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A review of Chrysidoidea (Hymenoptera, Aculeata), excluding Chrysididae of Iran

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ABSTRACT. Species of four chrysidoid families, Bethylidae, Dryinidae, Embolemidae, and Sclerogibbidae that occurred in Iran are reviewed. A total of 54 species within 27 genera from Iran are listed. The family Bethylidae with 34 species belonging to 16 genera was the largest group followed by Dryinidae with 17 species belonging to eight genera. The known Bethylidae species from Iran certainly represent a very small piece of the world fauna, distributed mainly in the Palaearctic region. Of the seventeen species of Dryinidae, the known distribution of ten species is known yet limited to the Palaearctic region, but five species are distributed in the north of the Afrotropical region (Arabian peninsula). The families, Embolemidae and Sclerogibbidae each represented by two and a single species in Iran, respectively. *Embolemus huberi* Olmi is here recorded from Kirghizstan, Turkey and Turkmenistan for the first time. Until now, no species of the families Plumariidae and Scolebythidae have been recorded from Iran. Despite the importance and diversity of both bethylids and dryinids, it seems that the least attempts have been done to study their fauna in Iran.

Key words: Fauna, checklist, Bethylidae, Dryinidae, Embolemidae, Sclerogibbidae

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INTRODUCTION

The superfamily Chrysidoidea (Hymenoptera) contains seven extant families, Bethylidae, Chrysididae, Dryinidae, Embolemidae, Plumariidae, Sclerogibbidae, and Scolebythidae (Carpenter, 1999), which together form a monophyletic group within the Aculeata, Hymenoptera (Gauld & Bolton, 1988), with more than 6590 described species (Aguiar et al., 2013) and an estimation of about 16,000 species, worldwide (Finnamore & Brothers, 1993). The Chrysidoidea are among the smallest Aculeata, comparing

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species of the superfamilies Apoidea and Vespoidea, together with their cryptic and parasitic behaviour led to leave the group more or less obscure (Carpenter, 1999). Classification of the whole groups has received substantial modifications, including description of a new family (Scolebythidae – Evans, 1963), fluctuating the subfamily level (Plumariidae – Brothers, 1974, 1975) and highlighted changes in the superfamily name (from Bethyloidea to Chrysidoidea – Day, 1977). The Chrysidoidea are parasitoids of larval Lepidoptera and Coleoptera (Azevedo et al., 2018), Embioptera (Olmi, 2005a), Hemiptera – Auchenorrhyncha (Olmi, 1994a) and even the eggs of Phasmatodea (Kimsey & Bohart, 1990). Many species of the family Chrysididae are known as cleptoparasites in the nests of other Aculeata (Martynova & Fateryga, 2015). Though the chrysidoids are classified in the Aculeata, their ovipositor serves both for envenom the potential hosts, and also for deposition of the eggs (Barbosa et al., 2021). The females of most Dryinidae use their modified protarsi (chela) to capture the hosts before stinging them. Then the female parasitoid deposits its eggs under the overlapping sclerites of the leafhopper host. In the other chrysidoids, females do not have chelae, but they grasp the host between their normal prolegs (Olmi, 1994a). From the evolutionary point of view, all species of Bethylidae, Dryinidae, Embolemidae and Sclerogibbidae are yet ectophagous, except for the species of the genus *Crovettia* Olmi 1984 and the first larval instars in the species of the genus *Aphelopus* Dalman, 1823 (Dryinidae). Sexual dimorphism is rather common in all four families, males and females are rather different, so it is impossible to associate the opposite sexes without rearing or DNA analysis (Olmi, 1994a, 2005a; Olmi et al., 2015; Azevedo et al., 2018). The extreme case of sexual dimorphism is typical for the species of Sclerogibbidae (Olmi, 2005a).

Bethylidae Haliday, 1839 are one of the widely distributed families of Chrysidoidea, with 2,920 species (Azevedo et al., 2018), divided into four extinct subfamilies and five living subfamilies (Colombo et al., 2020). They are known as gregarious ectoparasitoids of larval Coleoptera and Lepidoptera (Azevedo et al., 2018) and many of their hosts are important pests (Polaszek et al., 1994; Berry, 1998; Amante et al., 2017; Alipour et al., 2019). The family Chrysididae, commonly known as gold or cuckoo wasps, are a species-rich cosmopolitan group of aculeate hymenopterans, currently with more than 2,500 valid species nested into 94 extant genera and four subfamilies (Kimsey & Bohart, 1990; Aguiar et al., 2013). Dryinidae are the third largest family within Chrysidoidea, containing 17 (extant and extinct) subfamilies, 52 genera, and over 1900 species found worldwide (Olmi, 1994b; Olmi & Virla, 2014; Olmi et al., 2014, 2022). Dryinids are parasitoids and predators of Hemiptera, Auchenorrhyncha (Guglielmino & Olmi, 2006, 2007), have been considered the most frequent parasites of the leafhoppers and are recorded as important natural enemies suppressing the population of these important pests (Baldridge & Blocker, 1980; Sahragard et al., 1991; Olmi, 2000; Guglielmino, 2002; Mora-Kepfer & Espinoza, 2009; Virla et al., 2011). A few species of Dryinidae are also used for the biological control of leafhopper and planthopper pests of cultivated plants (Guglielmino & Olmi, 1997). The family Embolemidae include three genera and 64 extant species, worldwide (Contarini et al., 2020; Olmi, 2020). They are solitary ectoparasitoids and their hosts include nymphs of planthoppers (Hemiptera, Auchenorrhyncha, Achilidae and Cixiidae) (Varrone & Olmi, 2012; Guglielmino & Bückle, 2013). The hosts of Dryinidae feed on leaves or stems of trees, shrubs and grass, while the embolemids were found in association with root feeders or mycetophagous species (Olmi & van Harten, 2000). The Sclerogibbidae are obligate ectoparasitoids of the webspinners (Embiidina) (Ross, 2000b), which are characterized by their galleries made by the spinning of silk from the silk glands on their fore tarsi (Ross, 2000a). Twenty-four species (12 extinct) of Sclerogibbidae belonging to nine (seven extinct) genera have been described (Perkovsky et al., 2020). The family Scolebythidae comprises 12 species, and more than half are fossils (Engel & Grimaldi, 2007). Biological data on the species suggest that they are apparently parasitoids of wood-boring beetle larvae (Cerambycidae) (Evans, 1963, Evans et al., 1979).

Chrysidoidea of Iran have recently been received further attention, mainly focused on the family Chrysididae with a long history of 155 years (1866–2021). Records from the Chrysididae of Iran have appeared in several papers before WW-II (Radoszkowski, 1866, 1877, 1881, 1889, 1891; Mocsáry, 1889, 1890, 1892; du Buysson, 1900; Semenov-Tian-Shanskij, 1909, 1912, 1920; Bischoff, 1910, 1913; then followed by a long series of interesting works during the 20th century (Balthasar, 1953; Semenov-Tian-

Shanskij & Nikol'skaya, 1954; Semenov-Tian-Shanskij, 1954, 1967; Linsenmaier, 1959, 1968, 1997). Altogether with the recent works (Pourrafei et al., 2011; Rosa et al., 2013, 2015, 2017; Torabipour et al., 2013a, 2013b; Tavassoli & Fallahzadeh, 2015; Strumia & Fallahzadeh, 2015, 2016; Farhad et al., 2015, 2016, 2017, 2018, 2019; Strumia et al., 2016a, 2016b; Farzaneh et al., 2017; Iranmanesh et al., 2017; Rosa, 2018, 2020; Falahatpisheh et al., 2019, 2021a, 2021b), the number of known Chrysididae of Iran raised to 281 species (269 species and 12 subspecies). Since a major update is yet under preparation (Paolo Rosa, personal communication), so we exclude this large group from the current list of Iranian Chrysidoids.

The family Bethylidae in Iran is represented by 11 genera and about 32 species mainly recorded through sporadically surveys on the natural enemies of the insect pests (Davatchi & Shojai, 1968; Kadjbaf-Vala & Bayat-Asadi, 1995; Mohajery & Azimi, 1995; Habibpour et al., 2002; Alavi & Gholizadeh, 2008; Samadi Afshar et al., 2012, 2013; Ehteshami et al., 2010, 2013; Kamangar & Lotfalizadeh, 2014; Sharifi et al., 2014; Pourhaji et al., 2018; Khajeh et al., 2022). Until recently, the known Dryinidae of Iran were restricted to descriptions of species collected sporadically (Olmi, 1984, 2005b; Olmi & Xu, 2015). Subsequent studies and descriptions of new species in Derafshan et al. (2016, 2017, 2020, 2021) in the eastern part of the country led to an increase in the knowledge of this group through which, 17 species belong to eight genera and five subfamilies are listed. Two smaller families, Embolemidae and Sclerogibbidae each represented by two (Ghafouri Moghaddam et al., 2022) and a single species (Fallahzadeh et al., 2017) in Iran, respectively. The scope of this paper is to present an updated list of all known chrysidoid species that occurred in Iran (excluding Chrysididae), together with their zoogeographical distribution. Faunal analysis of each subgroup (families) in Iran compared with the elements of the whole biogeographical zone of distribution is also provided.

MATERIAL AND METHODS

The relevant published data on the occurrence of Chrysidoidea in Iran (excluding Chrysididae) are compiled. Data about the distribution of the listed species outside of Iran were harvested from the selected relevant literature and categorized within the Zoogeographical sequence, following Holt et al. (2013). Classification and nomenclature of the taxa followed Azevedo et al. (2018 – Bethylidae), Olmi & Xu (2015 – Dryinidae), Olmi (1994a, 1999 – Embolemidae), and Olmi (2005a – Sclerogibbidae). The distribution maps were generated in SimpleMappr (Shorthouse, 2010) using general coordinate data. Wherever exist, the depositories for the type specimens of the recorded species are provided for each recorded species, indicated by the following acronyms: **AMNH** – American Museum of Natural History, New York, USA; **BMNH** – The Natural History Museum, London, UK; **BPBM** – Bernice P. Bishop Museum, Honolulu, USA; **CNC** – Canadian National Collection of Insect, Ottawa, Canada; **DAFNE** – Department of Agricultural and Forestry Sciences, University of Tuscia, Viterbo, Italy; **OUMNH** – Oxford University Museum of Natural History, Oxford, UK; **HNHM** – Hungarian Natural History Museum, Budapest, Hungary; **HUS –** Entomological Institute, Hokkaido University, Sapporo, Japan; **INIC –** Israel National Insect Collection, Tel Aviv, Israel; **IZUN –** Istituto di Zoologia, Università di Napoli, Italy; **MACN** – Museo Argentino de Ciencias Naturales Bernardino Rivadavia, Buenos Aires, Argentina; **MNHN** – Muséum national d'Histoire naturelle, Paris, France; **MOLC** – Private collection of Massimo Olmi, Viterbo, Italy; **MRAC –** Musée Royal d'Afrique Centrale, Tervuren, Belgium; **MSNG** – Museo Civico di Storia Naturale "Giacomo Doria", Genova, Italy; **NHMW** – Naturhistorisches Museum Wien, Wien, Austria; **NHRS** – Naturhistoriska riksmuseet och Cosmonova, Stockholm, Sweden; **NMP** – Národní Muzeum, Prague, Czech Republic; **OLL** - Oberösterreichisches Landesmuseum, Linz, Austria; **UFES** – Universidade Federal do Espírito Santo, Vitória, Brazil; **USNM** – National Museum of Natural History, Washington D.C., USA; **ZMC –** Zoological Museum, Copenhagen, Denmark; **ZMHB** – Museum für Naturkunde, Berlin, Germany; **ZMMU** – Zoological Museum, Moscow Lomonosov State University, Russia; **ZMU** – Zoological Museum, Uppsala University, Uppsala, Sweden; **ZMUH –** Zoologisches Institut und Zoologisches Museum, Universität von Hamburg, Germany.

RESULTS

Species of four chrysidoid families, Bethylidae, Dryinidae, Embolemidae, and Sclerogibbidae occurred in Iran are listed. The species of each group are sorted alphabetically following their taxonomic classification. The provincial distribution of the Iranian chrysidoids (excluding Chrysididae) is provided for each species and illustrated on the maps (Figs 1–2). The general distribution of each species based on the previously recorded data throughout the world is also presented and discussed.

Taxonomic hierarchy

Class Insecta Linnaeus, 1758

Order Hymenoptera Linnaeus, 1758

Superfamily Chrysidoidea Latreille, 1802

Family Bethylidae Haliday, 1839

Subfamily Bethylinae Haliday, 1839

Genus *Bethylus* Latreille, 1802

Bethylus Latreille, 1802, 2:315. Type species: *Omalus fuscicornis* Jurine, 1807, subsequent designation.

***Bethylus boops* (Thomson, 1862)**

Anoxus boops Thomson, 1862 (1861), 18:452, ♂♀. – NHRS, Sweden, Smaland och Bohuslan.

Distribution in Iran: Fars province (Kiany et al., 2020).

General Distribution: Palaearctic (Belgium - Pauly, 1984; Czech Republic - Strejček, 1989, Gordh & Móczár, 1990, Macek et al., 2007; Finland - Vikberg, 1999; France - Marhic, 2022; Germany - Rond, 2001; Hungary, Sweden - Kieffer & Marshall, 1906, Gordh & Móczár, 1990; Iran - Kiany et al., 2020; Portugal - Graham, 1984, Gordh & Móczár, 1990; Norway - Hansen, 1995; Romania - Gordh & Móczár, 1990; United Kingdom - Burn, 1997, Else et al., 2016).

***Bethylus mandibularis* (Kieffer, 1904)**

Perisemus mandibularis Kieffer, 1904, 1:384, 385–386, ♂. – MSNG, Nigeria

Distribution in Iran: Fars province (Kiany et al., 2020).

General Distribution: Palaearctic (Iran - Kiany et al., 2020; Italy - Kieffer & Marshall, 1906, Gordh & Móczár, 1990, Olmi, 1994c; Scotland - Kieffer & Marshall, 1906; Spain - Ceballos et al., 1956, Gordh & Móczár, 1990).

Genus *Goniozus* Forster, 1856

Goniozus Forster, 1856, 2:95–96. Type species: *Bethylus claripennis* Forster, 1851, subsequent designation.

***Goniozus claripennis* (Forster, 1851)**

Bethylus claripennis Forster, 1851:7–10, ♀.– NHMW, Germany.

Distribution in Iran: Bushehr (Karampour & Fasihi, 2004); Khuzestan (Kadjbaf-Vala & Bayat-Asadi, 1995); and North Khorasan (Alavi & Gholizadeh, 2008; Lotfalizadeh et al., 2012) provinces.

General Distribution: Palaearctic (Belgium - Pauly, 1984; Czech Republic, Slovakia - Strejček, 1989, Macek et al., 2007; France - Kieffer & Marshall, 1906, Berland, 1928, Marhic, 2022; Germany - Kieffer & Marshall, 1906, Rond, 2001; Hungary - Kieffer & Marshall, 1906; Italy - Olmi, 1994c; Iran - Kadjbaf-Vala & Bayat-Asadi, 1995; Norway - Hansen, 1995; Russia - Kieffer & Marshall, 1906, Lelej & Fadeev, 2017; United Kingdom - Perkins, 1976, Else et al., 2016).

Note: This species was reported as *Goniozus audouinii* Westwood, 1874 by Alavi and Gholizadeh (2008).

Goniozus gallicola (Kieffer, 1905)

Parasierola gallicola Kieffer, 1905:260–261, ♀.– USNM/NHMW, Austria.

Distribution in Iran: North Khorasan province (Alavi & Gholizadeh, 2008; Lotfalizadeh et al., 2012).

General Distribution: Palaearctic (Austria - Kieffer & Marshall, 1906, Gordh & Móczár, 1990, France - Berland, 1928, 1935, Gordh & Móczár, 1990, Marhic, 2022; Iran - Alavi & Gholizadeh, 2008, Italy - Kieffer & Marshall, 1906, Gordh & Móczár, 1990, Olmi, 1994c; Moldavia - Gordh & Móczár, 1990; Russia - Lelej & Fadeev, 2017; Slovakia - Gordh & Móczár, 1990, Macek et al., 2007).

Goniozus legneri Gordh, 1982

Goniozus legneri Gordh, 1982:136–139, ♀♂. – USNM, USA.

Distribution in Iran: Fars province (Ehteshami et al., 2010, 2013).

General Distribution: Nearctic (USA - Gordh & Móczár, 1990), Neotropical (Uruguay - Gordh & Móczár, 1990), and Palaearctic (Iran - Ehteshami et al., 2010, Israel - Gordh & Móczár, 1990, Azevedo et al., 2010).

Goniozus swirskiana (Argaman, 1992)

Parasierola swirskiana Argaman, 1992:195–198, Holotype ♂♀. – Argaman Collection, INIC, Israel.

Distribution in Iran: Kerman province (Sadeghi et al., 2012).

General Distribution: Palaearctic (Afghanistan, Jordan, Israel - Argaman, 1992; Iran - Sadeghi et al., 2012).

Goniozus yezo Terayama, 2006

Goniozus yezo Terayama, 2006:222, ♀. – HUS, Japan.

Distribution in Iran: Kordestan province (Kamangar & Lotfalizadeh, 2014; Kamangar et al., 2017).

General Distribution: Palaearctic (Iran - Kamangar & Lotfalizadeh, 2014; Japan - Terayama, 2006).

Subfamily Epyrinae Kieffer, 1914

Genus *Anisepyris* Kieffer, 1905

Anisepyris Kieffer, 1905 [in Kieffer & Marshall, 1904–1906], 9:247. Type species: *Epyris amazonicus* Westwood, 1874, original designation by monotypy.

Anisepyris near *pallidipennis* (Kieffer, 1906)

Rhabdepyris pallidipennis Kieffer, 1906:382–383, ♀. – HNHM (lost), Hungary.

Distribution in Iran: East Azarbaijan province (Samadi Afshar et al., 2012).

General Distribution: Palaearctic (Czech Republic, Slovakia - Macek et al., 2007; France - Berland, 1928, 1935, Marhic, 2022; Hungary - Kieffer & Marshall, 1906; Iran - Samadi Afshar et al., 2012).

Note: The type of this species originally described in *Rhabdepyris* Kieffer (1904) is lost (Gordh & Móczár, 1990). The available taxonomic data is not enough to reach its identity. Waichert & Azevedo (2009) transferred this species into *Anisepyris* when they synonymized *Trichotepyris* Kieffer, 1906 under *Anisepyris*. However, it is a Neotropical genus (Barbosa & Azevedo, 2018). According to few vouchers of this species deposited in some European museums, it is quite probable that it would be better to locate it in *Epyris* Westwood, 1832.

Genus *Disepyris* Kieffer, 1905

Disepyris Kieffer, 1905, 29:105, 115. Type species: *Disepyris rufipes* Kieffer, 1905, original designation by monotypy.

Disepyris niveus Lim & Azevedo, 2014

Disepyris niveus Lim & Azevedo, 2014:533–536, Holotype ♀. – UFES, UAE.

Distribution in Iran: Sistan-o Baluchestan province (Khajeh et al., 2022).

General Distribution: Afrotropical (UAE, Yemen - Lim & Azevedo, 2014), and Palaearctic (Iran - Khajeh et al., 2022).

Genus *Epyris* Westwood, 1832

Epyris Westwood, 1832, 1:129. Type species: *Epyris niger* Westwood, 1832, original designation by monotypy.

Epyris macrocerus Kieffer, 1908

Epyris macrocerus Kieffer, 1906:316–317, ♀. – HNHM (lost), Hungary, Djakovar.

Distribution in Iran: East Azarbaijan province (Samadi Afshar et al., 2012, 2013).

General Distribution: Palaearctic (Hungary - Nagy, 1970, Gordh & Móczár, 1990; Iran - Samadi Afshar et al., 2012).

Epyris macromma Kieffer, 1906

Epyris macromma Kieffer, 1906, 9:328, ♂. – HNHM (lost), Hungary, Budapest.

Distribution in Iran: East Azarbaijan province (Samadi Afshar et al., 2012, 2013).

General Distribution: Palaearctic (Hungary - Kieffer & Marshall, 1906, Nagy, 1970, Gordh & Móczár, 1990; Iran - Samadi Afshar et al., 2012; Romania - Nagy, 1970, Gordh & Móczár, 1990).

Epyris niger Westwood, 1832

Epyris niger Westwood, 1832, 1:129, ♂. – OUMNH, United Kingdom

Distribution in Iran: East Azarbaijan province (Samadi Afshar et al., 2012, 2013).

General Distribution: Oriental (India - Gordh & Móczár, 1990), and Palaearctic (Belgium - Pauly, 1984; Czech Republic, Slovakia - Strejček, 1989, Macek et al., 2007; Egypt - Kieffer & Marshall, 1906, Nagy, 1970, Gordh & Móczár, 1990, Azevedo et al., 2010; France - Kieffer & Marshall, 1906, Berland, 1928; Arle, 1929, Nagy, 1970, Marhic, 2022; Germany - Kieffer & Marshall, 1906, Nagy, 1970, Rond, 2001; Hungary - Kieffer & Marshall, 1906, Nagy, 1970; Iran - Samadi Afshar et al., 2012; Italy - Kieffer & Marshall, 1906, Nagy, 1970, Olmi, 1994c; Romania - Nagy, 1970; Turkey - Can, 2022; United Kingdom - Nagy, 1970, Perkins, 1976, Else et al., 2016).

Epyris transversus Kieffer, 1906

Epyris transversus Kieffer, 1906:317, ♀. – HNHM (lost), Hungary.

Distribution in Iran: East Azarbaijan province (Samadi Afshar et al., 2012, 2013).

General Distribution: Palaearctic (China - Xu et al., 2003b; Hungary - Kieffer & Marshall, 1906, Nagy, 1970, Gordh & Móczár, 1990; Iran - Samadi Afshar et al., 2012; Israel - Gordh & Móczár, 1990, Azevedo et al., 2010; Romania - Nagy, 1970, Gordh & Móczár, 1990; Spain - Gordh & Móczár, 1990).

Genus *Laelius* Ashmead, 1893

Laelius Ashmead, 1893, 45:50. Type species: *Laelius trogogermatis* Ashmead, 1893, original designation.

Laelius anthrenivorus Trani, 1909

Laelius anthrenivorus Trani, 1909:5–6, ♂♀. – IZUN, Italy, Naples.

Distribution in Iran: Khuzestan province (Habibpour et al., 2002).

General Distribution: Palaearctic (Czech Republic, Slovakia - Strejček, 1989, Macek et al., 2007; France - Vance & Parker, 1932, Berland, 1928, Gordh & Móczár, 1990, Marhic, 2022; Iran - Habibpour et al., 2002; Italy - Gordh & Móczár, 1990, Olmi, 1994c, Vikberg & Koponen, 2005; Romania - Gordh & Móczár, 1990).

Laelius pedatus (Say, 1836)

Bethylus pedatus Say, 1836:281, ♀. – USNM, USA, Indiana.

Distribution in Iran: Fars province (Kiany et al., 2020).

General Distribution: Afrotropical (UAE, Yemen - Barbosa & Azevedo, 2010), Nearctic (Canada, USA - Gordh & Móczár, 1990), Neotropical (Brazil, Mexico - Gordh & Móczár, 1990), and Palaearctic (Finland - Vikberg & Koponen, 2005; Czech Republic - Strejček, 1989, Macek et al., 2007; France - Marhic, 2022; Germany - Rond, 2001; Iran - Kiany et al., 2020; Netherlands – Heitmans, 1998, Mayhew & Heitmans, 2000; Turkey - Can, 2022; United Kingdom - Notton et al., 2014, Else et al., 2016).

Laelius rufipes (Forster, 1860)

Bethylus rufipes Förster, 1860:108–109, ♀♂. – HNHM (lost), Germany.

Distribution in Iran: East Azarbaijan province (Samadi Afshar et al., 2012).

General Distribution: Palaearctic (France - Berland, 1928, Gordh & Móczár, 1990; Germany - Pauly, 1984, Gordh & Móczár, 1990, Rond, 2001; Iran - Samadi Afshar et al., 2012).

Genus *Psilepyris* Kieffer, 1913

Psilepyris Kieffer, 1913, 7:108. Type species: *Epyris indivisus* Kieffer, 1906, subsequent designation.

Psilepyris bilineatus (Thomson, 1862)

Epyris bilineatus Thomson, 1862:453, ♀. – NHRS, Sweden, Lund.

Distribution in Iran: East Azarbaijan province (Samadi Afshar et al., 2012, 2013).

General Distribution: Palaearctic (Belgium - Pauly, 1984; United Kingdom - Perkins, 1976, Gordh & Móczár, 1990, Else et al., 2016; France - Gordh & Móczár, 1990, Marhic, 2022; Germany - Rond, 2001; Iran - Samadi Afshar et al., 2012; Italy - Gordh & Móczár, 1990, Olmi, 1994c; Norway - Hansen, 1995; Romania - Nagy, 1970; Slovakia - Strejček, 1989, Macek et al., 2007; Sweden - Kieffer & Marshall, 1906, Nagy, 1970, Gordh & Móczár, 1990).

Note: This species reported as *Epyris fraternus* Westwood 1874 by Samadi Afshar et al. (2012).

Psilepyris marshalli (Kieffer, 1906)

Epyris Marshalli Kieffer, 1906:323, ♀. – Marshall Collection (lost), France, Aries.

Distribution in Iran: East Azarbaijan province (Samadi Afshar et al., 2012, 2013).

General Distribution: Palaearctic (Czech Republic - Strejček, 1989, Macek et al., 2007; France - Kieffer & Marshall, 1906, Berland, 1928, Nagy, 1970, Gordh & Móczár, 1990, Marhic, 2022; Iran - Samadi Afshar et al., 2012; Israel - Gordh & Móczár, 1990, Azevedo et al., 2010; Romania - Nagy, 1970, Gordh & Móczár, 1990; Spain - Ceballos et al., 1956, Nagy, 1970, Gordh & Móczár, 1990; Tunisia - Gordh & Móczár, 1990).

Psilepyris minor (Kieffer, 1906)

Epyris marshalli var. *minor* Kieffer, 1906:324, ♀. – HNHM (lost), Hungary, Szomotor.

Distribution in Iran: East Azarbaijan province (Samadi Afshar et al., 2012, 2013).

General Distribution: Palaearctic (Czech Republic, Slovakia - Strejček, 1989, Macek et al., 2007; Hungary - Kieffer & Marshall, 1906, Nagy, 1970, Gordh & Móczár, 1990; Iran - Samadi Afshar et al.,

2012; Italy - Olmi, 1994c; Romania - Nagy, 1970, Gordh & Móczár, 1990; Russia - Ruchin & Antropov, 2019; Tunisia - Gordh & Móczár, 1990).

Psilepyris quinquecarinatus (Kieffer, 1906)

Epyris quinquecarinatus Kieffer, 1906:319–320, ♀. – MNHN, Algeria.

Distribution in Iran: East Azarbaijan province (Samadi Afshar et al., 2012, 2013).

General Distribution: Neotropical (Nicaragua - Kieffer, 1906), and Palaearctic (Algeria - Kieffer & Marshall, 1906, Nagy, 1970, Gordh & Móczár, 1990; Egypt - Nagy, 1970, Gordh & Móczár, 1990, Azevedo et al., 2010; Iran - Samadi Afshar et al., 2012; Spain - Kieffer & Marshall, 1906, Ceballos et al., 1956, Nagy, 1970, Gordh & Móczár, 1990; Tunisia - Gordh & Móczár, 1990).

Genus *Rysepyris* Kieffer, 1906

Rysepyris Kieffer, 1906 [in Kieffer & Marshall 1904–1906], 9:341, as subgenus of *Holepyris*. Type species: *Holepyris (Rysepyris) numidicus* Kieffer, 1906, subsequent designation.

Rysepyris angusticollis (Kieffer, 1906)

Holepyris angusticollis Kieffer 1906, 9:358–359, ♀. – MNHN, Iran.

Distribution in Iran: Locality not exactly specified (Kieffer & Marshall, 1906, Azevedo et al., 2010).

General Distribution: Endemic to Iran.

Rysepyris glabratus (Fabricius, 1798)

Tiphia glabrata Fabricus 1798:254. – ZMC, Germany, Halle, Saxony.

Distribution in Iran: Fars province (Kiany et al., 2020).

General Distribution: Afrotropical (West Africa), Nearctic (USA), Neotropical (Mexico, Venezuela), Oceanic (Hawaii) (Gordh & Móczár, 1990), and Palaearctic (Iran - Kiany et al., 2020).

Rysepyris fulvus (Xu, He & Ma, 2003)

Holepyris fulvus Xu, He & Ma, 2003:326, Holotype ♂. – China.

Distribution in Iran: East Azarbaijan province (Samadi Afshar et al., 2012).

General Distribution: Palaearctic (China - Xu et al., 2003a; Iran - Samadi Afshar et al., 2012).

Rysepyris near *fuscus* (Xu, He & Ma, 2003)

Holepyris fuscus Xu, He & Ma, 2003:327, Holotype ♂. – China.

Distribution in Iran: East Azarbaijan province (Samadi Afshar et al., 2012).

General Distribution: Palaearctic (China - Xu et al., 2003a; Iran - Samadi Afshar et al., 2012).

Rysepyris sylvanidis (Brèthes, 1913)

Parepypris sylvanidis Brèthes, 1913, 24:87, ♀♂. – MACN, Argentina.

Distribution in Iran: Locality not exactly specified (Gordh & Móczár, 1990, Azevedo et al., 2010).

General Distribution: Australasian (Australia - Gordh & Móczár, 1990), Nearctic (USA - Gordh & Móczár, 1990), Neotropical (Argentina, Brazil - Gordh & Móczár, 1990), Oriental (Bangladesh, India - Gordh & Móczár, 1990), and Palaearctic (Belgium - Pauly, 1984; Czech Republic, Slovakia - Strejček, 1989, Macek et al., 2007; Egypt, Israel - Gordh & Móczár, 1990, Azevedo et al., 2010; Iran - Gordh & Móczár, 1990; United Kingdom - Perkins, 1976, Else et al., 2016).

Subfamily Mesitiinae Kieffer, 1914

Genus *Anaylax* Móczár, 1970

Anaylax Móczár, 1970, 16:177–178. Type species: *Mesitius moczari* Nagy, 1968, original designation.

Anaylax integer (Kieffer, 1906)

Mesitius integer Kieffer, 1906:387–388, 535, 545, ♀. – MNHN, Greece, Attica, Corfu.

Distribution in Iran: Locality not exactly specified (Azevedo et al., 2010).

General Distribution: Oriental (India - Argaman, 2003), and Palaearctic (Afghanistan - Gordh & Móczár, 1990, Argaman, 2003; Egypt, Iraq, Israel - Argaman, 2003; Greece - Kieffer & Marshall, 1906, Gordh & Móczár, 1990, Argaman, 2003; Iran - Azevedo et al., 2010).

Genus *Botoryan* Argaman, 2003

Botoryan Argaman, 2003, 24:66, 69–70. Type species: *Mesitius discolor* Nagy, 1968, original designation by monotypy.

Botoryan discolor (Nagy, 1968)

Mesitius discolor Nagy, 1968:174–175, ♂. – USNM, India, Arallan [or Arauan].

Distribution in Iran: Southwest Iran (Gordh & Móczár, 1990); Locality not exactly specified (Argaman, 2003, Azevedo et al., 2010).

General Distribution: Oriental (India - Gordh & Móczár, 1990, Argaman, 2003), and Palaearctic (Iran - Gordh & Móczár, 1990).

Note: This species was recorded as *Sulcomesitius persicus* Moczar, 1970 by Gordh and Móczár (1990).

Subfamily Pristocerinae Mocsáry, 1881

Genus *Parascleroderma* Kieffer, 1904

Parascleroderma Kieffer, 1904, 41:376.Type species: *Paracleroderma fulviceps* Kieffer, 1904a, original designation.

Parascleroderma varlinda Argaman, 1988

Parascleroderma varlinda Argaman, 1988:146. – Argaman Collection, Israel, Sharon Plain.

Distribution in Iran: Locality not exactly specified (Gordh & Móczár, 1990, Azevedo et al., 2010).

General Distribution: Palaearctic (Iran - Gordh & Móczár, 1990; Israel - Gordh & Móczár, 1990, Azevedo et al., 2010; Italy - Olmi, 1994c, Gordh & Móczár, 1990).

Subfamily Scleroderminae Kieffer, 1914

Genus *Cephalonomia* Westwood, 1833

Cephalonomia Westwood, 1833, 6:420. Type species: *Cephalonomia formiciformis* Westwood, 1833, original designation by monotypy.

Cephalonomia hypobori Kieffer, 1919

Cephalonomia hypobori Kieffer, 1919:32–33, ♀. – Picard Collection, France, Montpellier.

Distribution in Iran: Qom (Radjabi, 2011) and Tehran (Davatchi & Shojai, 1968, Radjabi, 2011) provinces; Locality not exactly specified (Gordh & Móczár, 1990, Azevedo et al., 2010).

General Distribution: Palaearctic (Czech Republic - Strejček, 1989, Macek et al., 2007; France - Picard, 1919, Berland, 1928, Gordh & Móczár, 1990, Marhic, 2022; Iran - Gordh & Móczár, 1990; Israel - Gordh & Móczár, 1990, Azevedo et al., 2010; Italy - Gordh & Móczár, 1990, Olmi, 1994c; Tunisia - Zeiri et al., 2011).

Cephalonomia tarsalis (Ashmead, 1893)

Ateleopterus tarsalis Ashmead, 1893:44–46, Holotype ♀. – USNM, USA, Indiana, Lafayette.

Distribution in Iran: East Azarbaijan, North Khorasan (Samadi Afshar et al., 2012; Lotfalizadeh & Hosseini, 2013); Khorasan-e Razavi (Akbari Asl et al., 2009), and Khuzestan (Mohajery & Azimi, 1995; Mohajery et al., 1998; Habibpour et al., 2002) provinces.

General Distribution: Afrotropical (Nigeria), Australasian (Australia), Nearctic (USA), Neotropical (Argentina) (Gordh & Móczár, 1990), and Palaearctic (Albania, Israel - Gordh & Móczár, 1990; Czech Republic - Strejček, 1989, Macek et al., 2007; Iran - Mohajery & Azimi, 1995; Japan - Tachikawa, 1985, Gordh & Móczár, 1990, Terayama, 2006; United Kingdom - Perkins, 1976, Gordh & Móczár, 1990, Else et al., 2016).

Genus *Glenosema* Kieffer, 1905

Glenosema Kieffer, 1905, 29:100. Type species: *Plastanoxus nigra* Kieffer, 1906, Subsequent designation by monotypy.

Glesonema sp.

Distribution in Iran: East Azarbaijan province (Samadi Afshar et al., 2012).

Genus *Israelius* Richards, 1952

Israelius Richards, 1952, 5:409. Type species: *Israelius carthami* Richards, 1952, original designation.

Israelius carthami Richards, 1952

Israelius carthami Richards, 1952, 5:409–410, ♀♂. – BMNH, Palestin, Gezer.

Distribution in Iran: East Azarbaijan and West Azarbaijan provinces (Pourhaji et al., 2018).

General Distribution: Palaearctic (Greece - Gordh & Móczár, 1990; Iran - Pourhaji et al., 2018; Israel - Richards, 1955, Gordh & Móczár, 1990, Azevedo et al., 2010, Barbosa et al., 2014; Palestine – Richards, 1955; Slovakia - Strejček, 1989, Macek et al., 2007).

Genus *Plastanoxus* Kieffer, 1904

Plastanoxus Kieffer, 1904 [in Kieffer & Marshall, 1904–1906], 9:244, Type species: *Plastanoxus chittendenii* Ashmead, 1893, subsequent designation.

Plastanoxus sp.

Distribution in Iran: East Azarbaijan province (Samadi Afshar et al., 2012).

Genus *Sclerodermus* Latreille, 1809

Sclerodermus Latreille, 1809, 4:118–119. Type species: *Sclerodermus domesticus* Klug [*in* Latreille, 1809], Original designation by monotypy.

Sclerodermus domesticus Klug in Latreille, 1809

Sclerodermus domesticus Klug [*in* Latreille, 1809], 4:118. – ZMHB, Germany, Berlin.

Distribution in Iran: Khorasan-e Razavi province (Sharifi et al., 2014; Karimi et al., 2017).

General Distribution: Palaearctic (Czech Republic - Strejček, 1989; France - Maneval, 1932, Berland, 1928, Marhic, 2022; Germany - Rond, 2001; Iran - Sharifi et al., 2014; Israel - Gordh & Móczár, 1990, Azevedo et al., 2010; Italy - Olmi, 1994c; Russia - Lelej & Fadeev, 2017).

Family Dryinidae Haliday, 1833

Subfamily Anteoninae R. Perkins, 1912

Genus *Anteon* Jurine, 1807

Anteon Jurine, 1807:302. Type species: *Anteon jurineanum* Latreille, 1809, original designation.

Anteon abdulnouri Olmi, 1987

Anteon abdulnouri Olmi, 1987:33, Holotype ♀. – AMNH, Lebanon, Fanar.

Distribution in Iran: North Khorasan and Sistan-o Baluchestan provinces (Derafshan et al., 2021).

General Distribution: Afrotropical (UAE - Olmi, 1999, Olmi & van Harten, 2000; Olmi, 2014, Olmi & Xu, 2015, Olmi et al., 2019; Yemen - Olmi & van Harten, 2000, 2006, Olmi & Xu, 2015, Olmi et al., 2019, Derafshan et al., 2021), and Palaearctic (Afghanistan, Lebanon, Oman, Turkey - Olmi, 1999; Olmi & van Harten, 2000, Olmi & Xu, 2015; Italy - Olmi, 1994c, Olmi & van Harten, 2000; China - North Eastern, Japan, Hungary - Olmi & Xu, 2015; Iran - Derafshan et al., 2021).

Anteon pubicorne (Dalman, 1818)

Gonatopus pubicornis Dalman, 1818:87, Holotype ♀. – NHRS, Sweden, Småland.

Distribution in Iran: North Khorasan province (Derafshan et al., 2021).

General Distribution: Palaearctic (Albania, Austria, Belgium, Bulgaria, Czech Republic, Finland, France, Greece, Ireland, Netherlands, Poland, Switzerland, United Kingdom - Olmi, 1984, Olmi & Xu, 2015; Armenia, Russia (including the European part, Siberia and Far East), Morocco - Olmi, 1994a, Olmi & Xu, 2015; China, Croatia, Germany, Hungary, Japan, Kazakhstan, Macedonia, Moldova, Montenegro, Romania, Slovakia, Slovenia, Spain, Turkey, Ukraine - Olmi & Xu, 2015; Denmark, Mongolia, Norway - Olmi, 1984, 1994a, Olmi & Xu, 2015; Iran - Derafshan et al., 2021; Italy - Olmi, 1994c, Olmi & Xu, 2015; Korea - Olmi, 1984, 1994a; Sweden - Olmi, 1994a, Olmi & Xu, 2015, Derafshan et al., 2021).

Subfamily Aphelopinae Perkins, 1912

Genus *Aphelopus* Dalman, 1823

Aphelopus Dalman, 1823, 45:8. Type species: *Dryinus atratus* Dalman, 1823, subsequent designation by Westwood (1839).

Aphelopus melaleucus (Dalman, 1818)

Gonatopus melaleucus Dalman, 1818:82, Holotype ♀. – NHRS, Sweden, Västergötland.

Distribution in Iran: Isfahan and Khorasan-e Razavi provinces (Derafshan et al., 2021).

General Distribution: Nearctic (Canada - Olmi, 1984, Olmi & Xu, 2015), and Palaearctic (Armenia, Norway - Olmi, 1994a, 1999, Olmi & Xu, 2015; Austria, Belgium, Finland, Germany, Hungary, Ireland, Netherlands, Scotland, Switzerland - Olmi, 1984, Olmi & Xu, 2015; Bosnia & Herzegovina, Bulgaria, Croatia, Czech Republic, France, Macedonia, Montenegro, Romania, Slovakia, Spain, Turkey - Strejček, 1989, Olmi, 1999, Olmi & Xu, 2015; China, Japan - Olmi & Xu, 2015; Cyprus, Denmark, Lebanon - Olmi, 1984, 1994a, Olmi & Xu, 2015; France - Berland, 1928, Olmi, 1984; Iran - Derafshan et al., 2021; Italy - Olmi, 1994c, Olmi & Xu, 2015; Russia (including the European part, Siberia and Far East) - Olmi, 1994a, Olmi & Xu, 2015, Lelej & Loktionov, 2017; South Korea - Kim & Lee, 2016; Sweden - Olmi, 1984, 1994a, Olmi & Xu, 2015, Derafshan et al., 2021; United Kingdom - Perkins, 1976, Olmi, 1984, Olmi & Xu, 2015).

Aphelopus orphanidesi Olmi, 1994

Aphelopus orphanidesi Olmi [*in* Olmi & Orphanides], 1994:408, Holotype ♂. – AMNH, Cyprus, Pakhna.

Distribution in Iran: Isfahan province (Derafshan et al., 2021).

General Distribution: Palaearctic (Cyprus, France, Germany, Iran, Italy, Norway, Sweden - Derafshan et al., 2021).

Subfamily Bocchinae Richards, 1939

Genus *Bocchus* Ashmead, 1893

Bocchus Ashmead, 1893:91. Type species: *Bocchus flavicollis* Ashmead, 1893, original designation.

Bocchus hyalinus Olmi, 1998

Bocchus hyalinus Olmi, 1998:65, Holotype ♀. – CNC, Oman, Dhagmar.

Distribution in Iran: Kerman and Sistan-o Baluchestan provinces (Derafshan et al., 2021).

General Distribution: Afrotropical (Kenya - Olmi et al., 2015, 2019; UAE - Olmi, 2008, 2014, Olmi et al., 2019), and Palaearctic (Iran - Derafshan et al., 2021; Oman - Olmi, 1998, Olmi et al., 2019, Derafshan et al., 2021).

Genus *Mirodryinus* Ponomarenko, 1972

Mirodryinus Ponomarenko, 1972, 1:673. Type species: *Mirodryinus ungulatus* Ponomarenko, 1972, original designation.

Mirodryinus atlanticus Olmi, 1984

Mirodryinus atlanticus Olmi, 1984:672, Holotype ♀. – ZMUH, Spain, Canary Islands, Fuerteventura Island, Gran Tarajal.

Distribution in Iran: Sistan-o Baluchestan province (Derafshan et al., 2017, 2021).

General Distribution: Afrotropical (UAE - Olmi, 2008, 2014, Olmi & Xu, 2015, Derafshan et al., 2017), and Palaearctic (Canary Islands - Olmi, 1984; Egypt, Tunisia, Turkmenistan - Olmi & Xu, 2015, Derafshan et al., 2017; Iran - Derafshan et al., 2017; Morocco - Olmi, 1991, Olmi & Xu, 2015, Derafshan et al., 2017).

Subfamily Dryininae Haliday, 1833

Genus *Dryinus* Latreille, 1804

Dryinus Latreille, 1804:176. Type species: *Dryinus collaris* (Linnaeus, 1767); subsequent designation by monotypy.

Dryinus gharaeii Olmi, 2005

Dryinus gharaeii Olmi, 2005b: 207, Holotype ♀. – MOLC, Iran, Ilam.

Distribution in Iran: Ilam province (Olmi, 2005b, Olmi & Xu, 2015, Derafshan et al., 2016, 2021).

General Distribution: Endemic to Iran.

Dryinus tamaricicola Rakhshani & Olmi, 2016

Dryinus tamaricicola Rakhshani & Olmi [in Derafshan et al.], 2016: 412, Holotype ♀. – MOLC, Iran, Zabol.

Distribution in Iran: Sistan-o Baluchestan province (Derafshan et al., 2016, 2021).

General Distribution: Endemic to Iran.

Dryinus tarraconensis Marshall, 1868

Dryinus tarraconensis Marshall, 1868:204, Holotype ♀. – HNHM, Spain, Huesca, near Torla.

Distribution in Iran: Kerman province (Derafshan et al., 2016, 2021).

General Distribution: Palaearctic (Bulgaria, Montenegro, Morocco, Slovakia, Turkey - Olmi & Xu, 2015; Croatia, Czech Republic, Poland, Tajikistan - Olmi & Xu, 2015, Derafshan et al., 2016; Iran - Derafshan et al., 2016; Slovakia - Olmi, 1984, Strejček, 1989; France, Germany, Greece, Hungary, Iraq, Romania - Olmi, 1984, Olmi & Xu, 2015; Italy - Olmi, 1984, 1994c; Russia (including the European part and Far East) - Olmi & Xu, 2015, Derafshan et al., 2016, Lelej & Loktionov, 2017; Spain - Olmi, 1984, Olmi & Xu, 2015, Derafshan et al., 2016).

Subfamily Gonatopodinae Kieffer [*in* Kieffer & Marshall] 1906

Genus *Echthrodelphax* R. Perkins, 1903

Echthrodelphax Perkins, 1903, 1:36. Type species: *Echthrodelphax fairchildii* Perkins, 1903, Original designation by monotypy.

Echthrodelphax tauricus Ponomarenko, 1970

Echthrodelphax tauricus Ponomarenko, 1970:432, Holotype ♀. – MNHN, Ukraine, Crimea, Sevastopol.

Distribution in Iran: Sistan-o Baluchestan province (Derafshan et al., 2020).

General Distribution: Afrotropical (Central African Republic - Olmi et al., 2016; Kenya - Olmi et al., 2015; UAE - Olmi, 1998, 2008, 2014; Yemen - Olmi & van Harten, 2000, 2006, Olmi, 2008, 2014), and Palaearctic (Azerbaijan, Oman - Olmi, 2008, 2014; Olmi et al., 2019; Crimea - Ponomarenko, 1970; Iran - Derafshan et al., 2020).

Note: This species was recorded as *Echthrodelphax hortusensis* (Abdul-Nour, 1976) in Olmi (1998) and *Echthrodelphax migratorius* Benoit, 1954 in Olmi & van Harten 2000, 2006).

Genus *Gonatopus* Ljungh, 1810

Gonatopus Ljungh, 1810:161. Type species: *Gonatopus formicarius* Ljungh, 1810, by monotypy.

Gonatopus camelinus Kieffer, 1904

Gonatopus camelinus Kieffer, 1904: 361, Holotype ♀. – MSNG, Italy, Giglio Island.

Distribution in Iran: Fars and Sistan-o Baluchestan provinces (Derafshan et al., 2020).

General Distribution: Afrotropical (UAE - Olmi, 1999, 2008, Olmi & Xu, 2015), and Palaearctic (Algeria, Portugal (including the Azores) - Olmi, 1999, Olmi, 2008, Olmi & Xu, 2015; Egypt, France, Greece, Morocco, Turkey - Olmi, 1991, 1999, 2008, Olmi & Xu, 2015; Iran - Derafshan et al., 2020; Italy - Olmi, 1984, 1994c, Olmi & Xu, 2015; Japan, Tajikistan, Turkmenistan, Uzbekistan - Olmi & Xu, 2015; Siberia (Russia) - Olmi & Xu, 2015, Lelej & Loktionov, 2017; Spain - including the Canary islands) - Olmi, 1984, 1991, Olmi & Xu, 2015; United Kingdom - Olmi, 1999, 2008, Olmi & Xu, 2015).

Note: This species was recorded in Olmi (1984, 1991) as *Pseudogonatopus camelinus* Kieffer, 1904.

Gonatopus clavipes (Thunberg, 1827)

Gonatopus clavipes Thunberg, 1827:202, Holotype ♀. – ZMU, Sweden, Uppland, Uppsala.

Distribution in Iran: Fars, Tehran (Olmi & Xu, 2015, Derafshan et al., 2020), North Khorasan, Khorasan-e Razavi (Derafshan et al., 2020), and West Azarbaijan (Olmi & Xu, 2015) provinces.

General Distribution: Palaearctic (Austria, Azerbaijan, Belgium, Bulgaria, Croatia, Czech Republic, Finland, France, Germany, Greece, Hungary, Ireland, Macedonia, Netherlands, Poland, Romania, Slovakia, Slovenia, Switzerland, Tunisia, Ukraine, United Kingdom - Olmi, 1999, Olmi & Xu, 2015; Denmark, Norway, Portugal (including the Azores) - Olmi & Xu, 2015; Iran – Olmi & Xu, 2015, Derafshan et al., 2020; Italy - Olmi, 1994c, Olmi & Xu, 2015; Japan - Olmi & Xu, 2015; North Korea, Kazakhstan, Mongolia, Uzbekistan - Olmi, 1994a, Olmi & Xu, 2015; Russia (including the European part, Siberia and Far East) - Olmi, 1994a, Olmi & Xu, 2015, Lelej & Loktionov, 2017; Spain (including the Canary islands), Sweden, Turkey - Olmi, 1994a, 1999, Olmi & Xu, 2015).

Gonatopus distinguendus Kieffer, 1905

Gonatopus distinguendus Kieffer [*in* Kieffer & Marshall], 1905:116, Lectotype ♀, Paralectotype ♀. – NMNH, United Kingdom, Weymouth.

Distribution in Iran: Kermanshah (Olmi & Xu, 2015, Derafshan et al., 2020) and North Khorasan (Derafshan et al., 2020) provinces.

General Distribution: Palaearctic (Austria, Czech Republic, France, Germany, Hungary, Ireland, Romania, Spain, Switzerland - Olmi, 1984, 1999, Olmi & Xu, 2015; Denmark, Turkey - Olmi, 1994a, 1999, Olmi & Xu, 2015; Finland, Morocco, Netherlands, Poland, Slovakia, Tunisia - Olmi, 1999, Olmi & Xu, 2015; Iran - Olmi & Xu, 2015, Derafshan et al., 2020; Italy - Olmi, 1984, 1994c, 1999, Olmi & Xu, 2015, Derafshan et al., 2020; Kazakhstan, Kirghizstan - Olmi & Xu, 2015; Mongolia, Sweden - Olmi, 1984, 1994a, 1999, Olmi & Xu, 2015; Russia (including the European part, Siberia and far East) - Olmi, 1994a, 1999, Olmi & Xu, 2015, Lelej & Loktionov, 2017; United Kingdom - Olmi, 1984, 1999, Olmi & Xu, 2015).

Gonatopus iranicus Olmi, 1984

Gonatopus iranicus Olmi, 1984:1523, Holotype ♀. – NMP, Iran, Zanjan province, Ziaran.

Distribution in Iran: Zanjan province (Olmi, 1984, Olmi & Xu, 2015, Derafshan et al., 2020).

General Distribution: Palaearctic (Greece - Olmi & Xu, 2015, Derafshan et al., 2020; Iran - Olmi, 1984).

Gonatopus lunatus Klug, 1810

Gonatopus lunatus Klug, 1810:164. Lectotype ♀. – ZMHB, Germany, Berlin.

Distribution in Iran: Sistan-o Baluchestan province (Derafshan et al., 2020).

General Distribution: Palaearctic (Albania, Belgium, Bulgaria, Greece, Hungary, Jordan, Luxembourg, Slovakia, Ukraine - Olmi, 1999, Olmi & Xu, 2015; Austria, Czech Republic, Finland, France, United Kingdom, Germany, Netherlands, Romania, Spain, Switzerland - Olmi, 1984, 1999, Olmi & Xu, 2015; Denmark, Lebanon, Morocco, Norway - Olmi, 1994a, 1999, Olmi & Xu, 2015; Iran - Derafshan et al., 2020; Israel, Portugal (including Madeira and the Azores), Sweden, Turkey - Olmi, 1984, 1994a, 1999, Olmi & Xu, 2015; Italy - Olmi, 1984, 1994c, 1999, Olmi & Xu, 2015; Kazakhstan, Turkmenistan - Olmi, 1994a; Korea, Mongolia - Olmi, 1984, 1994a; Russia (including the European part and Siberia) - Olmi, 1994a, Lelej & Loktionov, 2017, Ruchin & Antropov, 2019; United Kingdom - Olmi, 1984, 1999, Olmi & Xu, 2015).

Gonatopus opsiicida Rakhshani & Olmi, 2020

Gonatopus opsiicida Rakhshani & Olmi [*in* Derafshan et al.], 2020:387, Holotype ♀. – DAFNE, Iran, Zabol.

Distribution in Iran: Sistan-o Baluchestan province (Derafshan et al., 2020).

General Distribution: Endemic to Iran.

Genus *Haplogonatopus* Perkins, 1905

Haplogonatopus Perkins, 1905:39. Type species: *Haplogonatopus apicalis* Perkins, 1905, by original designation.

Haplogonatopus apicalis Perkins, 1905

Haplogonatopus apicalis Perkins, 1905:39, Lectotype ♀. – BPBM, Australia: Queensland.

Distribution in Iran: Fars province (Derafshan et al., 2020).

General Distribution: Australasian (Australia, Malaysia, Philippines - Olmi, 1984, Olmi & Xu, 2015), Oriental (India, Sri Lanka, Thailand - Olmi, 1984, Xu et al., 2013, Olmi & Xu, 2015; Vietnam - Mita & Pham, 2014), and Palaearctic (China - Olmi, 1984, Xu et al., 2013, Olmi & Xu, 2015, Derafshan et al., 2020; Iran - Derafshan et al., 2020; Japan - Olmi, 1984, Olmi & Xu, 2015).

Family Embolemidae Foerster, 1856

Genus *Ampulicomorpha* Ashmead, 1893

Ampulicomorpha Ashmead, 1893:79. Type species: *Ampulicomorpha confusa* Ashmead, 1893, original designation by monotypy.

Ampulicomorpha thauma Rasnitsyn & Matveev, 1989

Ampulicomorpha thauma Rasnitsyn & Matveev, 1989:657, Holotype ♀. – ZMMU, Russia, Rostov Oblast, Model Experimental Farm.

Distribution in Iran: Kerman province (Ghafouri Moghaddam et al., 2022).

General Distribution: Palaearctic (Iran - Ghafouri Moghaddam et al., 2022; Japan - Mita & Olmi, 2018; Russia (European part and Far East) - Olmi et al., 2014, Chény et al., 2020; South Korea - Kim & Lee, 2016).

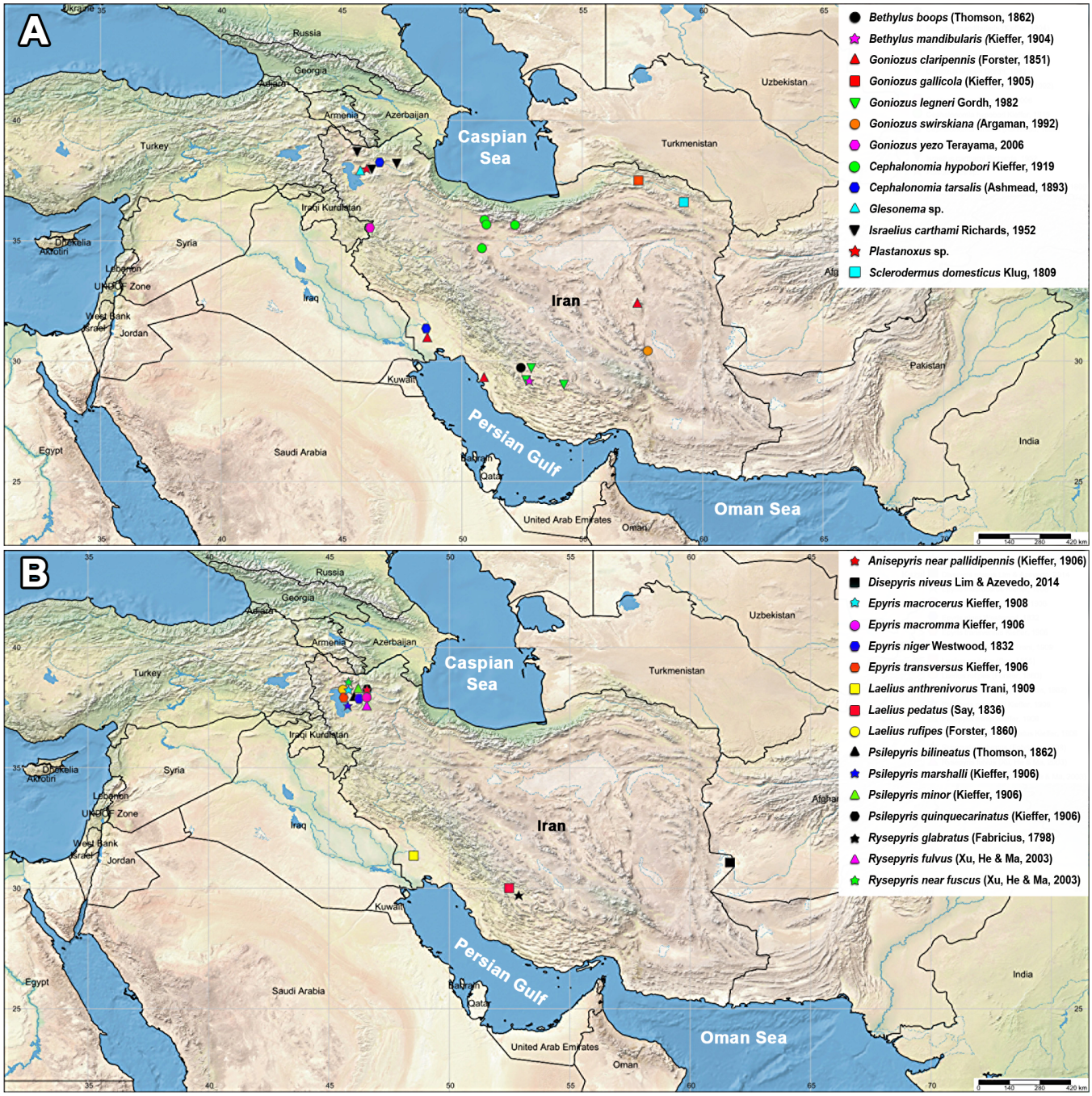

Figure 1. Distribution map for species of Bethylidae in Iran. **A.** Bethylinae and Scleroderminae; **B.** Epyrinae. (No locality was recorded for the species of Mesitiinae and Pristocerinae).

Genus *Embolemus* Westwood, 1833

Embolemus Westwood, 1833, 2:444. Type species: *Embolemus ruddii* Westwood, 1833, by monotypy.

Embolemus huberi Olmi, 1997

Embolemus huberi Olmi, 1997:137, ♂. – CNC, Iran, Tehran.

Material examined: Kirghizstan, Kirghizsky Mt. Rg., Tshon – Azyk, VI.2000, V. Gurko leg., 1♂ (MOLC); Turkey, Mugla, University campus, 37°09′N 28°22′E, 700 m, 23.IX.2012, Barták leg., 1♂ (OLL); same locality label, 39°09′42′′N 28°22′13′′E, 720 m, 19.VIII.2015, H. Kavak leg., 1♂ (OLL). Turkmenistan: Kopet Dag, Garrygala environs, VII.1997, J. Miatleuski leg., 1♂ (OLL).

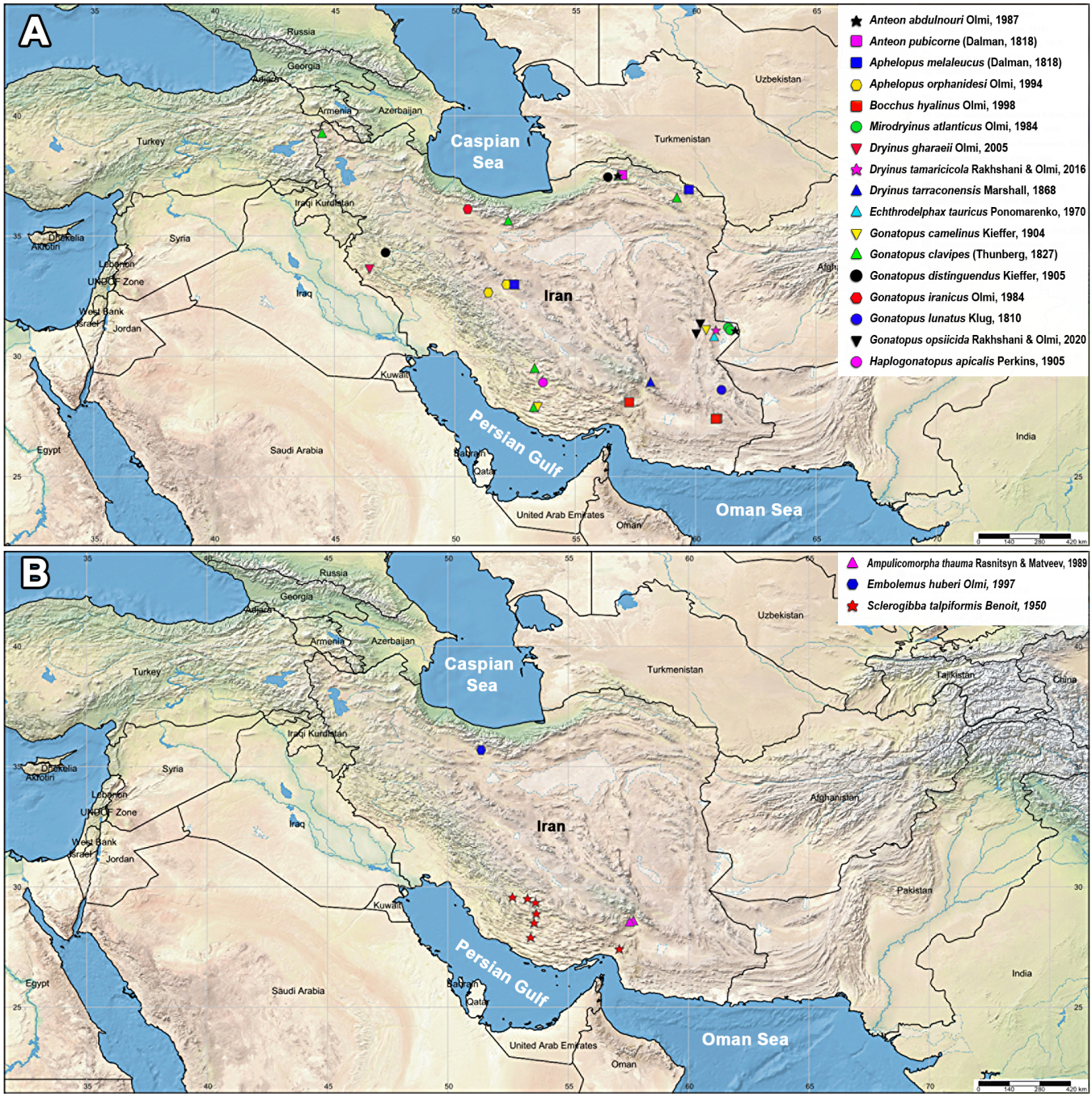

Figure 2. Distribution map for Chrysidoidea of Iran. **A.** Dryinidae; **B.** Embolemidae and Sclerogibbidae.

Distribution in Iran: Tehran province (Olmi, 1997; Ghafouri Moghaddam et al., 2022).

General Distribution: Palaearctic (Iran - Olmi, 1997, Ghafouri Moghaddam et al., 2022; Kirghizstan (**New record)**; Turkey (**New record)**; Turkmenistan (**New record**)).

Family Sclerogibbidae Ashmead 1902

Genus *Sclerogibba* Riggio & De Stefani-Perez, 1888

Sclerogibba Riggio & De Stefani-Perez, 1888:19. Type species: *Sclerogibba crassifemorata* Riggio & De Stefani-Perez, 1888, by monotypy.

Sclerogibba talpiformis Benoit, 1950

Sclerogibba talpiformis Benoit, 1950: 133, ♀. – MRAC, Congo, Sankuru.

Distribution in Iran: Fars and Hormozgan provinces (Fallahzadeh et al., 2017).

General Distribution: Afrotropical (Botswana, Burkina Faso, Burma, Congo, Gabon, Namibia, Nigeria, South Africa, Zambia - Olmi, 2005a; Central African Republic, Uganda - Olmi et al., 2015, 2016; Kenya, Kameron, Mali, Mozambique, Zimbabwe, Yemen - Olmi et al., 2015), Nearctic (USA), Neotropical (Brazil), Oriental (India), and Palaearctic (Pakistan, Tunisia) (Olmi, 2005a).

DISCUSSION

Summarizing the published data revealed the occurrence of 54 species of Chrysidoidea (excluding Chrysididae) in Iran from the family Bethylidae (16 genera, 34 species); Dryinidae (8 genera, 17 species; Embolemidae (2 genera, 2 species), and Sclerogibbidae (1 genus, 1 species). Until now, no species of the families Plumariidae and Scolebythidae have been recorded from Iran. Both families comprise a few extant genera and species mainly distributed in the southern hemisphere (Azevedo, 1999; Carpenter, 1999). Two known species of Embolemidae from Iran, *Ampulicomorpha thauma* and *Embolemus huberi* have a Palaearctic distribution. The latter was supposed an endemic species to Iran, until the new evidence confirmed a wider occurrence in central (Kirghizstan, Turkmenistan) and western Asia (Turkey). A single species of Sclerogibbidae, *Sclerogibba talpiformis* from Iran (Fallahzadeh et al., 2017) is widely distributed in the Palaearctic, Afrotropical, Nearctic, Neotropical and Oriental regions. The known Bethylidae species from Iran certainly represent a very small piece of the world fauna (2,920 species), with the elements, their distribution is mainly known only in the Palaearctic region (Fig. 3). Two species including *Anaylax integer* and *Botoryan discolor* were also found in the Oriental region (India). On the other hand, there are some species including *Cephalonomia tarsalis*, *Laelius pedatus*, *Rysepyris glabratus*, and *Rysepyris sylvanidis*, with an area of distribution in at least four zoogeographical regions. This wide range of distribution is essentially connected with the habitat of their host insects, mainly as stored products (Amante et al., 2017), which are widely transported worldwide (Hulme, 2009). *Rysepyris angusticollis* was originally described from Iran (Kieffer & Marshall, 1906), and can be considered as an endemic species. It has never been recorded after its original description anywhere.

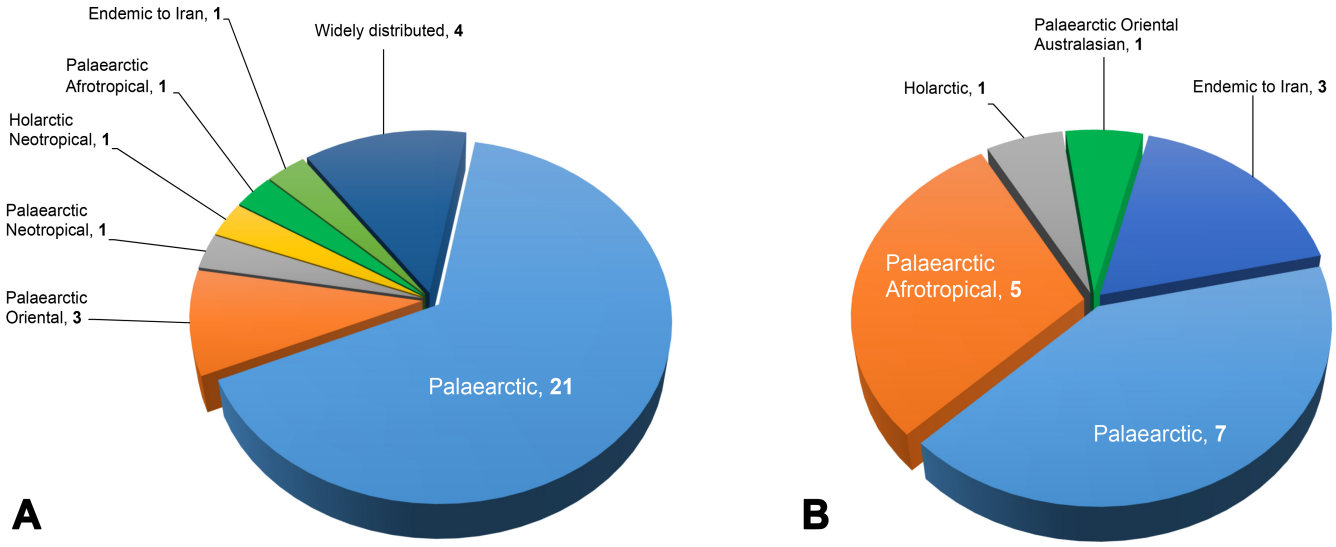

Figure 3. Biogeographical distribution of the known species from Iran. **A.** Bethylidae; **B.** Dryinidae.

Of the seventeen species of Dryinidae, the knowledge of the distribution of ten species is yet limited to the Palaearctic regions, but there are five species that have a known distribution if the north of the Afrotropical region (Arabian peninsula). A wider expansion in the range of distribution both inside and outside of the Palaearctic region is expected for the Dryinidae of Iran to be investigated by subsequent research, at least within the adjacent countries (Ponomarenko & Olmi, 2006; Guglielmino et al., 2019; Speranza et al., 2021). Despite the importance and diversity of bethylids, it seems that least attempts have been done to study their fauna in Iran. The polarity in distributions of the recorded species (Fig. 1), indicated the sporadical works were focused on the small areas in the north-west (Samadi Afshar et al., 2012, 2013) and a few spots in the south-central (Ehteshami et al., 2010, 2013; Kiany et al., 2020) parts of the country. It means almost the whole parts of the country including various open or cryptic habitats for the bethylids are yet unknown. In the same way, the whole assemblage of the known Dryinidae from Iran is limited to 17 species, half of them are recently recorded from the Eastern and Southeastern parts of the country (Derafshan et al., 2016, 2017, 2020, 2021). Since the basic knowledge of the dryinid fauna of Iran (Olmi, 1984, 2005b, Olmi & Xu, 2015) was also limited to very small areas, the major part of the country still remains unexplored (Fig. 2).

Due to the fact that some species of the Bethylidae are parasitoids of the stored product pests, they can spread into different regions of the world through transportation of the infested seeds and consequently occur outside the range of native distribution (Hulme, 2009). On the other hand, there are a series of Bethylidae species recorded from Iran on the basis of inadequate or irrelevant evidence. The invalid name, *Epyris penetatus* Kieffer was improperly listed in the bethylids fauna of Iran (Azevedo et al., 2010), while this species does not really exist. *Cephalonomia waterstoni* has a discrete distribution in Canada, Australia and western Europe, but have never recorded in Asian countries, except by an irrelevant record from Iran (Eyidozehi et al., 2013). The other cases are based on the specimens that have never gone through the trustable identification by the expert taxonomist, either with unclear statements about depositories for the voucher specimens. Besides the absence of taxonomic clues for supporting the reliability of these records, the irrelevancy (Eyidozehi et al., 2013; Sakenin et al., 2011; or lacking a peer-review process (Ghahari et al., 2008; Sakenin et al., 2011; Ghahari & Lim, 2012, 2018) in the of the periodicals, led to the suspension of this erroneous records from the bethylid fauna of Iran (Table 1). Additional works are necessary to be done for confirming the occurrences of these species by field samplings through the same regions or by getting access to the examined specimens.

Table 1. Irrelevant records of Bethylidae species that suspended from the list of Iranian fauna.

Excluded species	References	Zoogeographical distribution
Anaylax moczari (Nagy, 1968)	(Ghahari & Lim, 2018)	Palaearctic
Bethylus cephalotes (Forster, 1860)	(Ghahari et al., 2008)	Palaearctic
Cephalonomia gallicola (Ashmead, 1887)	(Ghahari & Lim, 2012, 2018)	Palaearctic
Cephalonomia waterstoni (Gahan, 1931)	(Eyidozehi et al., 2013)	Australasian, Nearctic, Palaearctic
Epyris fuscipes (Kieffer, 1906)	(Ghahari & Lim, 2012)	Palaearctic
Epyris penetatus Kieffer	(Azevedo et al., 2010)	Palaearctic (Iran)
Epyris punctatus (Kieffer, 1906)	(Ghahari et al., 2008)	Palaearctic
Goniozus indicus Ashmead, 1903	(Sakenin et al., 2011)	Oriental, Madagascan
Laelius microneurus (Kieffer, 1906)	(Ghahari et al., 2008)	Palaearctic
Ukayakos obscurus (Kieffer, 1906)	(Ghahari & Lim, 2018)	Palaearctic

AUTHOR'S CONTRIBUTION

The authors confirm their contribution in the paper as follows: H.B.: Compiling the species records and their distribution, and generating the distributional maps.; N.K.: Preparing the early list of bethylids; C.O.A. & M.O: Updating the taxonomy, providing the type data, confirmation of the records and revising the manuscript, E.R. drafting the manuscript and correspondence. All authors read and approved the final version of the manuscript.

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AVAILABILITY OF DATA AND MATERIAL

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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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مرور بالاخانواده Chrysidoidea (Hymnoptera, Aculeata) به استثنای خانواده Chrysididae در ایران

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چکیده: گونه‌های چهار خانواده از زنبورهای بالاخانواده Chrysidoidea شامل Bethylidae، Dryinidae، Embolemidae و Sclerogibbidae گزارش شده از ایران شامل ۵۴ گونه از ۲۷ جنس مرور شدند. خانواده Bethylidae با ۳۴ گونه متعلق به ۱۶ جنس بزرگ‌ترین گروه بوده و پس از آن، خانواده Dryinidae با ۱۷ گونه از ۸ جنس قرار گرفت. زنبورهای Bethylidae گزارش شده از ایران تنها شامل بخش بسیار کوچکی از فون شناخته شده جهانی بوده و عمدتاً در منطقه پالئارکتیک انتشار دارند. در بین ۱۷ گونه زنبورهای Dryinidae، انتشار ده گونه محدود به منطقه پالئارکتیک است، اما ۵ گونه در بخش شمالی منطقه آفروتروپیکال (کشورهای عربی) نیز انتشار دارند. خانواده‌های Embolemidae و Sclerogibbidae هر یک به ترتیب دارای دو و یک گونه در ایران هستند. گونه *Embolemus huberi* Olmi برای اولین بار از کشورهای قرقیزستان، ترکیه و ترکمنستان نیز گزارش شد. تاکنون حضور هیچ گونه‌ای از دو خانوادهٔ Plumariidae و Scolebythidae از ایران ثبت نشده است. علی‌رغم اهمیت و تنوع دو خانواده Bethylidae و Dryinidae به نظر می‌رسد که بررسی بسیار کمی برای شناسایی فون این حشرات در ایران انجام شده است.

واژگان کلیدی: فون، چک‌لیست، بتیلیده، درینیده، امبولمیده، اسکلروگیبیده.