

An updated checklist of the Iranian Miracinae, Pambolinae and Sigalphinae (Hymenoptera: Braconidae)

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Abstract

The Iranian species diversity of three braconid subfamilies, Miracinae (three species from two genera: *Centistidea* Rohwer, *Mirax* Haliday), Pambolinae (one species from one genus, *Pambolus* Haliday) and Sigalphinae (two species from two genera: *Acampsis* Wesmael, *Sigalphus* Latreille) are summarized in this checklist. A faunistic list is given comprising both local and global distribution of each species under study as well as host records.

Keywords: Hymenoptera; Braconidae; Miracinae; Pambolinae; Sigalphinae; checklist; Iran

Resum. *Llista de control de Miracinae, Pambolinae i Sigalphinae (Hymenoptera: Braconidae) d'Iran*

La diversitat d'espècies de tres subfamílies de braconíds, Miracinae (tres espècies de dos gèneres: *Centistidea* Rohwer, *Mirax* Haliday), Pambolinae (una espècie del gènere *Pambolus* Haliday) i Sigalphinae (dues espècies de dos gèneres: *Acampsis* Wesmael i *Sigalphus* Latreille), es resum en aquesta llista de control. S'aporta una llista faunística que inclou la distribució local i global de cada espècie estudiada, així com registres dels hostatgers.

Paraules clau: Hymenoptera; Braconidae; Miracinae; Pambolinae; Sigalphinae; llista de control; Iran

Introduction

Miracinae Viereck, 1918 is a small cosmopolitan subfamily in the family Braconidae, with currently 47 described species in two genera, *Centistidea* Rohwer, 1914 and *Mirax* Haliday, 1833 (Yu et al., 2012; Papp, 2013; Cauich-Kumul et al., 2014;

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Farahani et al., 2014); of which 17 species are known from the Palaearctic region (Yu et al., 2012; Farahani et al., 2014). It has been formerly included in the subfamily Microgastrinae by several authors (e.g. Nixon, 1965; Čapek, 1970; Huddleston, 1978) until being raised to a subfamily level by van Achterberg (1984). The genus *Centistidea* has been synonymized with *Mirax* by some authors (Muesebeck, 1922; Papp, 2013), but treated as a separate genus by many others (Chen et al., 1997; Pentead-Dias, 1999; van Achterberg & Mehrnejad, 2002; Yu et al., 2012; Farahani et al., 2014). Miracinae is placed in the Microgastroid complex (Murphy et al., 2008; Sharanowski et al., 2011) and this is strongly supported in most molecular analyses.

Miracines are small, squat and fairly dark insects, recognized by their 14-segmented antenna; absence of occipital carina; vein 2-SR of fore wing connected with pterostigma or nearly so; hind wing with strongly oblique cu-a vein; the absence of prepectal carina; notum of metasomal T1 strongly narrowed towards apex and medially; the absence of scutellar sulcus; metasoma with an inverted Y-shaped structure formed by the sclerotized part of the first metasomal tergites surrounded by lateral membranous areas (Shaw & Huddleston, 1991; van Achterberg 1984, 1993; Farahani et al., 2014). They are koinobiont endoparasitoids attacking small leaf-mining lepidopterous caterpillars of different families (van Achterberg, 1993; Farahani et al., 2014).

In Iran, the subfamily Miracinae is represented by three species, *Centistidea (Paracentistidea) pistaciella* van Achterberg & Mehrnejad, 2002; *Mirax caspiana* Farahani, Talebi, van Achterberg & Rakhshani, 2014 and *Mirax rufilabris* Haliday, 1833 (van Achterberg & Mehrnejad, 2002; Mehrnejad & Basirat, 2009; Fallahzadeh & Saghaei, 2010; Ghahari et al., 2011; Farahani et al., 2014; Samin et al., 2016).

The cosmopolitan Pambolinae Marshall, 1885 is a small subfamily of the family Braconidae. It comprises about 53 species in five genera and two tribes (Chremylini and Pambolini) (Martínez et al., 2012; Yu et al., 2012), of which 12 species are known from the Palaearctic region (Yu et al., 2012). DNA studies revealed that Pambolinae is a derived group than the groups of subfamilies Hormiinae, Lysiterminae and Betylobraconinae (Belshaw et al., 2000; Braet & van Achterberg, 2003).

Pambolines are diagnosed by the following combination of characters: antenna 11-14 segmented, if more than 14, then labrum sculptured; propodeum with two lateral spines, if absent, then first metasomal tergite greatly widened posteriorly; hypoclypeal depression present; labrum usually nearly flattened; metasomal first and second tergites with large flap-like epipleura (van Achterberg, 1993, 1995; Wharton, 1993).

They are frequently gregarious idiobiont ectoparasitoids of larval Coleoptera and Lepidoptera (van Achterberg, 1993, 1995). Among Coleoptera, some records indicate that chrysomelid larvae are their hosts (Shaw & Huddleston, 1991; Zaldívar-Riverón & Quicke, 2002). The hosts in most cases are unknown (Martínez et al., 2012).

Iranian Pambolinae is represented by a single species, *Pambolus (Phaenodus) pallipes* Foerster, 1862 (Belokobylskij, 1998; Fallahzadeh & Saghaei, 2010).

The cosmopolitan Sigalphinae Haliday, 1833 is a small subfamily of the family Braconidae. It comprises 40 species in eight genera (Yu et al., 2012; van

Achterberg, 2014), of which 13 species in the two genera *Acampsis* Wesmael, 1835 and *Sigalphus* Latreille, 1802, are known from the Palaearctic region (Yu et al., 2012).

Because of the form of its metasomal carapace, sigalphines were formerly and traditionally regarded as chelonines (Shaw & Huddleston, 1991). They differ from chelonines mainly by their carapace which is articulated between first and second tergites (Shaw & Huddleston, 1991).

Sigalphines are diagnosed by their dark colours; the first sculptured three metasomal tergites form a shield that largely or completely conceal the following tergites; ovipositor short, more or less curved, without teeth, nodus or notch; ovipositor sheath usually widened (but slender in *Afrocampsis*); occipital carina reduced either completely (as in *Acampsis*) or only medially; prepectal ridge present; notaulices are deep, resulting in the convex middle lobe of mesoscutum as those of lateral lobes; prescutellar depression absent; pronotum with lateral and dorsal pronope; trochantelli present, without small pegs; dorsal carina of first metasomal tergite strongly developed; marginal cell of fore wing short (van Achterberg, 1976, 1990, 1993; van Achterberg & Austin, 1992; Tobias, 1986).

Little is known about the biology of the sigalphine braconids (van Achterberg & Austin, 1992). But are the sole koinobiont endoparasitoids of lepidopterous larvae of the families Noctuidae and Geometridae (van Achterberg, 1984, 1990, 1993; Quicke & van Achterberg, 1990; van Achterberg & Austin, 1992; Tobias, 1986; Yu et al., 2012; Sharanowski et al., 2014). Ovo-larval parasitism may also occur in correlation with the carapace-like metasoma of its members (van Achterberg & Austin, 1992).

The subfamily Sigalphinae is represented in Iran by two species, *Acampsis alternipes* (Nees, 1816) and *Sigalphus irrorator* (Fabricius, 1775) (Ghahari et al., 2010; Samin et al., 2015, 2016).

Material and methods

The published data on the subfamilies Miracinae, Pambolinae and Sigalphinae from Iran are summarized. Classification and general distribution of the different taxa follows Yu et al. (2012) with some up-dates, and in other situations the related references are given. Names of the valid genera are listed alphabetically within tribes, and valid species names are listed alphabetically within the genera. The following data are included: the valid taxa names, published records within provincial distribution, when the locality is not available "Iran (no specific locality)" is given, general distribution and host records.

Results

Three subfamilies of Iranian Braconidae including, Miracinae, Pambolinae and Sigalphinae are discussed in this checklist. In total of three species for Miracinae, one species for Pambolinae, and two species for Sigalphinae are listed as the fauna of Iran.

Subfamily Miracinae Viereck, 1918

Genus *Centistidea* Rohwer, 1914

Centistidea (Paracentistidea) pistaciella van Achterberg & Mehrnejad, 2002
Distribution in Iran: Kerman (van Achterberg & Mehrnejad, 2002; Mehrnejad & Basirat, 2009), Iran (no specific locality) (Fallahzadeh & Saghaei, 2010).

General distribution: So far from Iran (van Achterberg & Mehrnejad, 2002; Mehrnejad & Basirat, 2009; Yu et al., 2012).

Hosts: It has been reported from *Kermania pistaciella* Amsel (Lepidoptera: Oinophylidae), a minor pest in pistachio orchards *Pistacia vera* in Iran (van Achterberg & Mehrnejad, 2002; Yu et al., 2012).

Genus *Mirax* Haliday, 1833

Mirax caspiana Farahani, Talebi, van Achterberg & Rakhshani, 2014

Distribution in Iran: Guilan, Mazandaran (Farahani et al., 2014).

General distribution: So far from Iran (Farahani et al., 2014).

Host records. Unknown.

Mirax rufilabris Haliday, 1833

Distribution in Iran: Chaharmahal & Bakhtiari (Samin et al., 2016), Isfahan (Ghahari et al., 2011 as *M. dryochares* Marshall).

General distribution: Armenia, Azerbaijan (Yu et al., 2012), Bulgaria, Canary Islands, France, Lithuania, Slovakia (Yu et al., 2012; van Achterberg, 2013), Moldova, Romania, Ukraine (Yu et al., 2012), Austria, Finland, Ireland, Poland, Sweden (Shenefelt, 1973a under Microgastrinae; Yu et al., 2012; van Achterberg, 2013), Caucasus, Russia (Shenefelt, 1973a under Microgastrinae; Tobias, 1986; Yu et al., 2012), Croatia (Papp, 2010; Yu et al., 2012), Czech Republic (Shenefelt, 1973a under Microgastrinae; Papp, 1984, 2011-2012 all as *M. dryochares* Marshall; Lozan et al., 2010; Yu et al., 2012; van Achterberg, 2013), England (Haliday, 1833; Dalla Torre, 1898 under Microgastrinae; Shenefelt, 1973a under Microgastrinae; Shaw & Askew, 1976; Yu et al., 2012; van Achterberg, 2013; Broad et al., 2016), Germany (Dalla Torre, 1898 under Microgastrinae; Shenefelt, 1973a under Microgastrinae; Belokobylskij et al. 2003; Papp, 2011-2012 as *M. dryochares* Marshall; Yu et al., 2012; van Achterberg, 2013), Greece (Papp, 2003, 2015; Papp, 2007 as *M. dryochares* Marshall; Yu et al., 2012; van Achterberg, 2013), Hungary (Papp, 1984, 2007, 2011-2012 all as *M. dryochares* Marshall; Papp, 2008; van Achterberg, 2013), Israel (Papp, 2011-2012 as *M. dryochares* Marshall), Italy (Yu et al., 2012; van Achterberg, 2013; Papp, 2015), Poland (Marczak & Buszko, 1993 as *M. dryochares* Marshall and as *M. rufilabris* Haliday; van Nieukerken et al., 2004; van Achterberg, 2013), Madeira Islands (van Achterberg & Aguiar, 2009; Yu et al., 2012; van Achterberg, 2013), Malta (Papp, 2015), Netherlands (van Achterberg, 2013), Scotland (Shaw & Askew, 1976;

Broad et al., 2016), Spain (van Nieukerken, 2007; Yu et al., 2012; van Achterberg, 2013; Papp, 2015), Switzerland (Dalla Torre, 1898 under Microgastrinae), Turkey (Beyarslan, 2009; Özgen et al., 2012; Yu et al., 2012; Papp, 2015).

Host records: It was reported attacking *Ectoedemia septembrella* (Stainton) (Lepidoptera: Nepticulidae) on *Hypericum hirsutum* Linnaeus and *Stigmella microtheriella* (Stainton) (Lepidoptera: Nepticulidae) on *Carpinus betulus* Linnaeus (Papp, 2008). In Malta, it has been reared from the larvae of *Ectoedemia euphorbiella* (Stainton) and *Stigmella aurella* (Fabricius) (Lepidoptera: Nepticulidae) as well as an unidentified nepticulid species feeding on *Rhamnus lycioides* (Papp, 2015). Shenefelt (1973a) reported *Ectoedemia septembrella* (Stainton), *S. prunetorum* (Stainton), *S. microtheriella* (Stainton), *S. atricapitella* (Haworth), *S. salicis* (Stainton), *S. agrimonia* Frey, *Parafomoria cistivora* (Peyerimhoff), *S. tityrella* (Stainton), *Nepticula* sp., *Stigmella thuringiaca* (Petty), *Ectoedemia hexapetalae* (Szöcs) (Lepidoptera: Nepticulidae). In Poland, it has been reported from *Ectoedemia agrimoniae* (Frey) on *Agrimonia eupatoria*, *E. weavri* (Stainton) on *Vaccinium vitis-idaea*, *Ectoedemia septembrella* (Stainton) on *Hypericum perforatum*, *Stigmella aeneofasciella* (Herrisch-Schäffer) on *Agrimonia eupatoria*, *Ectoedemia hannoverella* (Glitz) on *Populus nigra* (Lepidoptera: Nepticulidae) (Marczak & Buszko, 1993). In Spain, it is reared from *Acalypttris minimella* (Rebel) (Lepidoptera: Nepticulidae) (van Nieukerken, 2007); it was also reported from *Trifurcula pallidella* (Duponchel) (Lepidoptera: Nepticulidae) (van Nieukerken et al., 2004). In Turkey, it is reported as a larval-pupal parasitoid of Pistachio twig borer *kermania pistaciella* Amsel (Lepidoptera: Oinophilidae) (Özgen et al., 2012).

Subfamily Pambolinae Marshall, 1885

Genus *Pambolus* Haliday, 1836

Pambolus (*Phaenodus*) *pallipes* (Foerster, 1862)

Distribution in Iran: Iran (no specific locality) (Belokobylskij, 1998; Fallahzadeh & Saghaei, 2010).

General distribution: Central Europe (Belokobylskij, 1998 as *Phaedrus pallipes* under Exothecinae). Bulgaria, Hungary, Italy, Lithuania (Yu et al., 2012; van Achterberg, 2013), Finland, Japan, Kazakhstan, Korea, Slovenia, Sweden, Tajikistan, former Yugoslavia (Yu et al., 2012), Czech Republic (Lozan et al., 2010 as *Phaenodus pallipes* under Exothecinae; Yu et al., 2012; van Achterberg, 2013), England, Scotland (Belokobylskij, 1986; Yu et al., 2012; Broad et al., 2016), Germany (Dalla Torre, 1898 as *Phaenodus pallidipes* Marshall; Dahl, 1912 as *Parapambolus rufigaster*; Belokobylskij et al., 2003 as *Phaenodus pallipes*; Yu et al., 2012; van Achterberg, 2013), Moldova, Ukraine (Tobias, 1986 under Doryctinae; Belokobylskij, 1998 as *Phaedrus pallipes* under Exothecinae; Yu et al., 2012; van Achterberg, 2013), Russia (Tobias, 1986 as *P. pallipes* f. *magnus* Tobias under Doryctinae; Belokobylskij, 1998 as *Phaedrus pallipes* under Exothecinae; Yu et

al., 2012; van Achterberg, 2013), Spain (Docavo, 1960 as *Phaenodus chalveri*; Tobias, 1986 as *P. chalveri* Docavo; Yu et al., 2012; van Achterberg, 2013), Turkey (Yu et al., 2012; Beyarslan, 2015 under Doryctinae).

Hosts: Unknown.

Subfamily Sigalphinae Haliday, 1833

Genus *Acampsis* Wesmael, 1835

Acampsis alternipes (Nees, 1816)

Distribution in Iran: West Azarbaijan (Samin et al., 2016).

General distribution: Western Palaearctic species (van Achterberg & Austin, 1992). Austria, Netherlands (Dalla Torre, 1898 under Cheloninae; Shenefelt, 1973b under Cheloninae; Yu et al., 2012; van Achterberg, 2013), Belgium (Wesmael, 1835 as *Rhitigaster alternipes*; Dalla Torre, 1898 under Cheloninae; Shenefelt, 1973b under Cheloninae; Braet, 1997; Yu et al., 2012; van Achterberg, 2013), Bulgaria, Italy (Yu et al., 2012; van Achterberg, 2013), Moldova, former Yugoslavia (Yu et al., 2012), France, Poland, Switzerland (Shenefelt, 1973b under Cheloninae; Yu et al., 2012; van Achterberg 2013), Czech Republic (Shenefelt, 1973b under Cheloninae; Čapek, 1975; van Achterberg, 2013), England (Shenefelt, 1973b under Cheloninae; Shaw & Huddleston, 1991; van Achterberg, 2013; Broad et al., 2016), Germany (Dalla Torre, 1898 under Cheloninae; Shenefelt, 1973b under Cheloninae; Belokobylskij et al., 2003; Yu et al., 2012; van Achterberg, 2013), Hungary (Shenefelt, 1973b under Cheloninae; Papp 2006, 2008; Yu et al., 2012; van Achterberg, 2013), Macedonia (Papp, 2010; Yu et al., 2012), Russia (Shenefelt, 1973b under Cheloninae; Tobias, 1986; Yu et al., 2012; van Achterberg, 2013).

Host records: *Acampsis alternipes* is reported as a koinobiont endoparasitoid of the geometrid moth *Alsophila* Hübner (Lepidoptera: Geometridae) (Shaw & Quicke, 2000). Okyar & Mironov (2008) and Yu et al. (2012) reported *Alsophila aceraria* (Denis & Schiffermüller, 1775), *A. aescularia* (Denis & Schiffermüller, 1775), *Erannis defoliaria* (Clerck, 1759), *Operophtera brumata* (Linnaeus, 1758) (Lepidoptera: Geometridae). In Czech Republic (Čapek, 1975) and England (Shaw & Huddleston, 1991), it has been reared from *Alsophila* sp. (Lepidoptera: Geometridae).

Genus *Sigalphus* Latreille, 1802

Sigalphus irrorator (Fabricius, 1775)

Distribution in Iran: Golestan (Ghahari et al., 2010; Samin et al., 2015).

General distribution: Palaearctic region (Sharkey & Janzen, 1995; van Achterberg & Austin, 1992; van Achterberg, 2002, 2014). Austria, Italy, Latvia, Netherlands, Spain, Sweden (Shenefelt, 1973b under Cheloninae; Yu et al., 2012; van

Achterberg, 2013), Belgium (Wesmael, 1835 as *Rhitigaster irrorator*; Shenefelt, 1973b under Cheloninae, Sigalphini; Braet, 1997; Yu et al., 2012; van Achterberg, 2013), Croatia (Papp, 2010; Yu et al., 2012), former Czechoslovakia, Finland, Korea, Switzerland, Ukraine (Yu et al., 2012), France (Geoffroy in Fourcroy 1785 as *Ichneumon globulifer* Fourcroy & Geoffroy, 1785; Shenefelt, 1973b under Cheloninae; Yu et al., 2012; van Achterberg, 2013), Germany (Shenefelt, 1973b under Cheloninae, Sigalphini; Belokobylskij et al., 2003; Yu et al., 2012; van Achterberg, 2013), Hungary (Papp, 2008; Yu et al., 2012), Japan (Watanabe, 1937 under Cheloninae; Shenefelt, 1973b under Cheloninae, Sigalphini; Tobias, 1986; Yu et al., 2012), Poland, Romania (Yu et al., 2012; van Achterberg, 2013), Russia (Tobias, 1986; Lelej, 2012; Yu et al., 2012), Slovakia (Shenefelt, 1973b under Cheloninae, Sigalphini; Schlarmannová & Lukás 2004 under Cheloninae).

Host records: *Acronicta aceris* (Linnaeus, 1758), *A. psi* (Linnaeus, 1758), *A. tridens* (Denis & Schiffermüller, 1775), *Calophasia lunula* (Hufnagel, 1766), *Lacanobia pisi* (Linnaeus, 1758) (Lepidoptera: Noctuidae) (Shenefelt, 1973b; Tobias, 1986; Lelej, 2012; Yu et al., 2012). In Europe, it has been recorded from noctuids, especially from the genus *Acronicta* (Lepidoptera: Noctuidae) (Shaw & Huddleston, 1991).

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