

**SOME RECORDS OF PARASITOID WASPS ASSOCIATED
WITH GALL WASPS (HYMENOPTERA: CYNIPIDAE)
IN ISTANBUL, TURKEY**

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ABSTRACT: Cynipid galls, represent physically bounded microcosms for parasitoid wasps along with other inhabitants of galls, such as gall wasps and phytophagous inquilines. In the current work, 11 parasitoid species and one seed-feeder were identified belonging to five families; Eurytomidae, Ormyridae, Pteromalidae, Torymidae, and Ichneumonidae. The species *Torymus cerri* Mayr and *T. notatus* (Walker) are new records for Turkey. In addition, some new associations between parasitoid wasp species and host cynipid galls were recorded.

KEY WORDS: Hymenoptera, parasitoid wasps, Chalcidoidea, Ichneumonidae, gall wasps, Cynipidae, new records

Parasitoid lifestyle is one of the most remarkable characteristics which can be seen among the order Hymenoptera, and the parasitoid wasps have a high species diversity besides a wide range of hosts. Approximately 200 species of hymenopteran parasitoids associated with gall wasps are known in the Western Palaearctic (Askew, 1961; Fulmek, 1968; Graham & Gijswit, 1998).

Cynipid gall wasps (Hymenoptera: Cynipidae) induce complex plant galls on oaks, roses, and a wide diversity of other plants (Csóka et al., 2005). Each species induce a characteristic gall structure, and these structural traits represent the extended phenotypes of the gall wasp genes (Crespi et al., 1997; Stern, 1995). Studies support a defensive role for several gall traits on the outer gall tissues such as sticky resins and spines (Bailey et al., 2009; Stone & Cook, 1998). However, even they have surrounded by protective gall tissues, cynipid galls host diverse communities consisting parasitoids, inquilines, and predators. The mortality rates of the gall wasps can reach to 90% with mutual effects of parasitoids and inquilines (Hawkins et al., 1988; Shorthouse et al., 2005; Stone et al., 1995).

There is an increasing number of studies about the gall wasp fauna in Turkey and new records are continuing to be added on this knowledge (Azmaz & Katılmış, 2015, 2017a; Dinç et al., 2014; Güçlü et al., 2008; Katılmış & Kiyak, 2009a,b, 2010, 2011a,b,c,d,e, 2012; Kemal & Koçak, 2010; Kiyak et al., 2008; Kiyak & Katılmış, 2010; Koçak & Kemal, 2012; Melika & Stone, 2001; Melika et al., 2004; Mete & Demirsoy, 2012; Mutun & Dinç, 2011, 2015; Mutun et al., 2014). Recently, Azmaz & Katılmış (2017b) have listed 148 species of cynipid gall wasps

in Turkey. There are also some studies on the parasitoid wasps related with cynipid galls in Turkey (Bayram et al., 1998; Boyadzhiev et al., 2017; Çoruh et al., 2004; Doğanlar, 1984, 1990, 2014, 2016, 2017; Doğanlar & Çam, 1991; Kılınçer, 1983; Özbek et al., 1999; Mete & Mergen, 2016, 2017). All of the parasitoids associated with cynipid galls in Western Palaearctic are listed in Askew et al. (2006, 2013) and Lotfalizadeh et al. (2007, 2012).

Here, we aimed to contribute to the knowledge on parasitoid wasps associated with gall wasps in Istanbul, the west of Turkey.

MATERIALS AND METHODS

All gall specimens on host plants were collected from different localities in Istanbul between 2012 and 2013 by MA and YK. Gall specimens were kept in laboratory conditions and checked weekly for emerged wasps. Adult gall wasps and parasitoids were subsequently fixed in ethanol. The adults were then air-dried, fixed on cards (5x10 mm), and pinned. Reared wasp specimens were identified using the works of Bouček and Rasplus (1991), Goulet & Huber (1993), Graham & Gijswijt (1998), Lotfalizadeh et al. (2006), Melika (2006), Noyes (2017), Roques & Skrzypczynska (2003), Yu et al. (2012), and Zerova & Seryogina (1999, 2006). Identifications were made by HL and OM.

Specimens are deposited in insect collection of the Department of Plant Protection, East-Azerbaijan Research & Education Center for Agriculture & Natural Resources, Tabriz, Iran.

RESULTS

Family Eurytomidae

Eurytoma caninae Lotfalizadeh & Delvare, 2007

Materials examined: İSTANBUL, Eyüp, Belgrad Forest, Binbaşı Çeşmesi Promenade, 41°09'N, 28°55'E, 50 m, 20.X.2012, galls of *Diplolepis nervosa*, on *R. canina*, emerged 01.II.2013, 1♀; Pendik, Aydos Forest, 40°55'N, 29°15'E, 313 m, 19.X.2012, galls of *D. nervosa*, on *R. canina*, emerged 30.XII.2012, 1♀.

Scyophila biguttata (Swederus, 1795)

Materials examined: İSTANBUL, Beykoz, Kaynarca, 41°10'N, 29°09'E, 135 m, 03.III.2013, galls of *C. quercusfolii*, on *Q. frainetto*, 1♀.

Family Ormyridae

Ormyrus nitidulus (Fabricius, 1804)

Materials examined: İSTANBUL, Beykoz, Anadolu Feneri, 41°12'N, 29°09'E, 68 m, 31.V.2013, galls of *A. curvator*, on *Q. frainetto*, 2♂♂; Çatalca, Binkılıç-Yalıköy 12. km, 41°29'N, 28°13'E, 207 m, 25.XI.2012, galls of *C. quercusfolii*, on *Q. frainetto*, 1♂; Eyüp, Belgrad Forest, Falih Rıfki Atay-Ayvad Bendi Promenade 4. km, 41°11'N, 28°55'E, 83 m, 20.X.2012, galls of *C. quercusfolii*, on *Q. frainetto*, 2♀♀; Eyüp, Kemerburgaz, Odayeri, 41°14'N, 28°51'E, 120 m, 20.X.2012, galls of *A. galeatus*, on *Q. petraea*, 1♂; Pendik, Aydos Forest, 40°55'N, 29°15'E, 360 m, 19.X.2012, galls of *C. quercusfolii* and *A. gallaearnaeformis*, on *Q. infectoria*, 2♀♀; Silivri, Danamandıra-Yaylacık 3. km, 41°19'N, 28°14'E, 177 m, 25.XI.2012, galls of *Ap. cerricola*, on *Q. cerris*, 7♀♀, 2♂♂; Şile, Çayırbaşı-Yeniköy 2. km, 41°08'N, 29°39'E, 150 m, 24.XI.2012, galls of *A. conglomeratus*, on *Q. infectoria*, 1♂; Şile, Korucu-Kalealtı 3. km, 41°07'N, 29°32'E, 30 m, 03.III.2013, galls of *Andricus* sp., on *Quercus* sp., 2♂♂; Şile, Korucu-Kalealtı 7. km, 41°07'N, 29°30'E, 40 m, 03.III.2013, galls of *A. mitratus*, on *Q. petraea*, 1♀; Şile, Kurna-Karakiraz 1. km, 41°11'N, 29°21'E, 88 m, 03.III.2013, galls of *A. glutinosus*, on *Q. frainetto*, 1♀; Şile, Sortullu-Hacılı 1.

km, Doğan Yuvası Fire Watch-Tower, 41°03'N, 29°43'E, 308 m, 24.XI.2012, galls of *A. lucidus*, on *Q. cerris*, 1♂.

Family Pteromalidae

Pteromalus bedeguaris Thomson, 1878

Materials examined: İSTANBUL, Silivri, Çeltik-Çerkezköy 3. km, 41°08'N, 28°06'E, 122 m, 25.XI.2012, galls of *Diplolepis rosae*, on *R. canina*, emerged 25.I.2013, 06.V.2013, 9♀♀, 1♂.

Family Torymidae

Bootanomyia almusiensis (Doğanlar, 1989)

Materials examined: İSTANBUL, Şile, Sofular-Doğançalı 1. km, 41°10'N, 29°29'E, 21 m, 03.III.2013, galls of *Synophrus politus*, on *Q. cerris*, 1♀.

Bootanomyia stigmatizans (Fabricius 1789)

Materials examined: İSTANBUL, Şile, Akçakese-Kabakoz 2. km, 41°08'N, 29°41'E, 14 m, 02.III.2013, galls of *A. quercustozae*, on *Q. infectoria*, 1♂.

Glyphomerus stigma (Fabricius, 1793)

Materials examined: İSTANBUL, Sarıyer, Gümüşdere-Bahçeköy 2. km, 41°13'N, 28°58'E, 90 m, 04.III.2013, galls of *D. rosae*, on *R. canina*, emerged 18.VI.2013, 4♀♀; Sarıyer, Rumelifeneri, İstanbul Villas, 41°14'N, 29°06'E, 40 m, 04.III.2013, galls of *D. rosae*, on *R. canina*, emerged 18.VI.2013, 1♀, 1♂.

Megastigmus rosae Bouček, 1971

Materials examined: İSTANBUL, Sarıyer, Gümüşdere-Bahçeköy 2. km, 41°13'N, 28°58'E, 90 m, 04.III.2013, galls of *D. rosae*, on *R. canina*, emerged 18.VI.2013, 7♀♀; Sarıyer, Rumelifeneri, İstanbul Villas, 41°14'N, 29°06'E, 40 m, 04.III.2013, galls of *D. rosae*, on *R. canina*, emerged 18.VI.2013, 21♀♀; Şile, Korucu-Kalealtı 7. km, 41°07'N, 29°30'E, 40 m, 03.III.2013, galls of *D. rosae*, on *R. canina*, emerged 18.VI.2013, 1♀; Şile, Sofular, 41°10'N, 29°29'E, 37 m, 03.III.2013, galls of *D. rosae*, on *R. canina*, emerged 18.VI.2013, 3♀♀; Şile, Yeşilvadi-Sofular 2. km, 41°08'N, 29°28'E, 140 m, 03.III.2013, galls of *D. rosae*, on *R. canina*, emerged 18.VI.2013, 4♀♀.

Torymus bedeguaris (Linnaeus, 1758)

Materials examined: İSTANBUL, Arnavutköy, Tayakadın, Tayakadın Promenade 2, 41°14'N, 28°41'E, 178 m, 30.V.2013, galls of *D. rosae*, on *R. canina*, emerged 18.VI.2013, 12♀♀, 2♂♂; Beykoz, Hz. Yûşa Tomb, 41°09'N, 29°05'E, 169 m, 31.V.2013, galls of *D. spinosissimae*, on *R. canina*, emerged 18.VI.2013, 3♀♀, 1♂; Silivri, Çeltik-Çerkezköy 3. km, 41°08'N, 28°06'E, 122 m, 25.XI.2012, galls of *D. rosae*, on *R. canina*, emerged 25.I.2013, 06.V.2013, 2♀♀, 1♂; Şile, Yeşilvadi-Sofular 2. km, 41°08'N, 29°28'E, 140 m, 03.III.2013, galls of *D. rosae*, on *R. canina*, emerged 18.VI.2013, 2♀♀, 1♂.

Torymus cerri Mayr, 1874

Materials examined: İSTANBUL, Şile, Sofular-Doğançalı 1. km, 41°10'N, 29°29'E, 21 m, 03.III.2013, galls of *C. quercusfolii*, on *Q. cerris*, 1♀. New record for the Turkish fauna.

Torymus notatus (Walker, 1833)

Materials examined: İSTANBUL, Şile, Akçakese-Kabakoz 2. km, 41°08'N, 29°41'E, 14 m, 02.III.2013, galls of *C. divisa*, on *Q. frainetto*, 1♀. New record for the Turkish fauna.

Family Ichneumonidae

Orthopelma mediator (Thunberg, 1822)

Materials examined: İSTANBUL, Şile, Yeşilvadi-Sofular 2. km, 41°08'N, 29°28'E, 140 m, 03.III.2013, galls of *D. rosae*, on *R. canina*, emerged 18.VI.2013, 2♀♀, 2♂♂.

DISCUSSION

In the current work, 12 hymenopteran species from five families associated with cynipid galls were identified. One of them, *Megastigmus rosae* (Hymenoptera: Chalcidoidea) is a seed-feeder on *Rosa* spp. (Roques & Skrzypczynska, 2003; Daneshvar et al., 2009). The other specimens which identified here is parasitoid wasps from the superfamilies Chalcidoidea and Ichneumonoidea. Among them, *Ormyrus nitidulus* has the broadest range of associated gall wasp species (Table 1).

The species *T. cerri* and *T. notatus* are new records for Turkey, and their relationship with the galls of *C. quercusfolii* and *C. divisa*, respectively were first defined here. This is also the first record of the association between *O. nitidulus* and *A. gallaearnaeformis*. *Bootanomyia almusiensis* was reared from the oak gall specimens infested by the cynipid species *S. politus*, and the association between these two species is also new for our knowledge. The relation between these species needs to be investigated more detailed in further studies focusing on feeding relationships of the community members.

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Table 1. Hymenopteran species associated with some cynipid gall wasps in Istanbul, Turkey.

Gall wasp species	Family	Species
<i>Andricus conglomeratus</i>	Ormyridae	<i>Ormyrus nitidulus</i>
<i>Andricus curvator</i>	Ormyridae	<i>Ormyrus nitidulus</i>
<i>Andricus galeatus</i>	Ormyridae	<i>Ormyrus nitidulus</i>
<i>Andricus gallaearnaeformis</i>	Ormyridae	<i>Ormyrus nitidulus</i>
<i>Andricus glutinosus</i>	Ormyridae	<i>Ormyrus nitidulus</i>
<i>Andricus lucidus</i>	Ormyridae	<i>Ormyrus nitidulus</i>
<i>Andricus mitratus</i>	Ormyridae	<i>Ormyrus nitidulus</i>
<i>Andricus quercustozae</i>	Torymidae	<i>Bootanomyia stigmatizans</i>
<i>Andricus sp.</i>	Ormyridae	<i>Ormyrus nitidulus</i>
<i>Aphelonix cerricola</i>	Ormyridae	<i>Ormyrus nitidulus</i>
<i>Cynips divisa</i>	Torymidae	<i>Torymus notatus</i>
<i>Cynips quercusfolii</i>	Eurytomidae	<i>Sycophila biguttata</i>
	Ormyridae	<i>Ormyrus nitidulus</i>
	Torymidae	<i>Torymus cerri</i>
<i>Diplolepis nervosa</i>	Eurytomidae	<i>Eurytoma caninae</i>
<i>Diplolepis rosae</i>	Ichneumonidae	<i>Orthopelma mediator</i>
	Pteromalidae	<i>Pteromalus bedeguaris</i>
	Torymidae	<i>Glyphomerus stigma</i>
		<i>Megastigmus rosae*</i>
		<i>Torymus bedeguaris</i>
<i>Diplolepis spinosissimae</i>	Torymidae	<i>Torymus bedeguaris</i>
<i>Synophrus politus</i>	Torymidae	<i>Bootanomyia almusiensis</i>

*This species is originally a seed-feeder from the superfamily Chalcidoidea (Roques & Skrzypczynska, 2003; Daneshvar et al., 2009).