A preliminary survey of hymenopteran fauna of Iranian mangrove ecosystem, northern part of the Persian Gulf and Oman Sea

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ABSTRACT. The order Hymenoptera comprises an important group of insects, with ecological and economic importance, and serving as ecological indicators. Investigating the diversity and distribution of fauna is considered a prerequisite for biodiversity conservation. In this research, the hymenopteran fauna in mangrove forests on the southern coast of Iran were studied during 2021–2022. The collection was made by sweeping net and light trap. The survey revealed the presence of ten species and nine genera belonging to six families. Of which, two species, Ampulex assimilis Kohl, 1893 (Hym.: Ampulicidae) and Paridris leda Kozlov & Kononova, 1985 (Hym.: Scelionidae) are recorded for the first time for the Iranian fauna. Diagnostic characters of the new records and geographical distribution of all species are provided.

Key words: Coastal areas, Fauna, Hormozgan, Hymenoptera, parasitoid, saline woodland

INTRODUCTION

Hymenoptera (sawflies, wasps, ants, and bees) are one of four mega-diverse insect orders, comprising more than 153,000 described and possibly up to one million undescribed extant species (Grimaldi & Engel, 2005; Aguiar et al., 2013). As parasitoids, predators, and pollinators, Hymenoptera play a fundamental role in virtually all terrestrial ecosystems and are of substantial economic importance.
Iranian mangrove forests are located on the coast and islands of the Persian Gulf and Oman Sea, starting from the Goiter Gulf in the East (Oman Sea) to the Nayband Gulf in the West Persian Gulf. Two endemic plant species i.e., *Avicennia marina* (Forssk.) Vierh., 1907 and *Rhizophora mucronata* Lam., 1804 form the mangroves in Iran. The mangrove ecosystem in Iran covers an area of more than 27,310 hectares in southern Iran. The core area of mangrove forests in Iran is 13214.16 ha of which 9777.96 ha is related to the Qeshm Island and Khamir port (Zahed et al., 2010; Safiari, 2017). The mangrove ecosystem is ecologically important for supporting biodiversity, marine ecosystem function, and the food web of various aquatic organisms. The mangrove ecosystem can also prevent sedimentation, stabilize the habitat, and maintain nutrient cycles, thus providing protection to the inland ecosystem against the erosive force of the sea. Thus, the economic productivity of coastal and terrestrial communities relies on the maintenance of the ecological sustainability of mangroves (Budiadi et al., 2022). The mangroves are mainly threatened by natural (pest damage, storms, acid rain) and anthropogenic (oil spills, industrial wastes, infrastructure development) factors (Erfanifard, 2022). The mangrove invertebrate fauna plays a significant role in detritus production and energy flow in the mangrove inshore system. The turnover rate of nutrients is also increased by these attacks by the mangrove insects (Macintosh et al., 1981).

MATERIAL AND METHODS

This study was carried out in mangrove ecosystems in the Persian Gulf and Oman Sea of Iran during 2021-2022. Mangrove forests along the southern coast of Iran are located between the latitudes 25°10' to 27°55' north and longitudes 51°25' to 61°25' east (Safiari, 2017; Zahed et al., 2010). Significantly dense mangroves are observed in Qeshm Island and Khamir Harbor, while they form dense and open stands within other sites (Figs 1, 2). Sampling was done using light traps and sweeping nets at different locations of mangrove Forests of the Persian Gulf and Oman Sea (Figs 1). Collected specimens were temporarily stored in 75% ethanol and afterwards cleaned according to the AXA method (van Achterberg, 2009) and mounted on triangular cards. Relevant literature was used for taxonomical examination and identification of species and some species were compared with the identified species in the Hayk Mirzayans Insect Museum (HMIM). Illustrations were taken using an Olympus™ AX70 microscope and Olympus™ SZX9 stereomicroscope equipped with a Sony™ digital camera. A series of 4–5 captured images were then merged into a single in-focus image using the image-stacking software Combine ZP 1.0. Distribution of each species in Iran and general distributions are provided. All examined materials are deposited in HMIM (Hayk Mirzayans Insect Museum, The Insect Taxonomy Research Department of the Iranian Research Institute of Plant Protection, Tehran).

RESULTS

In this research, ten species within nine genera and seven subfamilies of hymenopteran fauna in mangrove ecosystems were collected and identified. Information regarding the global and Iranian distribution of species, along with some details about their hosts, are provided. Two species were identified as new records for the Iranian fauna that are marked by an asterisk (*). The compiled list of identified genera and species is as follows:
Figure 1. Map of the sampling localities in the mangrove ecosystem in southern Iran (Hormozgan and Bushehr province).

Figure 2. The sampling localities in the mangrove ecosystem in southern Iran. A–B. Khamir harbour; C. Qeshm Island (Hormozgan province) (photos taken by Dr. Arash Bijanpour).
**Taxonomic hierarchy**

Class Insecta Linnaeus, 1785  
Order Hymenoptera Linnaeus, 1758  
Superfamily Apoidea Latreille, 1802  
Family Ampulicidae Shuckard, 1840  
Genus *Ampulex* Jurine, 1807*  
*Ampulex assimilis* Kohl, 1893 (Fig. 3)

**Material examined.** Hormozgan province, Sirik, Azini Estuary (26°19'41.3"N, 57°06'22.3"E, 0±5 m a.s.l.), 12.v.2022; 1♂, Sweeping net, leg. A. Hajesmailian & M. Mofidi Nayestanak.

**Diagnosis.** Body length 18 mm (♂); head in dorsal view transverse, 1.68 times as wide as long; integument generally brilliant metallic (Figs 3A–B, D); antennal tubercles separated from each other (Figs 3A–B); pronotum with large median tubercle adjacent to posterior margin; fore wing with two submarginal cells (SMC1 and SMC2 fused), apex of marginal cell of fore wing not reaching wing margin (Fig. 3C).

**Distribution in Iran.** Hormozgan province (current study).

**Zoogeographical distribution.** Oman, Saudi Arabia, United Arab Emirates, Yemen (Gadallah, 2020), Iran (new record).

**Host.** Unknown, but probably preys on cockroaches, which is typical for the genus (Arvidson et al., 2018).

Family Apidae Latreille, 1802  
Subfamily Apinae Latreille, 1802  
Genus *Apis* Linnaeus, 1758  
*Apis florea* Fabricius, 1787

**Material examined.** Busher Province, Mangrove protected area, Nayband Gulf (27°27'24.5"N 52°40'36.5"E, 0±5 m a.s.l.), 06.vi.2021, 15♂♂, Sweeping net., leg. H. Alipanah, H. Falsafi, E. Gilasian, M. Moghadam, H. Nasserzadeh & M. Mofidi Nayestanak.

**Distribution in Iran.** Southern Iran (Parichehreh et al., 2020).

**Zoogeographical distribution.** Widely distributed in the Oriental, Afrotropical and Palearctic regions (Madl, 2018).

*Apis mellifera meda* Skorikov, 1929

**Material examined.** Hormozgan province, Sirik, Azini Estuary (26°19'24.3"N 57°05'43.3"E, 0±5 m a.s.l), 12.vi.2022, 23♀♀, Sweeping net. leg. A. Hajesmailian & M. Mofidi Nayestanak.

**Distribution in Iran.** The subtropical coast of the Caspian Sea (Mazandaran); northeast Iran (Mashad); West and Central (Azerbaijan -Iranian highlands) and Southeast Iran (Kerman) (Salehi & Nazemi-Rafie, 2020).

**Zoogeographical distribution.** Australasian, Ethiopian, Nearctic, Oriental and Palearctic regions.

Family Crabronidae Latreille, 1802  
Subfamily Bembicinae Latreille, 1802  
Genus *Bembix* Fabricius, 1775  
*Bembix oculata* Panzer, 1801

**Material examined.** Hormozgan province, Khamir, Mangrove protected area (Khor Khoran), Mardu Island, Gulf (26°58'32.8"N 55°40'25.5"E, 0±5 m a.s.l.), 30.x.2021, 1♀, Sweeping net, leg. H. Alipanah, H. Falsafi, E. Gilasian, M. Moghadam, H. Nasserzadeh & M. Mofidi Nayestanak.
Figure 3. *Ampulex assimilis* Kohl, 1893; A. General habitus in lateral view; B. Head, in dorsal view; C. Fore and hind wings; D. Mesonotum and Propodeum.

**Distribution in Iran.** East Azerbaijan (Ghazi-Soltani et al. 2010a, 2010b), Fars (Fallahzadeh et al. 2009; Atbaei et al. 2015), Guilan (Morice, 1921), Hormozgan, Khorasan-e Razavi, Markazi (Ebrahimi, 2014), Golestan, Mazandaran (de Beaumont, 1957; Ebrahimi, 2014), Qazvin (de Beaumont, 1957); Sistan and Baluchestan (Gussakovskij, 1933), South Khorasan (Gussakovskij, 1933; de Beaumont, 1970), Tehran (de Beaumont, 1957); no specific locality (Esmaili & Rastegar, 1974).

**Zoogeographical distribution.** Afghanistan, China, Europe, Iran, Middle Asia, North Africa and Pakistan (Nemkov, 2016).

**Host.** Diptera: Brachycera (Ebrahimi, 2015).

**Family Sphecidae Latreille, 1802**

**Subfamily Sceliphrinae Ashmead, 1899**

**Genus Sceliphron Klug, 1801**

**Sceliphron madraspatanum pictum** (F. Smith, 1856)

**Material examined.** Bushehr Province, Asaluyeh, Nayband (27°27'24.5"N 52°40'36.5"E, 0±5 m a.s.l), 06.xi.2021, 1♀, Sweeping net, leg. H. Nasserzadeh.

**Zoogeographical distribution.** Afghanistan, Bangladesh, Central Asia, China, Greece, India, Indonesia, Iran, Japan, Kazakhstan, Malaysia, Philippines, Saudi Arabia, Syria, Taiwan, Thailand, Turkey, United Arab Emirates and Uzbekistan (Jahantigh et al., 2017).

**Host.** In the agroecosystem, mud wasps were found to constitute the third trophic level within the food chain, comprising vegetable crops, insect pests and spiders. Specifically, *S. madraspatanum* and its role was found to be a potential agent for pest management (Halder et al., 2012).

**Subfamily Sphecinae Latreille, 1802**

**Genus Prionyx Vander Linden, 1827**

*Prionyx nudatus* (Kohl, 1885)

**Material examined.** Bushehr province, Asaluyeh, Sweeping net (27°27'24.5"N, 52°40'36.5"E, 0±5 m a.s.l), 06.xi.2021, 1♀, Sweeping net, leg. E. Gilasian.


**Host.** Orthoptera; Gryllidae (Ebrahimi, 2015).

**Superfamily Ichneumonoidea Latreille, 1802**

**Family Braconidae Nees, 1811**

**Subfamily Agathidinae Haliday, 1833**

**Genus Coccygidium Saussure, 1892**

*Coccygidium transcaspicum* (Kokujev, 1902)

**Material examined.** Hormozgan province, Khamir, Mangrove protected area (Khor Khoran), Mardu Island, Gulf (26°58'32.8"N, 55°40'25.5"E, 0±5 m a.s.l), 30.x.2021, 3♀♀, Light trap, leg. H. Alipanah, H. Falsafi, E. Gilasian, M. Moghadam, H. Nasserzadeh & M. Mofidi Nayestanak.

**Distribution in Iran.** Sistan and Baluchestan (Hedwig, 1957), no specific locality cited (Tobias, 1986).

**Zoogeographical distribution.** Palaeartic region (Yu et al., 2016).

**Host.** The fall armyworm (FAW), *Spodoptera frugiperda* (J. E. Smith)(Gupta et al., 2020).

**Subfamily Braconinae Nees, 1811**

**Genus Bracon Fabricius, 1804**

*Bracon (Habrobracon) hebetor Say, 1836*

**Material examined.** Hormozgan province, Khamir, Mangrove protected area (Khor Khoran), Mardu Island, Gulf (26°58'32.8"N, 55°40'25.5"E, 0±5 m a.s.l.), 30.x.2021, 1♀, Sweeping net., leg., H. Alipanah, H. Falsafi, E. Gilasian, M. Moghadam, H. Nasserzadeh & M. Mofidi Nayestanak.

**Distribution in Iran.** East Azerbaijan (Modarres Awal, 1997), Fars (Lashkari Bod et al., 2011), Hormozgan (Ameri et al., 2013), Isfahan (Bagheri & Nematollahi, 2006), Kerman, Tehran (Modarres Awal, 1997), Kermanshah (Noori, 1994), Qom (Norouzi et al., 2009), West Azerbaijan (Modarres Awal, 1997).

**Zoogeographical distribution.** Australasian, Ethiopian, Nearctic, Oriental and Palaeartic regions (Yu et al., 2016).

**Host.** Cosmopolitan idiobiont braconid which parasitizes the larvae of Pyralidae (Yu et al., 2016).
Family Ichneumonidae Latreille, 1802
Genus Enicospilus Stephens, 1835
Enicospilus pallidus (Taschenberg, 1875)


Distribution in Iran. Hormozgan Province, Bandar-e, Khamir (Johansson et al., 2021).

Zoogeographical distribution. Chad, Democratic Republic of Congo, Ethiopia, Kenya, Pakistan, South Africa, Sudan, Tanzania (Yu et al., 2016), Iran (Johansson et al., 2021).

Host. Enicospilus species are primarily known as nocturnal parasitoids of a wide range of lepidopteran larvae, particularly those are free-living caterpillars; however, the few species with long ovipositors seem to attack larvae that mine plant stems (Yu et al., 2016).

Superfamily Platygastroidea Haliday, 1833
Family Scelionidae Haliday, 1833
Genus Paridris Kieffer, 1908

Paridris leda Kozlov & Kononova, 1985* (Fig. 4)

Material examined. Hormozgan province, Sirik, Azini Estuary (26°19’24.3”N 57°05’43.3”E, 0±5 m a.s.l), 12.v.2022, 1♀, Sweeping net leg. A. Hajesmailian & M. Mofidi Nayestanak.

Diagnosis. Eyes setose; antennae densely pubescent, antennomere 2 oblong, 2 times as long as wide, antennomere 3 about 1.5 times as long as wide, antennomere 4 slightly longer than wide, antennomere 5 as long as wide; antennomere 6 transverse; mesonotum basally smooth (finely sculptured in P. stenus Kononova & Petrov), with distinct notauli (disappeared in P. stenus); stigmal vein as long as postmarginal vein (at most 0.85 times as long as postmarginal vein in P. stenus); basal abdominal horn smooth and shining (sculptured in P. stenus) (Fig. 4).

Figure 4. Paridris leda Kozlov & Kononova, 1985, general habitus. A. Lateral view; B. Dorsal view.
**Distribution in Iran.** Hormozgan province, Sirik, Azini Estuary (current study).

**Zoogeographical distribution.** Moldavia, Turkey (Kozlov & Kononova, 1985, 1990), Iran (new record).

**Host.** Unknown.

**DISCUSSION**

Ten species belonging to nine genera of the order Hymenoptera were collected and identified. Of these, two species, *Ampulex assimilis* and *Paridris leda* are new records for the Iranian fauna. Our samples were captured by light trap and sweeping nets therefore, we have no information about their host associations. None of the identified species have been reported as pests or herbivores. The samples were collected by light trap and sweep net, each of these methods is suitable for certain species. Mangrove trees provide crucial environmental services including habitat for birds, fish and invertebrates. They are responsible for coastal protection from hurricanes, floods, sea level rise, wave action and erosion (Kathiresan & Bingham, 2001; Sherman et al., 2001). Mangrove systems are recognized as one of the most fragile ecosystems, hence they are amongst the most threatened ecosystems globally (Taylor et al., 2003; Martinuzzi et al., 2009). Based on the mentioned reasons, the study of biodiversity in mangrove ecosystems is important. Species of the order Hymenoptera contribute to the biodiversity of an ecosystem and have a crucial role in maintaining ecological balance. High biodiversity often indicates good ecosystem health and resilience against disturbances. Pests are always one of the serious threats to mangrove ecosystems. Parasitoids perform an important ecosystem service by suppressing pest populations. Iranian fauna of the Mangrove ecosystem is poorly investigated. In recent years, 10 species are reported for the first time from mangroves in the south of Iran; *Apis mellifera* L. (Hym.: Apidae), *Muscina prolapsa* Fallen (Dipt.: Muscidae), *Oria musculosa* (Hubner) (Lep.: Noctuidae), *Agrotis daedalus* (Lep.: Noctuidae), *Lygephila* sp. (Lep.: Erebidae), *Helicoverpa armigera* (Hubner) (Lep.: Noctuidae), *Xylocopa latipes* (Drury 1773) (Hym.: Apidae), *Hypaetha schmidti* (W. Horn, 1927) (Col.: Carabidae), *Mylabris variabilis* (Pallas, 1781) (Col.: Meloidae), *Polistes carolina* (Linnaeus, 1767)(Hym.: Vespidae) (Jahani et al., 2020).

Concerning diverse climatic conditions and many unexplored areas such as Sistan and Baluchestan province, in Iran, we expect that the Hymenoptera fauna of the mangrove ecosystem of Iran will be substantially increased by further investigations. Iran is located in the Western Palaeartic region, with some influences from the Afrotropical and Oriental regions, particularly evident in the southern regions of Iran (Ghafouri Moghaddam et al., 2019; Derafshan et al., 2021; Minab et al., 2023). *Coccygidium transcaspicum was* reported from India (belonging to the Oriental zoogeographical region. This species was previously identified in India as a natural predator of *Spodoptera frugiperda* (J.E. Smith, 1797) (Lepidoptera: Noctuidae) (Gupta et al., 2020) which has recently become a serious threat in the southern provinces of Iran as an invasive alien species (Naseri et al., 2024). Additionally, *A. assimilis*, documented for the first time in Iran through this study, had previously been reported in the Afrotropical region (Gadallah, 2020). In this study, the biology and host information of the recorded species remains unknown because the specimens were collected by light traps and sweeping net. The results of this research may be useful for future biocontrol of insect pests and ecological studies. We expected that the mangrove fauna of Iran may be substantially increased in future studies.

**AUTHOR’S CONTRIBUTION**

The authors confirm their contribution to the paper as follows: A. Ameri: Identification, imaging the specimens, preparing the diagnostic characters, preparation of the draft, corrections on the final contents of the manuscript; H. Lotfalizadeh: Identification of some specimens; A.A. Talebi: Supervisor, confirmation of the identified species and technical review of the manuscript; A. Bagheri: Technical review of the manuscript, collection of specimens. E. Ebrahimi: Supervisor, confirmation of the identified species and technical review of the manuscript. The authors read and approved the final version of the manuscript.
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AVAILABILITY OF DATA AND MATERIAL
The specimens listed in this study are deposited in the Hak Mirzayans Insect Museum (Insect Taxonomy Research Department of the Iranian Research Institute of Plant Protection, Tehran), and are available from the curator, upon request.

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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مطالعه فون بالغشایبان روبشگاههای حرا در سواحل خلیج فارس و دریای عمان

برای این اظهارنامه، ۱۰ مورد از جمعیت‌های فون بالغشایبان که در سواحل خلیج فارس و دریای عمان حضور داشتند، بررسی گردید.

چکیده: راسته بالغشایبان گروه مهمی از حشرات دارای اهمیت اکولوژیک و اقتصادی بوده و به عنوان نشانگرهای اکولوژیک نیز شناخته می شوند. پژوهش در مورد تعداد و انتشار فون به عنوان بخش خاصی از تیپ گونه مورد نظر قرار دارد. در این تحقیق، فون بالغشایبان روبشگاههای حرا در سواحل خلیج فارس و دریای عمان طی سال‌های ۱۴۰۰-۱۴۰۱ مورد بررسی قرار گرفت. نمونه‌ها به وسیله تور جارو و تله توری جمع‌آوری گردید. تعداد ۱۰۰ گونه متعلق به ۹ ژنری و ۷ خانواده مختلف شناسایی شدند. از این گونه‌ها دو گونه Ampulex assimilis Kohl, 1893 و Paridris leda Kozlov & Kononova, 1985 از خانواده Paridris گزارش گردید. در این پژوهش برای انتقال گونه‌ها از ایران به دیگر کشورها در انتظار قرار گرفت.

واژگان کلیدی: فون بالغشایبان، بالغشایبان، پاراپستانی، نمک‌زار جنگلی