachile* (*Eutricharaea*) *apicalis* Spinola, 1808**

**Material examined:** Mazandaran province, Behshahr, 36°41′N 53°44′E, 2♀♀, 1♂, June 2013. **New record for Iran. General Distribution:** Canada, Caucasus, Central Asian part of the former USSR, North Afiica, South and Central Europe (Banaszak & Romasenko, 1998).

***Megachile* (*Eutricharaea*) *leachella* Curtis, 1828**

**Material examined:** Mazandaran province, Ramsar, 36°47′N 50°32′E, 1♂, September 2012. **Distribution in Iran:** East Azarbaijan (Khaghaninia et al., 2010). **General distribution:** Asia, Caucasus, Europe, North Africa, North America, Russain Far East, Siberia (Banaszak & Romasenko, 1998), Iran (Khaghaninia et al., 2010). **Plant association:** Polylectic (mainly Fabaceae) (Banaszak & Romasenko, 1998).

***Megachile* (*Xanthosarus*) *nigriventris* Schenck, 1870**

**Material examined:** Golestan province, Kordkoy, 36°41′N 54°12′E, 1♀, 2♂♂, August 2009. **Distribution in Iran:** East Azarbaijan (Khaghaninia et al., 2010). **General distribution:** North, South and Central Europe (Banaszak & Romasenko, 1998). **Plant association:** Polylectic (Rosaceae, Fabaceae and Caprifoliaceae) (Banaszak & Romasenko, 1998).

***Megachile* (*Megachile*) *pilicrus* Morawitz, 1878**

**Material examined:** Golestan province, Kordkoy, 36°41′N 54°12′E, 2♀♀, August 2009. **New record for Iran. General Distribution:** Caucasus Central Asian part of the former USSR (Banaszak & Romasenko, 1998), South, Eastern and Central Europe (Comba & Comba, 1991).

***Megachile* (*Eutricharaea*) *rotundata* (Fabricius, 1787)**

**Material examined:** Mazandaran province, Savadkooh, 36°05′N 52°55′E, 4♀♀, 3♂♂, August 2014. Golestan province, Minudasht, 37°10′N 55°30′E, 1♀, 1♂, October 2012. **Distribution in Iran:** Alborz (Talebi et al., 1995), East Azarbaijan (Khaghaninia et al., 2010), Fars (Izadi et al., 1998, 1999), Golestan (Esmaili & Rastegar, 1974), Guilan (Tavakkoli et al., 2010), Tehran (Esmaili & Rastegar, 1974; Imani & Tirgari, 1998), West Azarbaijan (Karimpour et al., 2002). **General distribution:** Caucasus, Central Asian part of the former USSR, Europe, Far East Russia, Kazakhstan, North Africa, North and South America, New Zeland (Comba & Comba, 1991; Banaszak & Romasenko, 1998), Turkey (Özbek & Zanden, 1994). **Plant association:** Polylectic (Asteraceae, Fabaceae and Lamiaceae) (Banaszak & Romasenko, 1998).

**Tribe Osmiini Newman, 1834**
**Genus *Chelostoma* Latreille, 1809**
***Chelostoma* (*Chelostoma*) *emarginatum* (Nylander, 1856)**

**Material examined:** Mazandaran province, Behshahr, 36°41′N 53°44′E, 1♀, 1♂, June 2013. **Distribution in Iran:** Guilan (Nadimi et al., 2013a). **General distribution:** Austria, Azerbaijan, Bulgaria, Bosnia-Herzegovina, Croatia, Czech Republic, France, Greece, Hungary, Iran, Italy, Macedonia, Portugal, Romania, Serbia and Montenegro, Sicily, Slovakia, Slovenia, Spain, Switzerland, Turkey (Grace, 2010; Müller, 2012). **Plant association:** Oligolectic on *Ranunculus* (Ranunculaceae) and possibly also on closely related genera (Amiet et al., 2004; Sedivy et al., 2008; Grace, 2010; Müller, 2012).

***Chelostoma* (*Gyrodromella*) *proximum* Schletterer, 1889**

**Material examined:** Golestan province, Kalaleh, 37°43′N 55°49′E, 2♀♀, October 2012. **Distribution in Iran:** Guilan (Nadimi et al., 2013a). **General distribution:** Azerbaijan, Caucasus, China, Far East, Georgia, Iran, Russia, Turkmenistan, Turkey, Ukraine (Banaszak & Romasenko, 1998; Grace, 2010). **Plant association:** Probably Oligolectic on Campanulaceae (Banaszak & Romasenko, 1998; Müller, 2012).

**Genus *Haetosmia* Popov, 1952**
***Haetosmia vechti* (Peters, 1974)**

**Material examined:** Mazandaran province, Savadkooh, 36°05′N 52°55′E, 1♀, 2♂♂, August 2014. **Distribution in Iran:** Tehran (Nadimi et al., 2013a). **General distribution:** Greece, Iran, Palestine, Turkey (Banaszak & Romasenko, 1998; Grace, 2010; Müller, 2012). **Plant association:** Oligolectic on *Heliotropium* (Boraginaceae) (Mavromoustakis, 1954).

**Genus *Hoplitis* Klug, 1807**
***Hoplitis* (*Hoplitis*) *adunca* (Panzer, 1798)**

**Material examined:** Golestan province, Gorgan, 36°50′N 54°30′E, 1♀, spring 2012. **New record for Iran. General distribution:** Asia Minor, Caucasus, Central Asian part of the former USSR, North Africa (Warncke, 1992; Banaszak & Romasenko, 1998; Amiet et al., 2004), South, Eastem and Central Europe (Comba & Comba, 1991).

***Hoplitis* (*Hoplitis*) *flabellifera* (Morice, 1901)**

**Material examined:** Mazandaran province, Amol, 36°28′N 52°21′E, 3♀♀, 1♂, April 2013. **Distribution in Iran:** Fars (Khodaparast et al., 2011; Khodaparast & Monfared, 2012, 2013), Tehran (Nadimi et al., 2013a). **General distribution:** Armenia, Iran, Jordan, Palestine, Syria, Turkey (Grace, 2010; Müller, 2012). **Plant association:** Polylectic with a strong preference for *Anchusa* (Boraginaceae) (Müller, 2012), *Vicia* (Fabaceae), *Borago officinalis* (Boraginaceae), *Centuria* (Asteraceae) (Khodaparast & Monfared, 2012), *Vicia* (Asteraceae), *Borago officinalis* (Boraginaceae), *Centaurea* (Asteraceae) (Khodaparast & Monfared, 2013).

**Genus *Osmia* Panzer, 1806**
***Osmia* (*Monosmia*) *apicata* Smith, 1853**

**Material examined:** Mazandaran province, Behshahr, 36°41′N 53°44′E, 2♀♀, June 2013. **Distribution in Iran:** Kuhguiloyeh & Boyerahmad (Monfared et al., 2012), Tehran (Nadimi et al., 2013a). **General distribution:** Albania, Armenia, Bulgaria, Croatia, Iran, Italy, Jordan, Georgia, Greece, Macedonia, Palestine, Russia, Serbia and Montenegro, Slovenia, Syria, Turkey (Grace, 2010; Müller, 2012). **Plant association:** Oligolectic on *Onosma* sp. (Boraginaceae) (Müller, 2012).

***Osmia* (*Osmia*) *bicornis* (Linnaeus, 1758)**

**Material examined:** Mazandaran province, Qaemshahr, 36°28′N 52°52′E, 2♀♀, 2♂♂, August 2014. **Distribution in Iran:** Guilan, Tehran (Nadimi et al., 2013a), Kuhguiloyeh & Boyerahmad (Monfared et al., 2012). **General distribution:** Algeria, Cyprus, Europe, Far Eastern Siberia, Iran, Kazakhstan, Kyrgyzstan, Morocco, Tunisia, Turkmenistan, Palestine, Syria, Turkey (Banaszak & Romasenko, 1998; Grace, 2010; Müller, 2012). **Plant association:** Polylectic, prefer Rosaceae and Fabaceae (Banaszak & Romasenko, 1998; Müller, 2012).

***Osmia* (*Metallinella*) *brevicornis* (Fabricius, 1798)**

**Material examined:** Golestan province, Minudasht, 37°10′N 55°30′E, 2♂♂, October 2012. **Distribution in Iran:** Mazandaran, Tehran (Nadimi et al., 2013a). **General**

**distribution:** Algeria, Caucasus, Cyprus, Iran, Morocco, Northern Asia, South eastern- and Central-Europe, Tunisia, Turkey (Banaszak & Romasenko, 1998; Grace, 2010; Müller, 2012). **Plant association:** Oligolectic on Brassicaceae (Banaszak & Romasenko, 1998; Müller, 2012).

***Osmia* (*Helicosmia*) *caerulescens* (Linnaeus, 1758)**

**Material examined:** Mazandaran province, Sari, 36°30′N 53°30′E, 1♀, 2♂♂, June 2013. **Distribution in Iran:** Alborz (Talebi et al., 1995), Fars (Khodaparast & Monfared, 2012, 2013), Kuhguiloyeh & Boyerahmad (Monfared et al., 2012), Tehran (Esmaili & Rastegar, 1974; Nadimi et al., 2013a). **General distribution:** Algeria, Canada, China, Cyprus, Egypt, Europe, India, Iran, Jordan, Kazakhstan, Kyrgyzstan, Morocco, Syria, Tajikistan, Tunisia, Turkey, Turkmenistan, USA, Uzbekistan (Banaszak & Romasenko, 1998; Grace, 2010; Müller, 2012). **Plant association:** Polylectic, prefers Fabaceae, Lamiaceae, Boraginaceae and Antirrhineae (Banaszak & Romasenko, 1998; Grace, 2010; Müller, 2012), *Vicia* sp. (Fabaceae), *Borago officinalis* (Boraginaceae), *Medicago sativa* (Fabaceae), *Euphorbia* sp. (Euphorbiaceae), *Epilobium hirsutum* (Onagraceae) (Khodaparast & Monfared, 2012, 2013).

***Osmia* (*Pyrosmia*) *cephalotes* Morawitz, 1870**

**Material examined:** Mazandaran province, Amol, 36°28′N 52°21′E, 2♀♀, 1♂, April 2013. Golestan province, Gorgan, 36°50′N 54°30′E, 2♀♀, spring 2012. **Distribution in Iran:** Fars (Khodaparast & Monfared, 2012, 2013), Guilan, Mazandaran (Nadimi et al., 2013a). **General distribution:** Algeria, Caucasus, Cyprus, Iran, Jordan, Libya, Morocco, Palestine, South- and Eastern-Europe, Syria, Tunisia, Turkey, Turkmenistan (Banaszak & Romasenko, 1998; Grace, 2010; Müller, 2012). **Plant association:** Polylectic with a preference for Fabaceae (Banaszak & Romasenko, 1998; Grace, 2010; Müller, 2012), *Vicia* (Fabaceae), *Borago officinalis* (Boraginaceae) (Khodaparast & Monfared, 2012, 2013).

***Osmia* (*Osmia*) *cornuta* (Latreille, 1805)**

**Material examined:** Mazandaran province, Qaemshahr, 36°28′N 52°52′E, 1♀, August 2014. **Distribution in Iran:** Kerman (Salehi Sarbijan et al., 2012), Tehran (Nadimi et al., 2013a). **General distribution:** Algeria, Cyprus, Egypt, Europe, Iran, Tunisia, Turkmenistan, Turkey (Banaszak & Romasenko, 1998; Grace, 2010; Müller, 2012). **Plant association:** Polylectic; prefers Rosaceae (Westrich, 1989; Banaszak & Romasenko, 1998; Amiet et al., 2004).

***Osmia* (*Helicosmia*) *dimidiata* Morawitz, 1870**

**Material examined:** Golestan province, Gonbad, 37°30′N 55°00′E, 1♀, 2♂♂, September 2013. **Distribution in Iran:** Guilan (Nadimi et al., 2013a). **General distribution:** Asia minor, Caucasus, Cyprus, Iran, Morocco, Kyrgyzstan, Lebanon, Palestine, South Europe, Turkey, Turkmenistan (Banaszak & Romasenko, 1998; Grace, 2010; Müller, 2012). **Plant association:** Probably oligolectic on Asteraceae, visiting *Cirsium syriacum*, *Calendula persica*, *Centaurea hyalolepis*, *Statice sinuata*, *Echium sericeum*, *Scolymus hispanicus* and *Marrubium vulgare apolum* (Grace, 2010; Müller, 2012).

***Osmia* (*Helicosmia*) *melanogaster* Spinola, 1808**

**Material examined:** Mazandaran province, Qaemshahr, 36°28′N 52°52′E, 1♂, August 2014. **Distribution in Iran:** Guilan (Nadimi et al., 2013a). **General distribution:** Algeria, Caucasus, Cyprus, Egypt, Iran, Jordan, Libya, South, Eastern and Central Europe, Morocco, Palestine, Syria, Tunisia, Turkey (Banaszak & Romasenko, 1998; Grace, 2010; Müller, 2012). **Plant association:** Oligolectic on Carduoideae (Asteraceae) (Müller, 2012).

***Osmia* (*Helicosmia*) *niveata* (Fabricius, 1804)**

**Material examined:** Golestan province, Gonbad, 37°30′N 55°00′E, 1♀, 1♂, September 2013. **Distribution in Iran:** Fars (Khodaparast et al., 2011; Khodaparast & Monfared, 2012, 2013), Guilan (Tavakkoli et al., 2010; Nadimi et al., 2013a), Mazandaran (Nadimi et al., 2013a). **General distribution:** Cyprus, Europe, Iran, Jordan, Lebanon, Northern Africa, Palestine, Syria, Turkey, Turkmenistan (Grace, 2010; Müller, 2012). **Plant association:** Oligolectic on Asteraceae with a distinct preference for Carduoideae (Westrich, 1989; Amiet et al., 2004; Müller, 2012).

***Osmia* (*Allosmia*) *rufohirta* Latreille, 1811**

**Material examined:** Mazandaran province, Sari, 36°30′N 53°30′E, 1♀, June 2013. **Distribution in Iran:** Guilan (Nadimi et al., 2013a). **General distribution:** Algeria,

Caucasus, China, Jordan, Morocco, South, Central and Eastern Europe, Syria, Turkmenistan, Tunisia, Turkey (Banaszak & Romasenko, 1998; Grace, 2010; Müller, 2012). **Plant association:** Polylectic with a preference for Fabaceae (Banaszak & Romasenko, 1998; Müller, 2012).

***Osmia* (*Helicosmia*) *signata* Erichson, 1835**

**Material examined:** Mazandaran province, Amol, 36°28′N 52°21′E, 2♀♀, April 2013. **Distribution in Iran:** Guilan (Nadimi et al., 2013a). **General distribution:** Albania, Algeria, China, Cyprus, Egypt, France, Greece, Corsica, Crete, Iran, Italy, Jordan, Morocco, Palestine, Portugal, Sardinia, Sicily, Spain, Syria, Turkey, Turkmenistan, Ukraine (Grace, 2010; Müller, 2012). **Plant association:** Oligolectic on Asteraceae (Müller, 2012).

## DISCUSSION

Upon the results of this research (with 24 species and 4 new records) together with other works on Megachilidae of northern Iran (e.g. Tavakkoli et al., 2010; Nadimi et al., 2013a,b, 2014) indicate that there is a diverse fauna of these beneficial insects in northern Iran. Although the fauna of Megachilidae of southern Iran was studied rather well (see references) but the fauna of northern Iran was poorly studied. Regarding to the diverse flora in northern Iran, we expect much more species of Megachilidae in the mentioned area. The megachilids are important pollinators of several wildflowers, vegetables and fruits, and are used as pollinators by commercial growers of blueberries, onions, carrots and alfalfa (Bohart, 1972; Pitts-Singer & Cane, 2011). In addition to the species diversity of Iranian Megachilidae, there are many other unknown data such as the diversity of nesting biology and floral relationships. Diverse materials are used in nest building and the inclusion of these foreign materials in nest construction may have promoted a massive range expansion and diversification within the family (Cane et al., 2007; Litman et al., 2011; Gonzales et al., 2012). Also, many insects (e.g. Chrysididae, Mutillidae, Formicidae, Rhipiphoridae, Meloidae, Cleridae, etc.) attack the nests of leafcutting bees (Ahmed Khattaby, 1992; Woodward, 1994). Determining of these natural enemies is an interesting research work in different regions of Iran.

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