



## A checklist of the bees of the genus *Hylaeus* Fabricius, 1793 (Hymenoptera: Apoidea: Colletidae) of Iran


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**ABSTRACT.** A checklist of the bees of the genus *Hylaeus* Fabricius, 1793 of Iran, based on the literature data and also field surveys in northeastern Iran (North Khorasan and Khorasan-e Razavi provinces) is presented. The resulting checklist comprises nine subgenera and 63 species. Four species of the genus *Hylaeus*, including *H. (Lambdopsis) rinki* (Gorski, 1852), *H. (Spatulariella) hyalinatus* Smith, 1842, *H. (Spatulariella) punctatus* (Brullé, 1832) and *H. (Prosopis) lionotus* (Alfken, 1909), are newly recorded for the fauna of Iran. The later species is considered as "very rare", has only known in Kazakhstan. A re-description of the male of *H. (Prosopis) lionotus* together with the illustrations of morphological characters is given.

**Key words:** Distribution, Iran, new reports, rare species, faunal records, pollinators

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### INTRODUCTION

The momentous role of bees, as the pivotal pollinators, in ecosystem stability and food production is undeniable due to their unavoidable contribution in the pollination of both cultivated and wild plants as well as their advanced interactions with flowering plants (Radchenko & Psenko, 1994, 1996; Steffan-Dewenter & Tschamtko, 2001; Huber et al., 2005; Müller et al., 2006). Meticulous exploitation and management of bees, as the foremost pollinators of food crops, are important issues that need to be considered as a matter of priority (Arbuckle et al., 2001; Eardley et al., 2010). The intricacy of bees'

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taxonomy, the minuscule number of trained taxonomists working today, and the lack of comprehensive identification keys as well as limited taxonomic revisions are the main problems, while assessing the biodiversity of these principal pollinators (Francisco et al., 2008). The prominence of bee studies is eminently incontrovertible and has been emphasized in numerous global research projects. Bees, as the keystone species, play a drastic conservative role in the terrestrial ecosystems, but unfortunately some of them are endangered. An increased risk of extinction forces the researchers to survey about the biodiversity of bees as target groups (Sároszpataki et al., 2005; Radchenko, 2017). The bees of the world are composed of approximately 20 000 species belonging to seven families including: Andrenidae, Apidae, Colletidae, Halictidae, Megachilidae, Melittidae and Stenotritidae (only found in Australia) (Michener, 2007; Ascher & Pickering, 2021). Among these families, Colletidae, with more than 2700 species, is ranked fifth in terms of number of species. This family usually consists of species with short, truncate or bilobed glossa and is represented in Holarctic region with only two genera including *Colletes* Latreille, 1802 and *Hylaeus* Fabricius, 1793 (Michener, 2007; Zhou et al., 2020).

The subfamily Hylaeinae (Hymenoptera: Apoidea: Colletidae) represented by a single genus *Hylaeus* in the Palaearctic region. Other genera of this subfamily are restricted to Africa, Australia, New Zealand, New Guinea and nearby islands (Michener, 2007). 55 subgenera and 750 species of the genus *Hylaeus* are documented, worldwide (Michener, 2007; Dathe, 2015; Ascher & Pickering, 2021), of which 11 subgenera and more than 200 species are currently known from the Palaearctic region (Michener, 2007; Proshchalykin & Dathe, 2012, 2016). Nine subgenera and 59 species of the genus *Hylaeus* are so far reported from Iran (Dathe, 1980a; Warncke, 1981; Grace, 2010; Khodaparast & Monfared, 2012; Kiani Bakiani et al., 2016; Khodarahmi Ghahnavieh & Monfared, 2019; Ascher & Pickering, 2021). The first identification key to the subgenera of *Hylaeus*, as well as the European species of this genus was provided by Dathe (1980b). One of the first specific studies about the geographical distribution and ecology of *Hylaeus* species was conducted by Koster (1986). Identification keys to *Hylaeus* species of China, Asian Russia, Central Asia and Turkey were presented by Chen & Xu (2009), Proshchalykin & Dathe (2012), Dathe & Proshchalykin (2018) and Ozbek & Dathe (2020), respectively. Additionally, Proshchalykin & Dathe (2021) provided an updated checklist of *Hylaeus* species of Caucasus region (Armenia, Azerbaijan, Georgia & Southern Russia). Despite being one of the important centers of bee diversity in the Palaearctic region (Nadimi et al., 2014; Allahverdi et al., 2016), the Iranian bee fauna (with about 900 species) in many taxa is still insufficiently studied (Khaghaninia et al., 2013; Nadimi et al., 2013a, 2013b; Allahverdi et al., 2015; Salarian et al., 2016; Safi et al., 2018; Khodarahmi Ghahnavieh & Monfared, 2019). With only a few scattered records and descriptions in the literature, the Iranian Colletidae fauna is not an exception (Dathe, 1980b; Izadi et al., 2006; Khodaparast & Monfared, 2012). The genus *Hylaeus* is also still poorly known in Iran. The most important data of this taxon in the country came from the publications by Popov (1967), Dathe (1980a) and Warncke (1981) which are all over 35 years old. Out of 52 species of bees of the superfamily Apoidea which were reported by Kiani Bakiani et al. (2016), only 1 new record belonged to the genus *Hylaeus*. In one of the latest studies on the pollinator bees of the superfamily Apoidea, 14 species of the genus *Hylaeus* were reported from Isfahan province which among them, four species were introduced to Iran for the first time (Khodarahmi Ghahnavieh & Monfared, 2019).

In this study, a list of 63 species of Iranian *Hylaeus* is presented together with notes on their local and general distributions. Moreover, we discuss about a rare species, *Hylaeus* (*Prosopis*) *lionotus* (Alfken, 1909), which has been previously recorded only from Kazakhstan.

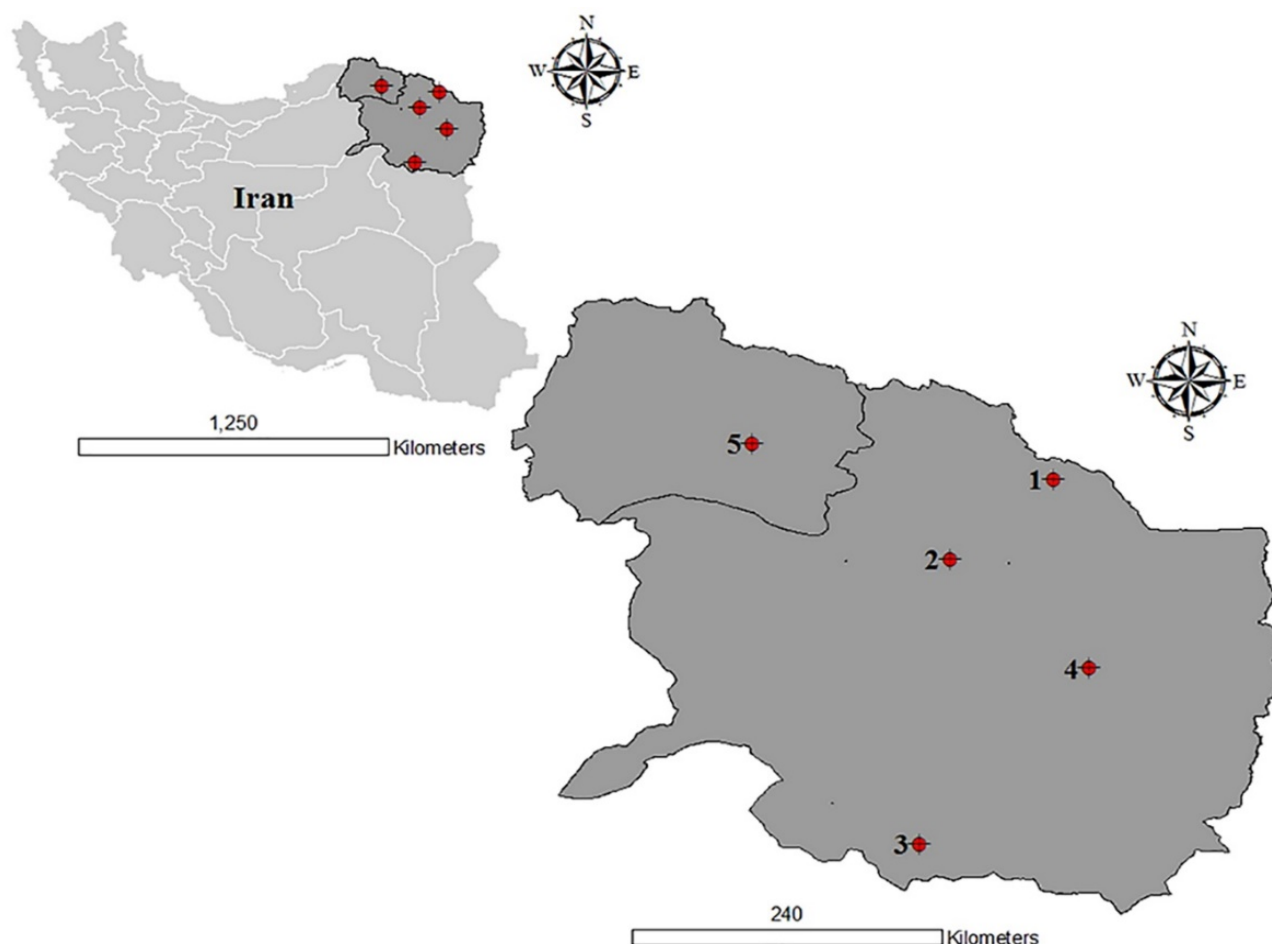
## MATERIAL AND METHODS

The list summarizes literature of Iranian *Hylaeus* species along with some additional information comes from field surveys of several localities in northeastern Iran, between the years 2017 and 2018. Coordinate data were recorded by Garmin eTrex® 10 (Garmin (Asia) Corporation, New Taipei, Taiwan). Samples were collected with a sweep net, killed within ethyl acetate and mounted subsequently. Color

photographs of *H. lionotus* were taken using a Canon® Mark-II 5D and Canon® EOS 5DS R cameras (Canon Inc., Tokyo, Japan) attached to a stereomicroscope with Leica® LED5000 HDI Illuminator by the second author in the IEENASU. Other photographs were made using a Canon® EOS REBEL XS attached to Olympus® stereomicroscope in the Entomology Laboratory of Ferdowsi University of Mashhad. Both classification and nomenclature followed Michener (2007) and Ascher & Pickering (2021). Samples were identified to the species level using relevant identification keys (Dathe, 1980b; Koster, 1986; Ozbek & Dathe, 2020). The morphological terminology for the re-description of the species follows Michener (2007). The map of *Hylaeus* species found in the studied area was generated in ArcMap® 10.6.1 software (Fig. 1). Examined specimens were deposited in the insect collection of Ferdowsi University of Mashhad, Iran, except *H. lionotus* which is stored in the collection of Institute for Evolutionary Ecology of the National Academy of Sciences of Ukraine (IEENASU, Kiev).

## RESULTS

In this study, nine Hylaeinae species belonging to five subgenera of *Hylaeus*, including *Hylaeus* Fabricius 1793, *Lambdopsis* Popov, 1939, *Koptogaster* Alfken, 1912, *Prosopis* Fabricius, 1804 and *Spatulariella* Popov, 1939, were collected and identified, among them, four species are new to the fauna of Iran. The species are presented alphabetically. List of previously known species of *Hylaeus*, as well as newly recorded species (marked with an asterisk, \*) are presented here.



**Figure 1.** Sampling points of *Hylaeus* species found in the studied area, northeastern Iran: **1.** Khorasan-e Razavi, Qare su, **2.** Khorasan-e Razavi, Neishabour, Bujan, **3.** Khorasan-e Razavi, Gonabad, **4.** Khorasan-e Razavi, Fariman Dam, **5.** Northern Khorasan, Shirvan, Gelian.

## Checklist of *Hylaeus* species in Iran

### Subgenus: *Abrupta* Méhely, 1935

Type species: *Hylaeus cornutus* Curtis, 1831

#### *Hylaeus (Abrupta) cornutus* Curtis, 1831

**Distribution in Iran:** Golestan (Warncke, 1981), Hamadan, Isfahan (Khodarahmi Ghahnavieh & Monfared, 2019).

**General distribution:** Eastern (Turkmenistan) and Western (Azerbaijan, Cyprus, Denmark, France, Germany, Greece, Iran, Italy, Russia, Slovakia, Spain, Syria, Tunisia, Turkey, Ukraine, United Kingdom) Palearctic (Khodarahmi Ghahnavieh & Monfared, 2019; Ascher & Pickering, 2021).

### Subgenus: *Dentigera* Popov, 1939

Type species: *Hylaeus brevicornis* Nylander, 1852

#### *Hylaeus (Dentigera) acer* Dathe, 1980

**Distribution in Iran:** Mazandaran (Warncke, 1981; Ascher & Pickering, 2021).

**General distribution:** Western Palearctic (Iran, Turkey) (Ascher & Pickering, 2021).

#### *Hylaeus (Dentigera) brevicornis* Nylander, 1852

**Distribution in Iran:** Alborz, Fars, Golestan, Hamadan, Kerman, Khorasan-e Razavi, Mazandaran (Warncke, 1981), Isfahan (Khodarahmi Ghahnavieh & Monfared, 2019).

**General distribution:** Eastern (Afghanistan) and Western (Czech Republic, Denmark, Estonia, Finland, France, Georgia, Greece, Ireland, Jordan, Italy, Latvia, Norway, Portugal, Romania, Russia, Slovakia, Spain, Sweden, Switzerland, Turkey, Uzbekistan, Iran) Palearctic (Khodarahmi Ghahnavieh & Monfared, 2019; Ascher & Pickering, 2021).

#### *Hylaeus (Dentigera) gredleri* Förster, 1871

**Distribution in Iran:** Fars (Kiani Bakiani et al., 2016); No locality cited (Warncke, 1981).

**General distribution:** Eastern (Kazakhstan) and Western (Austria, Azerbaijan, France, Germany, Greece, Hungary, Italy, Lebanon, Lithuania, Morocco, Russia, Spain, Tunisia, Turkey, Iran) Palearctic (Kiani Bakiani et al., 2016; Ascher & Pickering, 2021).

#### *Hylaeus (Dentigera) imparilis* Förster, 1871

**Distribution in Iran:** Isfahan (Khodarahmi Ghahnavieh & Monfared, 2019).

**General distribution:** Western Palearctic (Algeria, Azerbaijan, Bulgaria, Cyprus, France, Greece, Hungary, Iran, Italy, Spain, Switzerland, Tunisia, Turkey) (Khodarahmi Ghahnavieh & Monfared, 2019; Ascher & Pickering, 2021).

#### *Hylaeus (Dentigera) kahri* Förster, 1871

**Distribution in Iran:** No locality cited (Warncke, 1981).

**General distribution:** Western Palearctic (Algeria, Azerbaijan, Germany, France, Greece, Iran, Italy, Luxembourg, Turkey, Slovakia, Spain, Syria) (Ascher & Pickering, 2021).

#### *Hylaeus (Dentigera) punctus* Förster, 1871

**Distribution in Iran:** Fars (Kiani Bakiani et al., 2016); No locality cited (Warncke, 1981).

**General distribution:** Western Palaearctic (Bulgaria, Croatia, Greece, Iran, Israel, Turkey) (Kiani Bakiani et al., 2016; Ascher & Pickering, 2021).

**Subgenus:** *Hylaeus* Fabricius s. str.

Type species: *Prosopis annulata* Fabricius, 1804

*Hylaeus (Hylaeus) angustatus* (Schenck, 1861)

**Distribution in Iran:** No locality cited (Warncke, 1981).

**General distribution:** Eastern (China, Mongolia) and Western (Armenia, Czech Republic, Finland, France, Georgia, Greece, Iran, Italy, Jordan, Morocco, Norway, Portugal, Russia, Sweden, Switzerland, Turkey, Ukraine) Palaearctic (Ascher & Pickering, 2021).

*Hylaeus (Hylaeus) araxanus* (Warncke, 1981)

**Distribution in Iran:** Alborz, Fars, Hamadan, Kerman, Sistan-o Balouchistan, South Khorasan (Warncke, 1981), Isfahan (Khodarahmi Ghahnavieh & Monfared, 2019).

**General distribution:** Western Palaearctic (Iran, Turkey) (Khodarahmi Ghahnavieh & Monfared, 2019; Ascher & Pickering, 2021).

*Hylaeus (Hylaeus) cervinus* (Warncke, 1992)

**Distribution in Iran:** No locality cited (Warncke, 1981).

**General distribution:** Western Palaearctic (Iran, Turkey) (Ascher & Pickering, 2021).

*Hylaeus (Hylaeus) communis* Nylander, 1852

**Material examined:** 2♂♂, Iran, Khorasan-e Razavi, Neishabour, Bujan (36°23'59"N, 58°57'59"E), 17.IV.2017, Leg.: M. Allahverdi.

**Food association:** *Matricaria chamomilla* Linnaeus (Asteraceae).

**Distribution in Iran:** Isfahan, Mazandaran (Warncke, 1981).

**General distribution:** Eastern (Afghanistan, China, Estonia, Kazakhstan, Turkmenistan, Tajikistan) and Western (Armenia, Azerbaijan, Canada, Czech Republic, Denmark, England, Finland, France, Georgia, Greece, Iran, Ireland, Italy, Norway, Portugal, Romania, Russia, Slovakia, Spain, Sweden, Switzerland, Tunisia, Turkey) Palaearctic (Ascher & Pickering, 2021).

*Hylaeus (Hylaeus) crispulus* Dathe, 1980

**Distribution in Iran:** Mazandaran (Warncke, 1981).

**General distribution:** Western Palaearctic (Iran, Israel, Turkey) (Ascher & Pickering, 2021).

*Hylaeus (Hylaeus) dolichocephalus* Morawitz, 1876

**Distribution in Iran:** Isfahan (Khodarahmi Ghahnavieh & Monfared, 2019), South Khorasan (Warncke, 1981).

**General distribution:** Eastern (Afghanistan, China, Kazakhstan, Mongolia, Tajikistan) and Western (Iran, Turkey) Palaearctic (Khodarahmi Ghahnavieh & Monfared, 2019; Ascher & Pickering, 2021).

*Hylaeus (Hylaeus) ebmeri* Dathe, 1980

**Distribution in Iran:** No locality cited (Warncke, 1981; Ascher & Pickering, 2021).

**General distribution:** Western Palaearctic (Iran) (Warncke, 1981; Ascher & Pickering, 2021).

***Hylaeus (Hylaeus) fedtschenkoi* (Cockerell, 1906)**

**Distribution in Iran:** No locality cited (Warncke, 1981).

**General distribution:** Eastern (Afghanistan, China, Mongolia, Uzbekistan) and Western (Iran) Palaearctic (Ascher & Pickering, 2021).

***Hylaeus (Hylaeus) hungaricus* (Alfken, 1905)**

**Material examined:** 2♀♀, Iran, Khorasan-e Razavi, Gonabad (34°20'54"N, 58°44'42"E), 28.IV.2018, Leg.: M. Allahverdi.

**Food association:** *Tamarix* sp. (Tamaricaceae).

**Distribution in Iran:** Golestan (Warncke, 1981).

**General distribution:** Eastern (Afghanistan, Kyrgyzstan, Mongolia, Tajikistan, Turkmenistan) and Western (Iran, Georgia, Russia) Palaearctic (Ascher & Pickering, 2021).

***Hylaeus (Hylaeus) implicatus* Dathe, 1980**

**Distribution in Iran:** Isfahan (Khodarahmi Ghahnavieh & Monfared, 2019).

**General distribution:** Western Palaearctic (Iran, Turkey) (Khodarahmi Ghahnavieh & Monfared, 2019; Ascher & Pickering, 2021).

***Hylaeus (Hylaeus) jantaris* Dathe, 1980**

**Distribution in Iran:** No locality cited (Warncke, 1981).

**General distribution:** Western Palaearctic (Iran, Turkey) (Ascher & Pickering, 2021).

***Hylaeus (Hylaeus) kotschisus* (Warncke, 1981)**

**Distribution in Iran:** Isfahan (Khodarahmi Ghahnavieh & Monfared, 2019), Khorasan-e Razavi, Mazandaran (Warncke, 1981).

**General distribution:** Western Palaearctic (Iran, Turkey) (Khodarahmi Ghahnavieh & Monfared, 2019; Ascher & Pickering, 2021).

***Hylaeus (Hylaeus) leptcephalus* (Morawitz, 1871)**

**Distribution in Iran:** Alborz, Hamadan, Kurdistan, Zanjan (Warncke, 1981), Isfahan (Khodarahmi Ghahnavieh and Monfared, 2019).

**General distribution:** Nearctic (Canada, United States) and Western Palaearctic (Armenia Bulgaria, Czech Republic, Denmark, Germany, Greece, Iran, Italy, Latvia, Spain, Turkey, Ukraine) (Ascher & Pickering, 2021).

***Hylaeus (Hylaeus) moricei* (Friese, 1898)**

**Distribution in Iran:** Alborz, Hamadan (Warncke, 1981), Isfahan (Khodarahmi Ghahnavieh & Monfared, 2019).

**General distribution:** Western Palaearctic (Armenia, Austria, Egypt, Germany, Greece, Iran, Italy, Jordan, Lithuania, Russia, Spain, Turkey, Ukraine) (Khodarahmi Ghahnavieh & Monfared, 2019; Ascher & Pickering, 2021).

***Hylaeus (Hylaeus) nigrifacies* Bramson, 1879**

**Distribution in Iran:** Alborz, Hamadan, Qazvin (Warncke, 1981).

**General distribution:** Western Palaearctic (Iran, Ukraine) (Ascher & Pickering, 2021).

***Hylaeus (Hylaeus) nigritus* (Fabricius, 1798)**

**Distribution in Iran:** No locality cited (Warncke, 1981).

**General distribution:** Eastern (Kazakhstan) and Western (Austria, Belarus, Estonia, Finland, Georgia, Greece, Germany, Iran, Italy, Morocco, Russia, Spain, Turkey, Ukraine) Palaeartic (Ascher & Pickering, 2021).

***Hylaeus (Hylaeus) scutellaris* Morawitz, 1874**

**Distribution in Iran:** Alborz (Warncke, 1981; Ascher & Pickering, 2021), Isfahan (Khodarahmi Ghahnavieh and Monfared, 2019).

**General distribution:** Western Palaeartic (Azerbaijan, Cyprus, Greece, Iran, Slovakia, Turkey) (Khodarahmi Ghahnavieh & Monfared, 2019; Ascher & Pickering, 2021).

***Hylaeus (Hylaeus) tardus* (Warncke, 1981)**

**Distribution in Iran:** Hamadan, Fars (Warncke, 1981), Isfahan (Khodarahmi Ghahnavieh & Monfared, 2019).

**General distribution:** Western Palaeartic (Azerbaijan, Iran, Turkey) (Khodarahmi Ghahnavieh & Monfared, 2019; Ascher & Pickering, 2021).

***Hylaeus (Hylaeus) trifidus* (Alfken, 1936)**

**Distribution in Iran:** Isfahan (Warncke, 1981).

**General distribution:** Western Palaeartic (Algeria, Greece, Iran, Israel, Turkey) (Ascher & Pickering, 2021).

***Hylaeus (Hylaeus) trisignatus* Morawitz, 1876**

**Distribution in Iran:** Isfahan (Khodarahmi Ghahnavieh & Monfared, 2019).

**General distribution:** Eastern (Tajikistan) and Western (Iran, Turkey) Palaeartic (Khodarahmi Ghahnavieh & Monfared, 2019; Ozbek & Dathe, 2020; Ascher & Pickering, 2021).

***Hylaeus (Hylaeus) vulgaris* Morawitz, 1876**

**Distribution in Iran:** Fars, Khorasan (Warncke, 1981).

**General distribution:** Eastern (Afghanistan, China, Kazakhstan, Mongolia, Tajikistan) and Western (Iran) Palaeartic (Ascher & Pickering, 2021).

**Subgenus: *Koptogaster* Alfken, 1912**

Type species: *Prosopis bifasciata* Jurine, 1807

***Hylaeus (Koptogaster) bifasciatus* (Jurine, 1807)**

**Material examined:** 1♂, Iran, Khorasan-e Razavi, Qare su (36°58'21"N, 59°40'50"E), 10.VII.2018, Leg.: M. Allahverdi.

**Food association:** Asteraceae.

**Distribution in Iran:** East Azarbaijan (Warncke, 1981).

**General distribution:** Western Palaeartic (Albania, Belgium, Georgia, Germany, Greece, Iran, Israel, Italy, Malaysia, Romania, Turkey, Ukraine) (Ascher & Pickering, 2021).

***Hylaeus (Koptogaster) punctulatissimus* Smith, 1842**

**Material examined:** 1♀, Iran, Khorasan-e Razavi, Fariman Dam (35°36'54"N, 59°55'50"E), 1.VI.2018, 1♂, Leg.: M. Allahverdi.

**Food association:** *Astragalus gossypinus* (Fabaceae).

**Distribution in Iran:** Mazandaran (Warncke, 1981).

**General distribution:** Western Palaearctic (Bulgaria, Czech Republic, Denmark, Georgia, Germany, Greece, Iran, Israel, Italy, Moldova, Morocco, Netherland, Portugal, Russia, Slovakia, Switzerland, Turkey, Ukraine) (Ascher & Pickering, 2021).

**Subgenus:** *Lambdopsis* Popov, 1939

Type species: *Melitta annularis* Kirby, 1802

***Hylaeus (Lambdopsis) annularis* (Kirby, 1802)**

**Distribution in Iran:** Golestan, Mazandaran, North Khorasan (Warncke, 1981).

**General distribution:** Eastern (Tajikistan) and Western (Algeria, Belarus, Bulgaria, Czech Republic, Denmark, England, Finland, France, Germany, Iran, Italy, Netherlands, Russia, Spain, Sweden, Tunisia) Palaearctic (Ascher & Pickering, 2021).

***Hylaeus (Lambdopsis) dilatatus* (Kirby, 1802)**

**Distribution in Iran:** No locality cited (Warncke, 1981).

**General distribution:** Eastern (Kazakhstan) and Western (Albania, Algeria, Armenia, Austria, Azerbaijan, Denmark, England, Finland, Greece, Iran, Italy, Lithuania, Portugal, Russia, Switzerland, Tunisia, Turkey, Ukraine) Palaearctic (Ascher & Pickering, 2021).

***Hylaeus (Lambdopsis) sariensis* Dathe, 1980**

**Distribution in Iran:** Mazandaran (Warncke, 1981; Ascher & Pickering, 2021).

**General distribution:** Western Palaearctic (Iran) (Warncke, 1981; Ascher & Pickering, 2021).

***Hylaeus (Lambdopsis) scutellatus* (Spinola, 1838)**

**Distribution in Iran:** Alborz (Khodarahmi Ghahnavieh & Monfared, 2019; Ascher & Pickering, 2021).

**General distribution:** Western Palaearctic (Azerbaijan, Cyprus, Greece, Iran, Slovakia, Turkey) (Khodarahmi Ghahnavieh & Monfared, 2019; Ascher & Pickering, 2021).

***Hylaeus (Lambdopsis) rinki* (Górski, 1852)\* (Figs. 3A–B)**

**Material examined:** 1♂, Khorasan-e Razavi, Neishabour, Bujan (36°23'59"N, 58°57'59"E), 17.IV.2017, Leg.: M. Allahverdi; 1♂, North Khorasan, Shirvan, Gelian (37°13'59"N, 57°34'59"E), 17.V.2017, Leg.: M. Allahverdi.

**Food association:** *Astragalus gossypinus* (Fabaceae) and unknown for second locality.

**General distribution:** Western Palaearctic (Austria, Belgium, China, Estonia, Finland, France, Germany, Iran (New record), Italy, Latvia, Mongolia, Russia, Slovakia, Sweden, Switzerland, Ukraine) (Ascher & Pickering, 2021).

**Subgenus:** *Paraprosopis* Popov, 1939

Type species: *Hylaeus pictipes* Nylander, 1852

***Hylaeus (Paraprosopis) albonotatus* (Walker, 1871)**

**Distribution in Iran:** Kerman, Khuzestan (Warncke, 1981).

**General distribution:** Afrotropical (United Arab Emirates) and Western Palaearctic (Chad, Djibouti, Egypt, Iran, Israel, Libya, Mauritania, Morocco, Sudan, Tunisia, Yemen) (Ascher & Pickering, 2021).



***Hylaeus (Paraprosopis) lineolatus* (Schenck, 1861)**

**Distribution in Iran:** Alborz, Bushehr, Fars, Kerman, Mazandaran ([Warncke, 1981](#)).

**General distribution:** Western Palaearctic (Azerbaijan, Cyprus, Czech Republic, Germany, Greece, Iran, Italy, Moldova, Portugal, Russia, Slovakia Spain, Turkey, Ukraine) ([Ascher & Pickering, 2021](#)).

***Hylaeus (Paraprosopis) sinuatus* (Schenck, 1853)**

**Distribution in Iran:** Bushehr, Hamadan ([Warncke, 1981](#)).

**General distribution:** Western Palaearctic (Denmark, France, Germany, Iran, Lithuania, Portugal, Russia, Slovakia, Sweden, Switzerland, Turkey, Ukraine) ([Ascher & Pickering, 2021](#)).

***Hylaeus (Paraprosopis) socheri* Dathe, 2010**

**Distribution in Iran:** Yazd ([Warncke, 1981](#); [Ascher & Pickering, 2021](#)).

**General distribution:** Western Palaearctic (Iran ([Warncke, 1981](#); [Ascher & Pickering, 2021](#)), Turkey ([Ozbek & Dathe, 2020](#))).

***Hylaeus (Paraprosopis) styriacus* Förster, 1871**

**Distribution in Iran:** No locality cited ([Warncke, 1981](#)).

**General distribution:** Western Palaearctic (Azerbaijan, Czech Republic, Estonia, Germany, Georgia, Greece, Iran, Italy, Lebanon, Moldova, Poland, Russia, Turkey) ([Ascher & Pickering, 2021](#)).

**Subgenus: *Patagiata* Blüthgen, 1949**

Type species: *Prosopis difformis* Eversmann, 1852

***Hylaeus (Patagiata) difformis* (Eversmann, 1852)**

**Distribution in Iran:** Golestan ([Warncke, 1981](#)).

**General distribution:** Eastern (China) and Western (Denmark, Georgia, Greece, Finland, France, Iran, Italy, Latvia, Macedonia, Morocco, Poland, Russia, Spain, Sweden, Turkey, Ukraine) Palaearctic ([Ascher & Pickering, 2021](#)).

**Subgenus: *Prosopis* Fabricius, 1804**

Type species: *Mellinus bipunctatus* Fabricius, 1798

***Hylaeus (Prosopis) damascenus* (Magretti, 1890)**

**Distribution in Iran:** No locality cited ([Warncke, 1981](#)).

**General distribution:** Western Palaearctic (Iran, Iraq, Israel, Macedonia, Turkey) ([Ascher & Pickering, 2021](#)).

***Hylaeus (Prosopis) excelsus* (Alfken, 1931)**

**Distribution in Iran:** Golestan, Mazandaran ([Warncke, 1981](#)), Isfahan ([Khodarahmi Ghahnavieh & Monfared, 2019](#)).

**General distribution:** Western Palaearctic (Iran, Turkey) ([Khodarahmi Ghahnavieh & Monfared, 2019](#); [Ascher & Pickering, 2021](#)).

***Hylaeus (Prosopis) gibbus* Saunders, 1850**

**Distribution in Iran:** Golestan, Guilan, Hamadan, Markazi, Mazandaran ([Warncke, 1981](#)).

**General distribution:** Eastern (Kazakhstan) and Western (Austria, Azerbaijan, Belarus, Cyprus, Finland, Georgia, Germany, Greece, Iran, Iraq, Netherland, Russia, Spain, Sweden, Turkey, Ukraine) Palaearctic (Ascher & Pickering, 2021).

*Hylaeus (Prosopis) hyrcanius* Dathe, 1980

**Distribution in Iran:** Mazandaran (Warncke, 1981).

**General distribution:** Western Palaearctic (Azerbaijan, Iran, Russia) (Ascher & Pickering, 2021).

*Hylaeus (Prosopis) laevithorax* (Alfken, 1924)

**Distribution in Iran:** Fars, Kerman, Sistan-o Balouchistan (Warncke, 1981).

**General distribution:** Eastern (Pakistan) and Western (Iran, Israel) Palaearctic (Ascher & Pickering, 2021).

*Hylaeus (Prosopis) lionotus* (Alfken, 1909)\*

**Material examined:** 1♂, Iran, Khorasan-e Razavi, Qare su (36°58'21"N, 59°40'50"E), 10.VII.2018, Leg.: M. Allahverdi.

**Redescription** — Based on the non-type material collected from Khorasan-e Razavi.

**Male:** Total body length 6.0 mm (Figs. 2A–B).

**Head:** Width: 1.88 mm; length: 2.10 mm; Scape of antennae expanded, longer than wide, scape more than 2/3 yellow and black at upper side; Flagellum dark brown but antennomeres III to X reddish-yellow at lower parts; Clypeus, supraclypeal and two paraocular areas pale-yellow colored, mask completed (Fig. 2F); Clypeus with sparse erect light hairs, supraclypeal area and paraocular area sparsely punctuated, punctuation of supraclypeal area surface at lower sides denser than upper sides; Frons punctuated contiguously; Malar area shortened; Gena punctuated and ridged; Occiput rounded.

**Mesosoma:** Coloration black, except pronotum with a narrow yellow stripe, axillae, tegula and pronotal lobe pale-yellow, scutum and scutellum glossy, moderately punctuated (Fig. 2B); The integument of thorax completely shiny and glossy; Mesopleura with conspicuously coarse punctuation, total surface of mesosoma with short erect light yellow hairs except propodeal triangle; Propodeal triangle shiny-glossy with subcontiguous punctuation and without any hairs and pointed at lower part; Propodeum rugose; Legs black-brown but yellow at basitarsus and basitibia (Fig. 2A), Wings light brown and venation dark brown.

**Metasoma:** Abdomen coloration very dark but marginal parts of terga more light-reddish at least ½ of T1 which expanded in middle of disk, and semitransparent light-yellow on other terga with brown-red premarginal line (Fig. 2E); lateral parts of T1 with distinct long white fringes but in other terga less distinct with short light hairs on marginal zones of terga, T1 and following terga shiny with high subcontiguous coarse punctuation; all terga distinctly, finely and densely punctuated (Figs. 2A, 2B, 2D, 2); Genital capsule with enlarged gonocoxites, gonostylus elongated and rounded apically with impression at the distal part, and sparse long curved bristles (Fig. 2C).

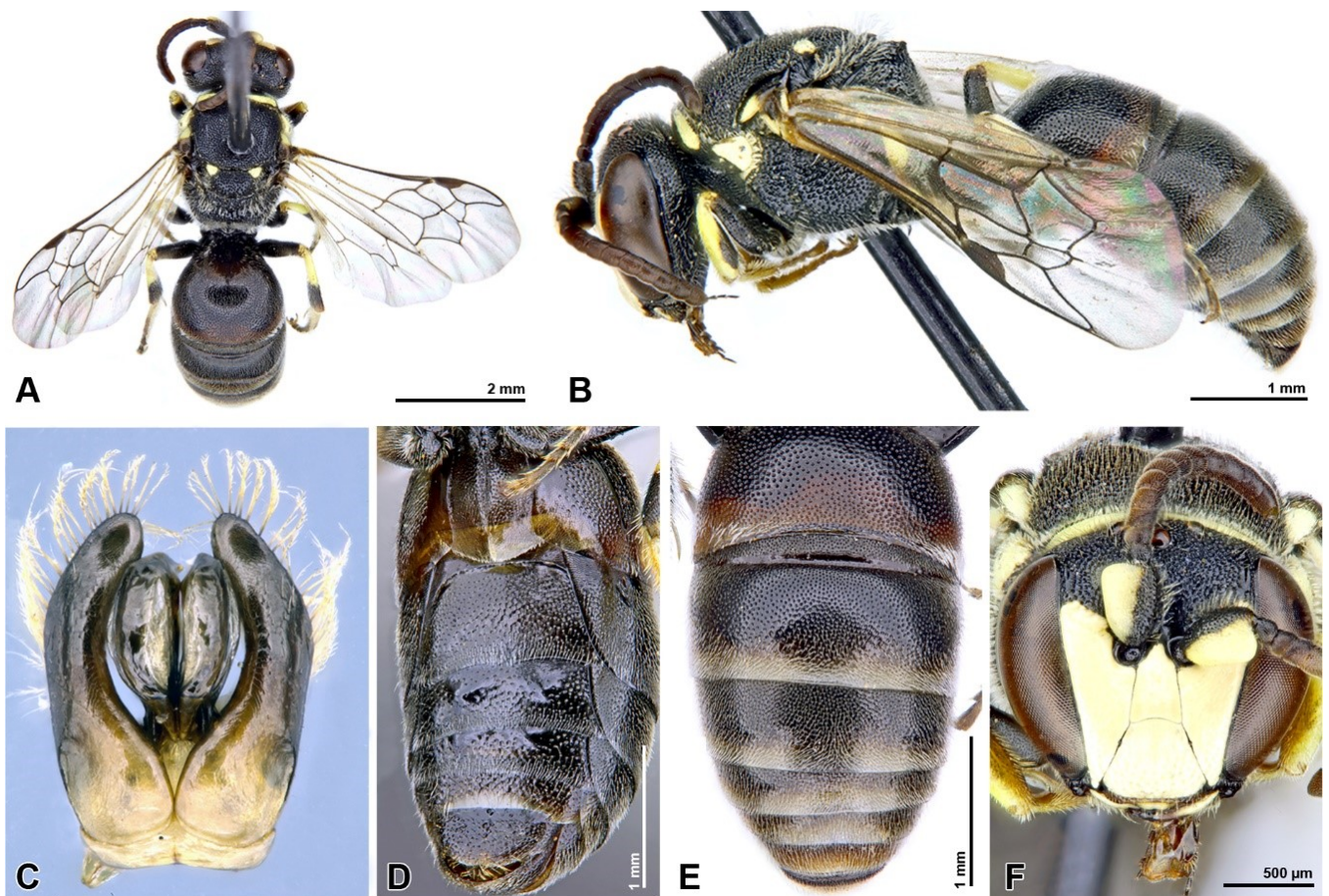
**Food association:** Asteraceae.

**General distribution:** Eastern (Kazakhstan) and Western (Iran–New record) Palaearctic (Dathe & Proshchalykin, 2018; Ascher & Pickering, 2021).

*Hylaeus (Prosopis) maculatus* (Alfken, 1904)

**Distribution in Iran:** No locality cited (Warncke, 1981).

**General distribution:** Western Palaearctic (Algeria, Iran, Israel, Turkey) (Ascher & Pickering, 2021).



**Figure 2.** *Hylaeus (Prosopis) lionotus* (Alfken, 1909): A–B. Total body, C. Genitalia, D–E. Metasoma in ventral and dorsal view, F. Head in frontal view.

***Hylaeus (Prosopis) meridionalis* Förster, 1871**

**Distribution in Iran:** Alborz (Warncke, 1981).

**General distribution:** Eastern (Kyrgyzstan, Tajikistan) and Western (Azerbaijan, Bulgaria, Croatia, Greece, Iran, Italy, Morocco, Portugal, Russia, Switzerland, Tunisia, Turkey, Ukraine) Palearctic (Ascher & Pickering, 2021).

***Hylaeus (Prosopis) pictus* (Smith, 1853)**

**Distribution in Iran:** Isfahan (Khodarahmi Ghahnavieh & Monfared, 2019).

**General distribution:** Western Palearctic (Algeria, Azerbaijan, Cyprus, Egypt, France, Greece, Iran, Italy, Slovakia, Spain, Tunisia, Turkey) (Khodarahmi Ghahnavieh & Monfared, 2019; Ascher & Pickering, 2021).

***Hylaeus (Prosopis) rubosus* (Warncke, 1981)**

**Distribution in Iran:** No locality cited (Warncke, 1981).

**General distribution:** Palearctic Western (Iran, Turkey) (Ascher & Pickering, 2021).

***Hylaeus (Prosopis) rugicollis* Morawitz, 1874**

**Distribution in Iran:** Alborz, Azarbaijan, Bushehr, Fars, Guilan, Kerman, Khuzestan (Warncke, 1981).

**General distribution:** Western Palearctic (Azerbaijan, Greece, Iran, Lebanon, Turkey) (Ascher & Pickering, 2021).

***Hylaeus (Prosopis) signatus* (Panzer, 1798)**

**Distribution in Iran:** No locality cited (Warncke, 1981).

**General distribution:** Eastern (Kyrgyzstan, Uzbekistan, Turkmenistan) and Western (Azerbaijan, Belarus, Finland, France, Germany, Greece, Iran, Israel, Italy, Morocco, Portugal, Russia, Slovakia, Spain, Sweden, Tunisia, Turkey, Ukraine, United Kingdom) Palaearctic (Ascher & Pickering, 2021).

***Hylaeus (Prosopis) variegatus* (Fabricius, 1798)**

**Material examined:** 2♀♀, North Khorasan, Shirvan, Gelian (37°13'59"N, 57°34'59"E), 17.V.2017, Leg.: M. Allahverdi.

**Food association:** Unknown.

**Distribution in Iran:** Alborz, Azarbaijan, Bushehr, Fars, Golestan, Hamadan, Kurdistan, Khorasan-e Razavi, Mazandaran, Qazvin, Tehran (Warncke, 1981; Ascher & Pickering, 2021).

**General distribution:** Eastern (Afghanistan, China, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan) and Western (Albania, Algeria, Armenia, Austria, Bulgaria, Croatia, Czech Republic, Egypt, France, Georgia, Germany, Greece, Iran, Israel, Italy, Jordan, Lebanon, Macedonia, Moldova, Mongolia, Montenegro, Morocco, Netherland, Poland, Portugal, Romania, Russia, Slovakia, Spain, Switzerland, Syria, Tunisia, Turkey, Ukraine) Palaearctic (Ascher & Pickering, 2021).

**Subgenus: *Spatulariella* Popov, 1939**

Type species: *Hylaeus hyalinatus* Smith, 1842

***Hylaeus (Spatulariella) alticola* (Warncke, 1981)**

**Distribution in Iran:** Mazandaran (Warncke, 1981; Ascher & Pickering, 2021).

**General distribution:** Western Palaearctic (Iran) (Warncke, 1981; Ascher & Pickering, 2021).

***Hylaeus (Spatulariella) armeniacus* (Warncke, 1981)**

**Distribution in Iran:** Fars, Tehran (Warncke, 1981).

**General distribution:** Western Palaearctic (Armenia, Iran, Lebanon, Turkey) (Ascher & Pickering, 2021).

***Hylaeus (Spatulariella) iranicus* Dathe, 1980**

**Distribution in Iran:** Mazandaran (Warncke, 1981).

**General distribution:** Western Palaearctic (Iran, Turkey) (Ascher & Pickering, 2021).

***Hylaeus (Spatulariella) irritans* Dathe, 1980**

**Distribution in Iran:** No locality cited (Warncke, 1981).

**General distribution:** Western Palaearctic (Iran, Turkey) (Ascher & Pickering, 2021).

***Hylaeus (Spatulariella) longimaculus* (Alfken, 1936)**

**Distribution in Iran:** Hamadan, Tehran (Warncke, 1981; Ascher & Pickering, 2021).

**General distribution:** Western Palaearctic (Armenia, Greece, Iran, Israel, Lebanon, Morocco, Turkey) (Ascher & Pickering, 2021).

***Hylaeus (Spatulariella) hyalinatus* Smith, 1842\* (Figs. 3C-D)**

**Material examined:** 1♀, Iran, Khorasan-e Razavi, Neishabour, Bujan (36°23'59"N, 58°57'59"E), 17.IV.2017, Leg.: M. Allahverdi.

**Food association:** *Matricaria chamomilla* (Asteraceae).

**General distribution:** Western Palaearctic (Belgium, Czech Republic, Denmark, Estonia, Finland, Georgia, Germany, Greece, Iran (**New record**), Israel, Italy, Ireland, Malaysia, Morocco, Norway, Poland, Portugal, Russia, Spain, Sweden, Turkey, Ukraine, United Kingdom) and Nearctic (Canada, United State) (Ascher & Pickering, 2021).

*Hylaeus (Spatulariella) punctatus* (Brullé, 1832)\* (Figs. 3E–F)

**Material examined:** 1♂, Iran, Khorasan-e Razavi, Gonabad (34°20'54"N, 58°44'42"E), 28.IV.2018, Leg.: M. Allahverdi.

**Food association:** *Tamarix* sp. (Tamaricaceae).

**General distribution:** Western Palaearctic (Azerbaijan, Germany, Greece, Iran (**New record**), Italy, France, Lebanon, Malta, Poland, Portugal, Romania, Turkey, Ukraine), Nearctic (Argentina, Canada, Chile, United State) (Ascher & Pickering, 2021).

### Unclassified species

*Hylaeus clusius* (Warncke, 1981)

**Distribution in Iran:** Khorasan-e Razavi (Warncke, 1981; Ascher & Pickering, 2021).

**General distribution:** Western Palaearctic (Iran) (Warncke, 1981; Ascher & Pickering, 2021).

*Hylaeus oriole* (Warncke, 1981)

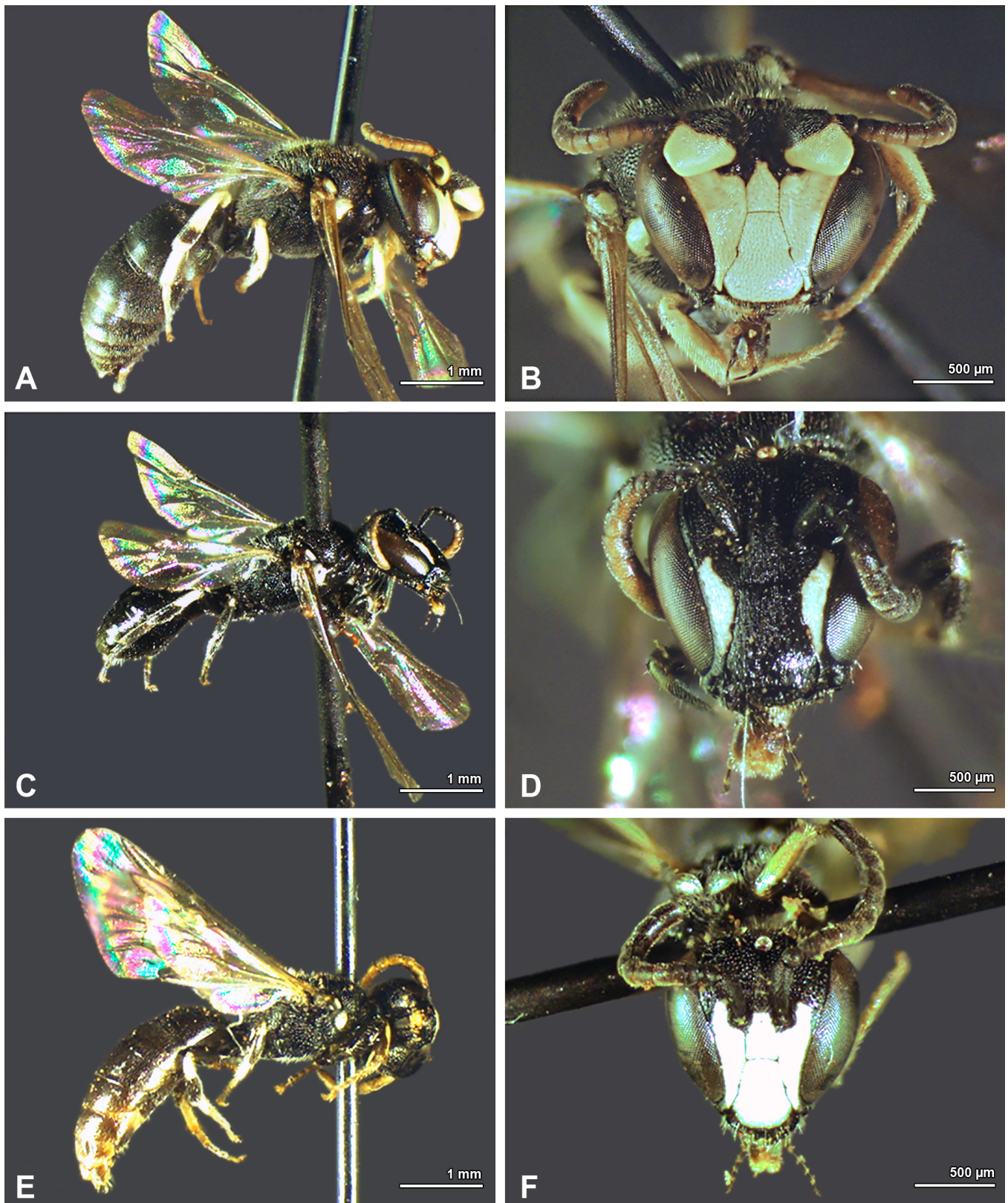
**Distribution in Iran:** Mazandaran (Warncke, 1981; Ascher & Pickering, 2021).

**General distribution:** Western Palaearctic (Iran) (Warncke, 1981; Ascher & Pickering, 2021).

## DISCUSSION

Ascher & Pickering (2021) presented a checklist of 761 world species of the genus *Hylaeus* including 52 species from Iran. Taking into account the new records of the current study and also considering all new and old local literatures (Warncke, 1981; Grace, 2010; Khodaparast & Monfared, 2012; Kiani Bakiani et al., 2016; Khodarahmi Ghahnavieh & Monfared, 2019), the total number of Iranian *Hylaeus* species reaches to 63. As shown in Fig. 4, up to now nine subgenera of the genus *Hylaeus* have been reported from Iran. Among all these subgenera, *Hylaeus* is the most diverse one with 21 species (Fig. 4). This is also the most diverse subgenus of genus *Hylaeus* in Palaearctic region (Ascher & Pickering, 2021).

The number of newly recorded species in the current study could be mirrored the high diversity of this bee group in the country. The percentage of *Hylaeus* species hitherto reported from Iran is 6.5% of the total species of the genus recorded so far in the world. This percentage is also nearly similar or higher than those of some neighboring countries (Iraq 6.9%, Azerbaijan 6.6%, Turkey 4.5%, Armenia 3.3%, Afghanistan 2.3%, Turkmenistan 2% and Pakistan 0.9%) (Ascher & Pickering, 2021). It is noteworthy to note that some of these low percentages might be an outcome of inadequate surveys in these countries, rather than being a reflection of the real number of the existed *Hylaeus* species. In some neighbouring countries of Iran such as Afghanistan and Iraq, political instability as well as civil wars probably have had a strong negative effect on taxonomic studies of various groups of insects including bees. In addition to *H. lionotus*, which was recorded as a very rare species by Dathe & Proshchalykin (2018), two other new reports of this study, i.e. *H. rinki* and *H. punctatus*, are also considered as rare species (Celary, 1999; Feitz et al., 2003; Kowalczyk et al., 2009; Haris, 2015). *Hylaeus lionotus* belongs to the "*variegatus* group".

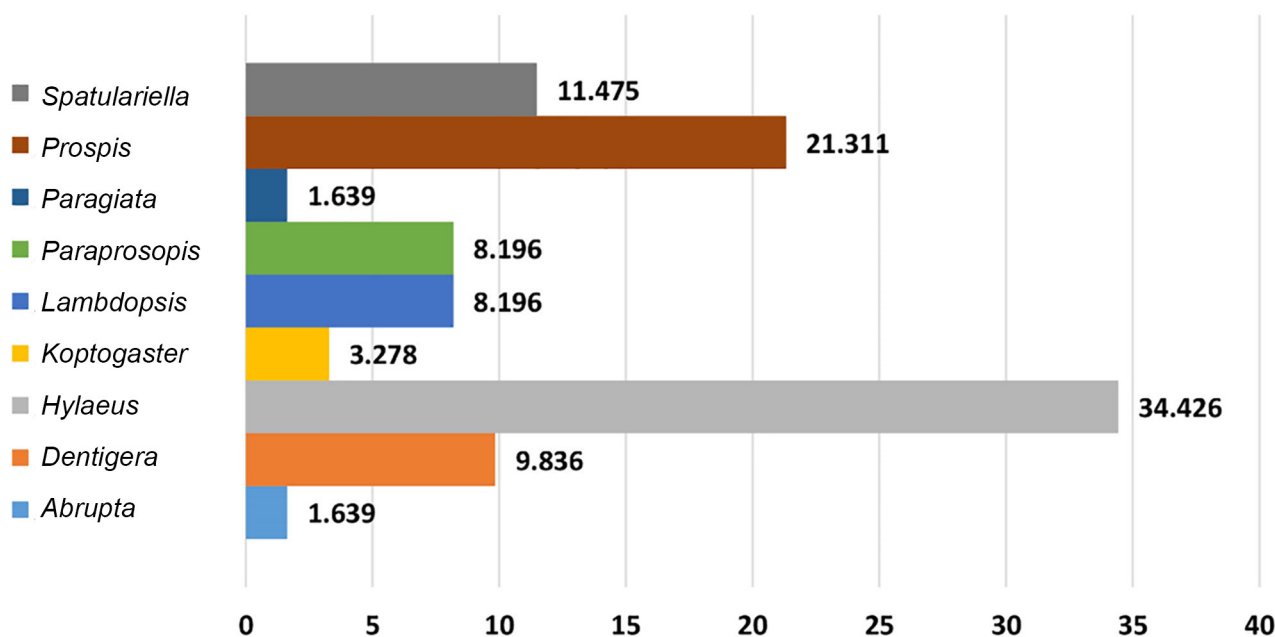


**Figure 3.** Photographs of *Hylae (Lambdopsis) rinki* (Gorski, 1852), *H. (Spatulariella) hyalinatus* Smith, 1842, *H. (Spatulariella) punctatus* (Brullé, 1832): **A-B.** Total body and head in frontal view of *H. Rinki*, **C-D.** Total body and head frontal view of *H. Hyalinatus*, **E-F.** Total body and head frontal view of *H. punctatus*.

The face-sides with no converging impressions, normal and not widened supraclypeal area and the antennal scape which is distinctly longer than wide are the main characteristics of *variegatus* group (Ozbek & Dathe, 2020). The species *H. lionotus* was previously only reported from Central Asia (Kazakhstan). Compared with the specimens from Kazakhstan, in Iranian specimens, the metasoma is not completely red but predominantly black with longer supraclypeal area. These differences may well be due to the morphological variability within this species. However in both Iranian and Kazakhstan samples, the penis valves are completely similar and without any longitudinal edge inside. As the morphological characteristics of this species are not clearly distinguishable from other species of *variegatus* group, molecular methods could be very informative, particularly to reveal the taxonomic status of the species (Dathe & Proshchalykin, 2018). Based on Koster (1986), in Netherland, both *H. rinki* and *H. hyalinatus* nest on the stems of *Rubus* sp. and collect pollens of various plants in the family Rosaceae (specially the genus *Rubus* Linnaeus). Nonetheless in our study, despite the existence of many raspberry bushes (Rosaceae) in the sampling area (Bujan village), both species were collected on *Matricaria chamomilla* (Asteraceae). Moreover, based on some old literatures (Pittioni, 1952; Koster, 1986), the flight periods of these two species are mid-May to mid-September and mid-May to mid-October, respectively. Nevertheless, our samples were collected in mid-April. The probable reason for this time mismatch could be the climatic differences, as the climate of Iran is influenced by its location between the subtropical aridity of the Arabian Desert areas and the subtropical humidity of the eastern Mediterranean area.

In conclusion, regarding the vastness, climatic diversity and rich and pristine vegetation cover of Iran, the actual number of Colletidae bees, particularly the species of the genus *Hylaeus*, is expected to be much higher than current reports. Hence, further studies are suggested in this field, particularly in some western and northwestern provinces of the country (Table 1), since so far, no information has been recorded about this group of bees in these regions.

### % of *Hylaeus* subgenera reported in Iran



**Figure 4.** Percentage of the recorded species of *Hylaeus* subgenera in Iran.

**Table 1.** Number of recorded *Hylaeus* species of each subgenus of the genus *Hylaeus* in Iranian Provinces.

Province	<i>Abrupta</i>	<i>Dentigera</i>	<i>Hylaeus</i>	<i>Koptogaster</i>	<i>Lambdopsis</i>	<i>Paraprosopis</i>	<i>Patagiata</i>	<i>Prosopis</i>	<i>Spatulariella</i>
Alborz	-	1	5	-	1	2	-	4	-
Ardabil	-	-	-	-	-	-	-	-	-
Bushehr	-	-	-	-	-	2	-	2	-
Chaharmahal and Bakhtiari	-	-	-	-	-	-	-	-	-
East Azarbaijan	-	1	-	1	-	-	-	1	-
Fars	-	2	3	-	-	1	-	3	1
Golestan	1	1	1	-	1	1	1	3	-
Guilan	-	-	-	-	-	-	-	2	-
Hamedan	1	-	5	-	-	1	-	3	1
Hormozgan	-	-	-	-	-	-	-	1	-
Ilam	-	-	-	-	-	-	-	-	-
Isfahan	1	2	11	-	-	-	-	2	-
Kerman	-	-	2	-	-	2	-	2	-
Kermanshah	-	-	-	-	-	-	-	-	-
Khorasan-e Razavi	-	-	7	4	1	-	-	2	2
Khuzestan	1	-	-	-	-	1	-	2	-
Kohgiluyeh and Boyer-Ahmad	-	-	-	-	-	-	-	-	-
Kurdistan	-	-	1	-	-	-	-	-	-
Lorestan	-	-	-	-	-	-	-	-	-
Markazi	-	-	-	-	-	-	-	1	-
Mazandaran	-	2	4	1	2	1	-	5	2
North Khorasan	-	-	-	1	2	-	-	2	-
Qazvin	-	-	2	-	-	-	-	1	-
Qom	-	-	-	-	-	-	-	-	-
Semnan	-	-	-	1	-	-	-	1	-
Sistan and Baluchistan	-	-	1	-	-	-	-	1	-
South Khorasan	-	-	2	-	-	-	-	-	-
Tehran	-	-	-	-	-	-	-	1	2
West Azarbaijan	-	-	-	-	-	-	-	1	-
Yazd	-	-	-	-	-	1	-	-	-
Zanjan	-	-	1	-	-	-	-	-	-

#### AUTHOR'S CONTRIBUTION

The authors confirm contribution to the paper as follows: M.A.: Data collection and species identification; M.A., L.F. and V.G.R.: draft manuscript preparation; all authors approved the final version of the manuscript.

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**AVAILABILITY OF DATA AND MATERIAL**

Not applicable.

**ETHICS APPROVAL AND CONSENT TO PARTICIPATE**

Not applicable.

**CONSENT FOR PUBLICATION**

Not applicable.

**CONFLICT OF INTERESTS**

The authors declare that there is no conflict of interest regarding the publication of this paper.

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## فهرست زنبورهای گردهافشان جنس *Hylaeus* Fabricious, 1793 (Hymenoptera: Apoidea: Colletidae) در ایران

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**چکیده:** براساس مطالعات پیشین و هم‌چنین نمونه‌برداری‌های انجام شده در شمال شرق ایران (استان‌های خراسان شمالی و رضوی)، فهرستی از زنبورهای گردهافشان جنس *Hylaeus* Fabricious, 1793 (Apoidea: Colletidae) ارائه شد. این فهرست شامل نه (۹) زیرجنس و ۶۳ گونه می‌باشد. چهار گونه *H. (Lambdopsis)*، *H. (Spatulariella) hyalinatus* Smith, 1842، *rinki* (Gorski, 1852) و *H. (Spatulariella) punctatus* (Brullé, 1832) و *H. lionotus* (Alfken, 1909) برای نخستین بار از ایران گزارش شده است. گونه‌ی *H. lionotus* بسیار نادر بوده و پیش از این، تنها از آسیای مرکزی (قزاقستان) گزارش شده بود. توصیف مجدد این گونه (بر اساس نمونه نر) به همراه تصاویر ویژگی‌های ریخت‌شناسی، ارائه شد.

**واژگان کلیدی:** پراکنش، ایران، گزارش‌های جدید، گونه‌های نادر، رکوردهای جانوری، گردهافشان‌ها