



## Diversity and abundance of the sawfly (Hymenoptera: Symphyta) community in Darab rain-fed damask rose plain, Fars province, southwestern Iran

Abbas Mohammadi-Khoramabadi<sup>1\*</sup> & Mohammad Khayrandish<sup>2</sup>

<sup>1</sup> Department of Plant Production, College of Agriculture and Natural Resources of Darab, Shiraz University, Shiraz, Iran. [mohamadk@shirazu.ac.ir](mailto:mohamadk@shirazu.ac.ir)

<sup>2</sup> Department of Plant Protection, College of Agriculture, Shahid Bahonar University of Kerman, Kerman, Iran. [m.khayrandish@uk.ac.ir](mailto:m.khayrandish@uk.ac.ir)

**ABSTRACT.** Sawflies (Hymenoptera, Symphyta) are one of the important pest groups on damask rose, *Rosa damascena* P. Mill. (Plantae: Rosaceae). This study has been carried out to identify and investigate species diversity of sawflies in Darab rain-fed damask rose plain, Fars province which with 5290 hectares is the largest organic, rain-fed damask rose plain in the world in 2019. Sampling was done using four Malaise traps which were installed in different areas of the plain, from spring to summer. Collecting pots were emptied at an interval of two weeks and sawfly individuals were then isolated, mounted, or pinned and finally identified. To predict species richness of sawflies, the rarefaction method was applied to abundance-based and sample-based data. Totally, 133 individuals were collected representing 5 species from two families, Argidae: a single species, *Arge cingulata* Jakowlew, 1891 and Tenthredinidae: four species, *Allantus (Allantus) viennensis* (Schrank, 1781), *Cladius pectinicornis* (Geoffroy, 1785), *Macrophya diaphenia* Benson, 1968 and *Tenthredo marginella* Fabricius, 1793. *Allantus viennensis* was dominant with 63.9% of collected individuals. *Tenthredo marginella* and *M. diaphenia* had the following abundance rankings of 26.3% and 8.27% collected individuals respectively. Two species, *A. cingulata* and *C. pectinicornis*, were the singletons. The adult flight period of the dominant species, *A. viennensis*, was registered in two distinct periods and the others in one. Rarefaction showed that more sampling will yield 6-8 sawfly species in this region. The differences between the sawfly community of Darab damask rose plain and other regions of Iran and the world were discussed.

**Key words:** *Rosa damascena*, pest, fauna, community

**Received:**  
02 December, 2020

**Accepted:**  
05 April, 2021

**Published:**  
08 April, 2021

**Subject Editor:**  
S.M. Madjdzadeh

**Citation:** Mohammadi-Khoramabadi, A. & Khayrandish, M. (2021) Diversity and abundance of the sawfly (Hymenoptera: Symphyta) community in Darab rain-fed damask rose plain, Fars province, southwestern Iran. *Journal of Insect Biodiversity and Systematics*, 7 (3), 231–244.

### Introduction

Damask (Oil) rose, *Rosa damascena* P. Mill., is a commercially high-value medicinal plant with about 18131 hectares cultivated area in Iran (Ebadzadeh et al., 2018). Nearly 40.1% (7281 hectares) of damask rose plantation areas in Iran belong to Fars province, the first top

Corresponding author: Abbas Mohammadi-Khoramabadi, E-mail: [mohamadk@shirazu.ac.ir](mailto:mohamadk@shirazu.ac.ir)

Copyright © 2021, Mohammadi-Khoramabadi & Khayrandish. This is an open access article distributed under the terms of the Creative Commons NonCommercial Attribution License (CC BY NC 4.0), which permits Share - copy and redistribute the material in any medium or format, and Adapt - remix, transform, and build upon the material, under the Attribution-NonCommercial terms.

ranking. The main outstanding characteristics of damask rose in Fars province is that some best and highly-yielded genotypes of this plant are mainly cultivated in the organic rain-fed areas of Darab county, known as the world largest damask rose rain-fed plain (Kiani et al., 2011; Masumi et al., 2014; Ebadzadeh et al., 2018; Haghghatnia et al., 2018).

Sawflies (Hymenoptera, Symphyta) with 43 known species living on wild and cultivated rose in the western Palaearctic including Europe, Turkey, Syria, and Iran are a diverse group of herbivorous insects (Taeger et al., 1998; Liston, 2004; Özbek & Çalmaşur, 2004; Khayrandish et al., 2017; Khayrandish & Nadimi, 2018). Some of them have been considered as important pests of rose by feeding on leaves or boring in woody stems of this plant (Hosseini & Sahragard, 2003; Aminaee et al., 2010; Demirözer & Karaca, 2011; Demirözer et al., 2011; Liston, 2012; Baser & Arslan, 2014; Nematollahi, 2018). In the north of Iran, damage of the leaf feeder guild, Rose sawfly, *Arge ochropus* (Gmelin, 1790) (Hym.: Argidae), and Small yellow and black wasp, *Allantus viennensis* (Schrank, 1781) (Hym.: Tenthredinidae), lead to severe defoliation of damask rose which consequently causes common weakness of the infested plants and encourages secondary stem pests (Sahragard & Heydari, 2002; Hosseini & Sahragard, 2003). Wood-boring guild, Rose shoot sawfly, *Ardis pallipes* (Serville, 1823) (Hym.: Tenthredinidae), and Rose stem sawfly, *Syrista parreyssii* (Spinola, 1843) (Hym.: Cephidae) have got less impact on this plant (Aminaee et al., 2010; Liston, 2012).

Darab damask rose rain-fed plain with a large area of about 5290 hectares is located between about 2500-2700 m a. s. l. in Fars province, Iran (Haghghatnia et al., 2018). High commercial value of healthy and organically grown damask rose flower and related products provide a special opportunity for the development of processing, beverage and oil-bearing industries, trading and export companies, increasing sustainable employment and safe investment in this region. Ecologically, the resident suite of species may be replaced over time. Information on the biodiversity of this area will help manage and conserve this valuable natural and organic agroecosystem. The main objective of this study was to evaluate the diversity and abundance of the sawfly community in Darab damask rose plain. Considering this group as one of the important herbivores on damask rose, this information is of great importance for pest management.

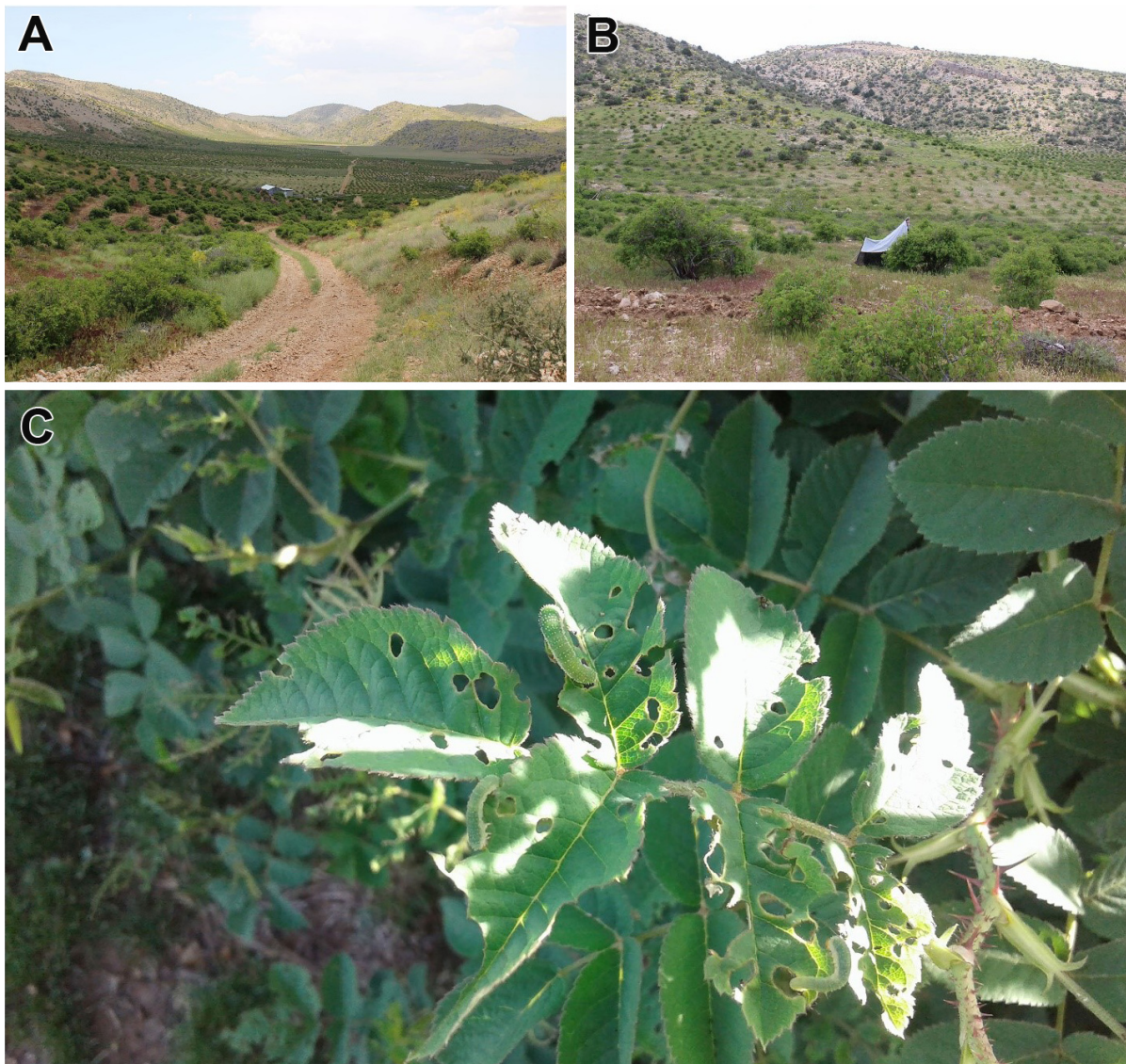
## Material and methods

This study was carried out in Darab damask rose plain, Fars province, Iran (Fig. 1). Four Malaise traps were installed, two traps in the boundaries and two others in the center of the plain with about 1000-2000 m distance from April to October 2019. Table 1 shows the geographical coordinates of the traps. They were made based on Townes-style Malaise traps with black walls and white roof and were placed beside rose bushes (Fig. 1B). The one-litre collecting jars of the traps were filled approximately to 0.9 volumes with ethanol 75% as killing and preserving agent and were emptied every two weeks. To prevent temperature rising and evaporation of alcohol, the jars were then covered with the aluminium plates. The captured sawfly specimens were then extracted, dried, and pinned. The specimens were identified by Dr. M. Khayrandish, a specialist on the taxonomy of Iranian sawflies. Scientific names and general distribution of the identified species followed Taeger et al. (2010). Digital photos were taken using a Canon EOS 600D on a SZ-ST Olympus stereomicroscope. They were then aligned and stacked using Adobe Photoshop



CS6 software. The voucher specimens are deposited in the insect collection of Darab College of Agriculture and Natural Resources, Shiraz University.

Because of the small number of recorded individuals of sawfly species as well as the rarity of two of the species found, we analyzed our data using both individual-based and sample-based (incidence) rarefaction methods in an asymptotic approach to predict the sawfly species richness in this area (Colwell et al., 2012; Chao & Jost, 2015). To plot the unified accumulation curve by linking the interpolated (rarefaction) curve to the extrapolated curve of our data, we used iNEXT software (Chao et al., 2016). Extrapolations were done at the double as well as beyond our data at the asymptote line. The degree of our sampling completeness and total sampling efforts needed to detect the expected sawfly richness in the studied areas were calculated.



**Figure 1.** A: Darab rain-fed damask rose plain; B: Installed Malaise traps; C: Severe foliage damage caused by larvae of *Allantus viennensis* on leaves of *Rosa damascena*.

**Table 1.** Geographical coordinates of the installed Malaise traps in Darab damask rose plain, Fars province, Iran during 2019.

Malaise trap	Geographical coordinate	Altitude (m a.s.l.)
ME	28° 41' 27" N, 54° 55' 21" E	2571
MH	28° 42' 01" N, 54° 54' 13" E	2615
MJ	28° 42' 15" N, 54° 54' 14" E	2641
MV	28° 42' 38" N, 54° 53' 17" E	2646

## Results

We captured 133 sawfly specimens belonging to two families and five species as follows:

### Family: Argidae

*Arge cingulata* Jakowlew, 1891 (**Fig. 2A**)

**Material examined:** IRAN, Fars province, Darab; 1♂ (ME), 2019.VIII.14–28; Leg. A. Mohammadi-Khoramabadi.

**Distribution within Iran:** Alborz, Guilan, Mazandaran, Kermanshah, Kerman, Tehran and Fars provinces ([Khayrandish & Farahani, 2019](#))

**General distribution:** Palaearctic (Iran and Tajikistan) ([Taeger et al., 2010](#); [Taeger et al., 2018](#)).

**Known hosts:** There is no documentation of plant host record.

### Family: Tenthredinidae

*Allantus (Allantus) viennensis* (Schrank, 1781) (**Fig. 2B**)

**Material examined:** IRAN, Fars province, Darab; 3♀♀, 2019.IV.27–2019.V.7; 9♀♀, 2019.V.7–16; 18♀♀, 2019.V.16–27; 54♀♀, 2019.V.28–2019.VI.9; 1♀, 2019.VII.29–2019.VIII.14; Leg. A. Mohammadi-Khoramabadi.

**Distribution within Iran:** Alborz, Qazvin, Guilan, Golestan, Tehran, Mazandaran ([Khayrandish et al., 2017](#); [Khayrandish & Farahani, 2019](#)) and Fars provinces (**Current study**).

**General distribution:** Palaearctic and Nearctic ([Taeger et al., 2010](#); [Taeger et al., 2018](#)).

**Known hosts:** *Rosa gallica* L., *Rosa glauca* Pourret, *Rosa pendulina* L., *Rosa spinosissima* L., *Rosa rubiginosa* L., *Rosa canina* L., *Rosa rugosa* Thunb. (Plantae: Rosaceae) ([Taeger et al., 1998](#)).

*Cladius (Cladius) pectinicornis* (Geoffroy, 1785) (**Fig. 2C**)

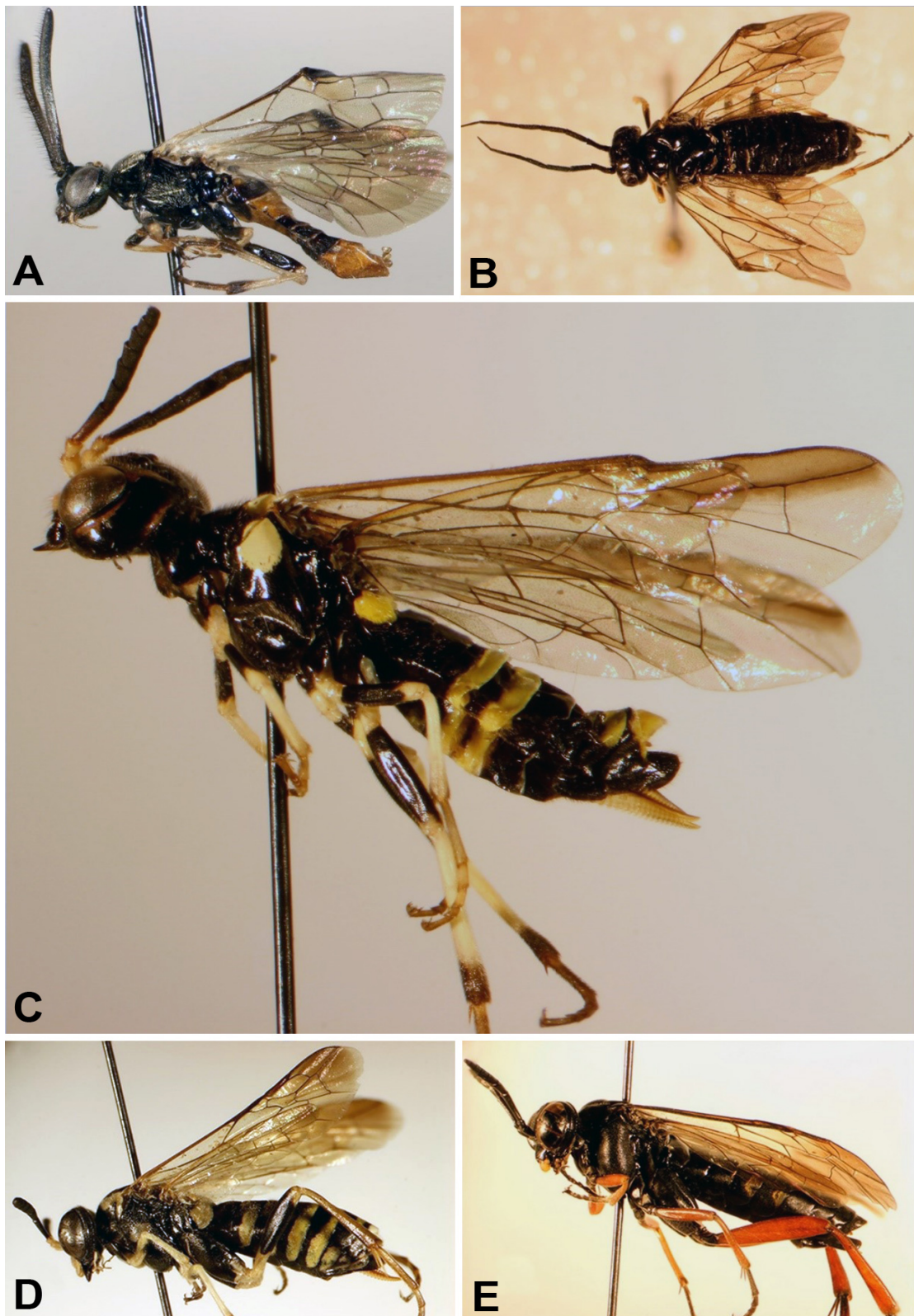
**Material examined:** IRAN, Fars province, Darab; 1♀ (MV), 2019.VII.29–2019.VIII.14; Leg. A. Mohammadi-Khoramabadi.

**Distribution within Iran:** Alborz, Guilan, Golestan, Qazvin, Mazandaran ([Khayrandish & Ebrahim, 2018](#); [Khayrandish & Farahani, 2019](#)) and Fars province (**Current study**).

**General distribution:** Palaearctic, Nearctic, Oriental ([Taeger et al., 2010](#); [Taeger et al., 2018](#))

**Known hosts:** *Rosa polliniana* Spreng., *Rosa luciae* Franch. & Rochebr., *Rosa multiflora* Thunb., *Rosa canina* L., *Rosa acicularis* Lindl. (Plantae: Rosaceae) ([Taeger et al., 1998](#)).





**Figure 2.** Sawflies of Darab rain-fed damask rose plain. **A.** *Arge cingulata* Jakowlew, 1891; **B.** *Allantus* (*Allantus*) *viennensis* (Schrank, 1781); **C.** *Cladius* (*Cladius*) *pectinicornis* (Geoffroy, 1785); **D.** *Tenthredo marginella* Fabricius, 1793; **E.** *Macrophya diaphenia* Benson, 1968.

***Macrophya diaphenia* Benson, 1968 (Fig. 2D)**

**Material examined:** IRAN, Fars province, Darab; 11♀♀, 2019.V.28–2019.VI.9; Leg. A. Mohammadi-Khoramabadi.

**Distribution within Iran:** Alborz, Qazvin, Guilan, Tehran, Mazandaran, Lorestan (Khayrandish et al., 2017), and Fars provinces (**Current study**).

**General distribution:** Western Palaearctic (Taeger et al., 2010).

**Known hosts:** There is no documentation of plant host record.

***Tenthredo marginella* Fabricius, 1793 (Fig. 2E)**

**Material examined:** IRAN, Fars province, Darab; 29♀♀6♂♂, 2019.V.28–2019.VI.9; Leg. A. Mohammadi-Khoramabadi.

**Distribution within Iran:** Alborz, East Azerbaijan, Mazandaran, Tehran (Taeger et al., 2018) and Fars provinces (**current study**).

**General distribution:** Palaearctic (Taeger et al., 2010; Taeger et al., 2018).

**Known hosts:** *Melissa officinalis* L., *Mentha piperita* L., *Ocimum basilicum* L., *Lycopus* sp., *Origanum vulgare* L. (Plantae: Lamiaceae); *Plantago* sp. (Plantae: Plantaginaceae); *Tussilago* sp. (Plantae: Asteraceae) (Taeger et al., 1998).

**Abundance and diversity of sawflies in Darab damask rose plain**

We recovered five sawfly species in 133 examined specimens (Table 2). The most abundant species was *A. viennensis* with 63.9% of total collected individuals followed by *T. marginella* and *M. diaphenia*. As can be seen in Table 2, two species namely *C. pectinicornis* and *Ar. cingulata* were represented by singletons.

Individual-based rarefaction and extrapolation of abundance data for the sawfly community showed that the maximum estimated number of the sawfly species will be 6 (The bootstrap LCL= 4.97 and UCL= 7.01) (Table 3, A). Extrapolation showed that about 225 individuals are required to reach the  $S_{max}=6$ . Similarly, sample-based rarefaction and extrapolation of incidence data estimated the maximum species richness of sawflies at  $S_{max}=6$  (The bootstrap LCL=3.65 and UCL= 8.30). The required sample to reach the  $S_{max}$  is estimated to be about double the number of collected samples (96) (Table 3, B).

**Table 2.** The relative abundance of sawfly species in Darab rain-fed damask rose plain during 2019.

Species	Collected specimens	Relative abundance (%)
<i>Allantus viennensis</i> (Schrank, 1781)	85	63.9
<i>Tenthredo marginella</i> Fabricius, 1793	35	26.3
<i>Macrophya diaphenia</i> Benson, 1968	11	8.27
<i>Cladius pectinicornis</i> (Geoffroy, 1785)	1	0.75
<i>Arge cingulata</i> Jakowlew, 1891	1	0.75

**Table 3.** Individual-based (A) and sample-based (B) rarefaction and extrapolation for the sawfly community on Darab rain-fed damask rose plain in Fars province, Iran, 2019.

<b>A) Individual-based rarefaction and extrapolation, <math>S_{obs}=5</math>, <math>n=133</math>. The extrapolation is extended to more than four times the number of the collected individuals, to reach a constant qD.</b>							
Rarefaction (Interpolation)				Extrapolation			
m	qD	qD.LCL	qD.UCL	m	qD	qD.LCL	qD.UCL
1	1	1	1	134	5.02	4.33	5.70
30	3.4	3.01	3.79	225	5.74	4.76	6.72
59	3.87	3.33	4.45	316	5.93	4.92	6.94
95	4.43	3.79	5.07	453	5.98	4.97	7
133	5	4.31	5.69	498	5.99	4.97	7.01

<b>B) Sample-based rarefaction and extrapolation, <math>S_{obs}=5</math>, <math>n=48</math>. The extrapolation is extended to more than four times the number of collected samples, to reach a constant qD.</b>							
Rarefaction				Extrapolation			
t	qD	qD.LCL	qD.UCL	t	qD	qD.LCL	qD.UCL
1	0.46	0.28	0.64	49	5.04	3.76	6.32
24	3.89	3.05	4.73	96	5.85	3.9	7.79
36	4.5	3.48	5.51	120	5.93	3.83	8.03
48	5	3.75	6.25	200	5.98	3.65	8.30

m = sample size; qD = the estimated diversity for a sample of size m; qD.LCL, qD.UCL = the bootstrap lower and upper confidence limits for the diversity at the specified level with a value of 0.95; t = sample size.

## Discussion

The results of this study showed that five sawfly species are present in Darab rain-fed damask rose plain. *Allantus viennensis* was the most abundant and dominant species. Of the 11 species of *Allantus* living on rose bushes (Table 4), *A. viennensis* is dominant and usually appears as a dangerous pest in the rose gardens (Hosseini & Sahragard, 2003; Özbek & Çalmaşur, 2004; Tomalak, 2008; Gholamzadeh-Chitgar et al., 2019; Zwakhals & Blommers, 2020), but not in the mixed forests (Khayrandish & Farahani, 2020). *Tenthredo marginella* and *M. diaphenia* were the next most abundant species. Although four species of *Tenthredo* and one species of *Macrophya* have been reported on *Rosa* spp. (Table 4), there is no documentation of *Rosa* species as host plants for these species. *Cladius pectinicornis* which was represented by a singleton in this study is known as a common rose sawfly in rose gardens of some countries like Poland (Tomalak, 2008). In the Hyrcanian forests of Mazandaran and Golestan provinces in northern Iran, *C. pectinicornis* was evaluated as the dominant species (Khayrandish & Farahani, 2020). Future research is needed to reveal the situation of *C. pectinicornis* in wild and cultivated roses in northern Iran. The other species represented by a singleton was *Ar. cingulata*. Five species of this genus live on rose (Table 4) and some of them, i.e. *Ar. ochropus* and *Ar. pagana*, are destructive pests on this plant

(Hosseini & Sahragard, 2003; Kawas, 2003; Demirözer & Karaca, 2011; Nematollahi, 2018), but up to now, the rose has not been registered as host plant of *Ar. cingulata*. On the other hand, two common known sawflies of rose have not been detected in this study, *Syrista parreyssii* (Scheibelreiter 1969) (Hym.: Cephidae) and *Arge ochropus* (Gmelin, 1790). The first is an important shoot boring pest of rose in Kerman province and the second is a leaf feeder in northern Iran (Aminae et al., 2010; Liston, 2012; Nematollahi, 2018) and Turkey (Demirözer et al., 2011; Tozlu & Calmasu, 2015; Tozlu et al., 2017).

**Table 4.** The known sawflies along with their host plant records in the genus *Rosa* in Europe, Turkey, Syria and Iran.

#	Species	Known host plant in Iran	Reference
1	<i>Allantus basalis</i> (Klug, 1818)	-	(Taeger et al., 1998)
2	<i>Allantus calceatus</i> (Klug, 1818)	-	(Taeger et al., 1998)
3	<i>Allantus cinctus</i> (L., 1758)	-	(Taeger et al., 1998)
4	<i>Allantus cingillum</i> (Klug, 1818)	-	(Taeger et al., 1998)
5	<i>Allantus cingulatus</i> (Scopoli, 1763)	-	(Taeger et al., 1998)
6	<i>Allantus coxalis</i> (Klug, 1818)	-	(Taeger et al., 1998)
7	<i>Allantus didymus</i> (Klug, 1818)	-	(Özbek & Çalmaşur, 2004; Mohammadkhani et al., 2019; Khayrandish & Farahani, 2020)
8	<i>Allantus laticinctus</i> (Serville, 1823)	-	(Taeger et al., 1998; Khayrandish & Farahani, 2019)
9	<i>Allantus rufocinctus</i> (Retzius, 1783)	-	(Taeger et al., 1998)
10	<i>Allantus truncatus</i> (Klug, 1818)	-	(Taeger et al., 1998)
11	<i>Allantus viennensis</i> (Schränk, 1781)	<i>Rosa</i> spp., <i>R. damascena</i>	(Taeger et al., 1998; Hosseini & Sahragard, 2003; Özbek & Çalmaşur, 2004; Zwakhals & Blommers, 2020)
12	<i>Apethymus apicalis</i> (Klug, 1818)	-	(Taeger et al., 1998)
13	<i>Ardis pallipes</i> (Serville, 1823)	-	(Taeger et al., 1998; Khayrandish et al., 2017; Zwakhals & Blommers, 2020)
14	<i>Arge gracilicornis</i> (Klug, 1814)	-	(Taeger et al., 1998)
15	<i>Arge nigripes</i> (Retzius, 1783)	-	(Taeger et al., 1998; Khayrandish & Ebrahim, 2018)
16	<i>Arge nigripes alpina</i> (Konow, 1884)	-	(Taeger et al., 1998)
17	<i>Arge ochropus</i> (Gmelin, 1790)	<i>Rosa</i> sp. and <i>Rosa canina</i> L.	(Taeger et al., 1998; Sahragard & Heydari, 2002; Khayrandish & Ebrahim, 2018)
18	<i>Arge pagana</i> (Panzer, 1797)	-	(Kawas, 2003)
19	<i>Blennocampa phyllocolpa</i> Viitasaari & Vikberg, 1985	-	(Taeger et al., 1998)



**Table 4.** Continued.

#	Species	Known host plant in Iran	Reference
20	<i>Caliroa annulipes</i> (Klug, 1816)	-	(Taeger et al., 1998)
21	<i>Caliroa cerasi</i> (Linnaeus, 1758)	-	(Taeger et al., 1998; Khayrandish et al., 2017)
22	<i>Cladardis elongatula</i> (Klug, 1817)	-	(Taeger et al., 1998; Khayrandish et al., 2017)
23	<i>Cladius compressicornis</i> (Fabricius, 1804)	-	(Taeger et al., 1998)
24	<i>Cladius pectinicornis</i> (Geoffroy, 1785)	-	(Taeger et al., 1998; Khayrandish et al., 2017; Khayrandish & Farahani, 2020)
25	<i>Dolerus murcius</i> (Konow, 1895)	Adult collected on <i>Rosa</i> sp.	(Khayrandish & Nadimi, 2018)
26	<i>Endelomyia aethiops</i> (Gmelin, 1790)	-	(Taeger et al., 1998; Zwakhals & Blommers, 2020)
27	<i>Macrophya annulata</i> (Geoffroy, 1785)	-	(Taeger et al., 1998; Khayrandish et al., 2017; Khayrandish & Farahani, 2020)
28	<i>Monardis plana</i> (Klug, 1817)	-	(Taeger et al., 1998)
29	<i>Pamphilius balteatus</i> (Falln, 1808)	-	(Taeger et al., 1998)
30	<i>Pamphilius inanitus</i> (Villers, 1789)	-	(Taeger et al., 1998)
31	<i>Pamphilius stramineipes</i> (Hartig, 1837)	-	(Taeger et al., 1998)
32	<i>Phyllococcus niger</i> (Harris, 1779)	-	(Taeger et al., 1998; Khayrandish & Farahani, 2019, 2020)
33	<i>Pristiphora biscalis</i> (Förster, 1854)	-	(Taeger et al., 1998; Khayrandish et al., 2017)
34	<i>Pristiphora insularis</i> Rohwer, 1910	-	(Taeger et al., 1998)
35	<i>Pristiphora punctifrons</i> (Thomson, 1871)	-	(Taeger et al., 1998)
36	<i>Rhogogaster chlorosoma</i> (Benson, 1943)	-	(Taeger et al., 1998; Özbek & Çalmaşur, 2004)
37	<i>Rhogogaster punctulata</i> (Klug, 1817)	-	(Taeger et al., 1998)
38	<i>Sterictiphora geminata</i> (Gmelin, 1790)	-	(Taeger et al., 1998)
39	<i>Syrista parreyssii</i> (Spinola, 1843)	<i>Rosa damascena</i>	(Özbek & Çalmaşur, 2004; Aminae et al., 2010; Liston, 2012)
40	<i>Tenthredo balteata</i> Klug, 1817	-	(Taeger et al., 1998; Özbek & Çalmaşur, 2004)
41	<i>Tenthredo livida</i> Linnaeus, 1758	-	(Taeger et al., 1998; Özbek & Çalmaşur, 2004)
42	<i>Tenthredo cinctipleuris</i> (Enselin, 1910)	Adults collected on <i>Rosa</i> sp.	(Taeger et al., 1998; Khayrandish & Nadimi, 2018)
43	<i>Tenthredo vespa</i> Retzius, 1783	-	(Taeger et al., 1998)

Populations of the dominant sawfly species, *A. viennensis* showed two distinct periods of adult appearance in Darab damask rose plain. The first period lasted for about 40 days, with the adults captured from the end of April to early June (Table 5). The second period was registered in the first half of August with just one adult specimen captured. Hosseini & Sahragard (2003) stated that based on visual evidence this species has three generations a year in Guilan province, Iran. But, two years of Malaise trapping in the north of Iran during 2010-2011 showed that the adults of *A. viennensis* were captured from the end of June to the end of July in their first period of appearance and early September in the next (Khayrandish, 2013). It can be concluded that the phenology of this species is more restricted in Darab damask rose plain depending on weather conditions in such high elevations.

The adult temporal occurrences of *T. marginella* and *M. diaphenia* were recorded at end of May–early June which overlaps with the peak of the adult appearance of *A. viennensis* in the first generation (Table 5). Based on the available adults collection data, *M. diaphenia* has a similar trend of adult appearances in different regions of Iran, mostly in late May (V) to late June (VI) (Khayrandish, 2013; Khayrandish & Ebrahim, 2018). But, little information on *T. marginella* in northern Iran shows a different adult occurrence at the end of July (Khayrandish, 2013). *Arge cingulata* showed one period of adult appearance at the end of August to the first half of September (Table 5). Regarding adult capture dates of *Ar. cingulata* from last decade of June to the second decade of July in the north of Iran (Guilan, Mazandaran and Alborz provinces) (Khayrandish, 2013) as well as the very low number of captured specimens in this study, may indicate that *Ar. cingulata* has another generation in Darab damask rose plain in spring. The single captured adult of *C. pectinicornis* in this study was observed in the first half of August (Table 5). Adults of this species have a very long period of appearance in lowlands to the altitudes of about 1300 m a.s.l. of Guilan and Mazandaran provinces, northern Iran which started from early April to about early November but with a shorter period from mid-April to mid-July in high altitudes of about 1800 m a.s.l. (Khayrandish, 2013). The location of Darab damask rose plain at very high altitude (2571-2641 m a.s.l.), may explain why only a singleton of *C. pectinicornis* was captured.

Estimation of species richness of the sawfly community by extrapolation of abundance-based and sample-based data showed that more sampling will yield in 6-8 species in Darab damask rose plain. It is obvious that this cannot be considered an accurate estimate of the true species richness of this group. Since our data were relatively few and sparsely populated in this study, the extrapolations resulted in wide confidence intervals. Based on the individual abundance and incidence data, we found two and three singletons (species represented by one individual), respectively in this study which strongly affect the statistical analysis of richness and our sampling completeness.

The study showed that 5 species of sawflies inhabit Darab damask rose plain. As we know, the genus *Rosa* hosts 43 sawfly species in western Palaearctic including Europe, Turkey, Iran, and Syria of which 15 species have been reported from Iran (Table 4) (Taeger et al., 1998; Liston, 2004; Özbek & Çalmaşur, 2004; Khayrandish et al., 2017; Khayrandish & Nadimi, 2018). There have been as yet just five reported host plant records from Iran. More intensive sampling is needed in the future to get a more complete picture of the sawfly community in wild and cultivated roses in different regions of Iran.

**Table 5.** The adult appearance of sawflies in Darab rain-fed damask rose plain during 2019.

Species	April	May	June	July	August	September
<i>Allantus viennensis</i>		■	■	■	■	
<i>Tenthredo marginella</i>			■	■		
<i>Macrophya diaphenia</i>			■	■		
<i>Cladius pectinicornis</i>					■	■
<i>Arge cingulata</i>					■	■

### Acknowledgments

This study was supported by the College of Agriculture and Natural Resources of Darab, Shiraz University, Grant Number [96GRS1M2228]. Our cordial thanks to GholamAbbas Khaghaninejad, Yaghoub Jafari, and Akbar Norouzi for their kind help with us in sampling.

### Conflict of Interests

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

### ORCID

Abbas Mohammadi-Khoramabadi: <http://orcid.org/0000-0001-6711-9952>

Mohammad Khayrandish: <http://orcid.org/0000-0002-2568-2306>

### References

- Aminae, M. M., Zare, R. & Zohdi, H. (2010) An investigation on *Lecanicillium muscarium* as a biocontrol agent of stem borer pests of *Rosa damascena* in Kerman Province of Iran. *Archives of Phytopathology and Plant Protection*, 43, 678–688. <https://doi.org/10.1080/03235400802075872>
- Baser, K. H. C. & Arslan, N. (2014) Oil Rose (*Rosa damascena*). In: Yaniv, Z. & Dudai, N. (eds.) *Medicinal and Aromatic Plants of the Middle-East*. Springer, pp. 281–304.
- Chao, A. & Jost, L. (2015) Estimating diversity and entropy profiles via discovery rates of new species. *Methods in Ecology and Evolution*, 6, 873–882. <https://doi.org/10.1111/2041-210x.12349>
- Chao, A., Ma, K. H. & Hsieh, T. C. (2016) iNEXT (iNterpolation and EXTrapolation) Online: Software for Interpolation and Extrapolation of Species Diversity. Program and User's Guide published at [http://chao.stat.nthu.edu.tw/wordpress/software\\_download/](http://chao.stat.nthu.edu.tw/wordpress/software_download/)
- Colwell, R. K., Chao, A., Gotelli, N. J., Lin, S.-Y., Mao, C. X., Chazdon, R. L. & Longino, J. T. (2012) Models and estimators linking individual-based and sample-based rarefaction, extrapolation and comparison of assemblages. *Journal of Plant Ecology*, 5, 3–21. <https://doi.org/10.1093/jpe/rtr044>
- Demirözer, O. & Karaca, İ. (2011) Phytophagous arthropod species associated with oil bearing rose, *Rosa damascena* Miller, in Isparta province with distributional remarks. *Süleyman Demirel Üniversitesi Fen Edebiyat Fakültesi Fen Dergisi*, 6, 9–25.
- Demirözer, O., Karaca, I. & Karsavuran, Y. (2011) Population fluctuations of some important pests and natural enemies found in oil-bearing rose (*Rosa damascena* Miller) production areas in Isparta province (Turkey). *Turkish Journal of Entomology*, 35 (4), 539–558.
- Ebadzadeh, H. R., Ahmadi, K., Mohammadnia Afrouzi, S., Abbas-Taghani, R., Abbasi, M. & Yari, S. (2018) *Iran agriculture statistic*, Tehran, Ministry of Jihad-e-Agriculture. 420 pp.



- Gholamzadeh-Chitgar, M., Jahanjou, F., Ghadamyari, M. & Hosseini, R. (2019) Biochemical characterization of the digestive proteases in the small black and yellow wasp, *Allantus viennensis* Schr. (Hym.: Tenthredinidae). *Journal of the Entomological Research Society*, 21, 271–280.
- Haghighatnia, H., Rejali, F. & Montazeri, Z. (2018) Effects of mycorrhizal fungi, growth promoting bacteria and animal manure on the performance and growth characteristics of *Rosa damascena* in Layzangan region of Fars Province. *Journal of Soil Biology*, 6, 93–103.  
<https://doi.org/10.22092/sbj.2018.111067.106>
- Hosseini, R. & Sahragard, A. (2003) Study on the morphological characters and some features of biology and spatial distribution pattern of rose minor leaf eating sawfly, *Allantus viennensis* (schr.) (Hym.; Tenthredinidae) in Guilan University. *Journal of Agricultural Sciences and Natural Resources*, 10, 103–115.
- Kawas, H. Z. (2003) Studies on the sawfly *Arge* spp. (Hymenoptera: Argidae) on *Rosa* spp. in Syria. *Arab Journal of Plant Protection*, 21, 43–45.
- Khayrandish, M. (2013) *Identification and species diversity of Sawflies (Hymenoptera Symphyta) in North Central of Iran* (Unpublished PhD Dissertation), Tarbiat Modares University.
- Khayrandish, M. & Ebrahim, E. (2018) Sawflies (Hym.: Symphyta) of Hayk Mirzayans Insect Museum with four new records for the fauna of Iran. *Journal of Entomological Society of Iran*, 37, 381–404. <https://doi.org/10.22117/jesi.2018.115354>
- Khayrandish, M. & Farahani, S. (2019) New Addition to Sawflies (Hymenoptera: Symphyta) from Hyrcanian Forests in Northern Iran. *Journal of Agricultural Science and Technology*, 21, 1183–1197.
- Khayrandish, M. & Farahani, S. (2020) Species diversity of sawflies (Hymenoptera: Symphyta) in forest parts of Golestan and Mazandaran provinces. *Iranian Journal of Forest and Range Protection Research*, 17, 185–196. <https://doi.org/10.22092/ijfrpr.2019.124257.1361>
- Khayrandish, M. & Nadimi, A. (2018) Sawflies from Zanjan Province, with the first report of *Dolerus murcius* Konow, 1895 (Hymenoptera: Tenthredinidae: Selandriinae) for Iran. *Journal of Insect Biodiversity and Systematics*, 4, 253–259.
- Khayrandish, M., Talebi, A. A. & Blank, S. M. (2017) Checklist of sawflies (Hymenoptera: Symphyta) from Iran. *Journal of Insect Biodiversity and Systematics*, 3, 165–227.
- Kiani, M., Zamani, Z., Khalighi, A., Fatahi-Moghaddam, M. R. & Kiani, M. R. (2011) Collection and evaluation of morphological diversity of damask rose genotypes of Iran. *Iranian Journal of Horticultural Sciences*, 41, 223–233.
- Liston, A. D. (2004) The hostplant and larva of *Allantus didymus* (Klug, 1818) (Hymenoptera: Tenthredinidae). *Entomologische Zeitschrift*, 114, 50–51.
- Liston, A. D. (2012) The identity of a stem sawfly recorded as a pest of *Rosa damascena* in Iran. *Archives of phytopathology and plant protection*, 45, 1039–1041.  
<https://doi.org/10.1080/03235408.2012.655151>
- Masumi, Z., Zandi, P. & Aghdaei, S. R. T. (2014) The quantity and quality of essential oil, yield and yield components of seven genotypes of rose (*Rosa damascena* Mill.) in Fars Province. *Iranian Journal of Medical and Aromatic Plants*, 30, 186–197.
- Mohammadkhani, R., Nadimi, A. & Khayrandish, M. (2019) A survey on the sawflies (Hymenoptera: Symphyta) of Gorgan County of Golestan Province in northern Iran. *Journal of Insect Biodiversity and Systematics*, 5, 1–9.
- Nematollahi, M. R. (2018) *Pests on Damask Rose in Iran and World*, Tehran, Iranian Research Institute of Plant Protection. 126 pp.
- Özbek, H. & Çalmaşur, O. (2004) A review of insects and mites associated with roses in Turkey. I International Rose Hip Conference 690, pp. 167–174.
- Sahragard, A. & Heydari, R. (2002) Biology and spatial distribution of Rose Sawfly, *Arge rosae* (Hym.: Argidae) in Guilan. *Journal of Entomological Society of Iran*, 21, 25–37.

- Taeger, A., Altenhofer, E., Blank, S., Jansen, E., Kraus, M., Pschorn-Walcher, H. & Ritzau, C. (1998) Kommentare zur Biologie, Verbreitung und Gefährdung der Pflanzenwespen Deutschlands (Hymenoptera, Symphyta). In: Taeger, A. & Blank, S.M. (eds.) *Pflanzenwespen Deutschlands (Hymenoptera, Symphyta)*. Kommentierte Bestandsaufnahme. Goecke & Evers, Keltern, pp. 49–135.
- Taeger, A., Blank, S. M. & Liston, A. D. (2010) World catalog of Symphyta (Hymenoptera). *Zootaxa*, 2580, 1–1064. <https://doi.org/10.11646/zootaxa.2580.1.1>
- Taeger, A., Liston, A. D., Prous, M., Groll, E. K., Gehroldt, T. & Blank, S.M. (2018) *ECatSym – Electronic World Catalog of Symphyta (Insecta, Hymenoptera)*. Müncheberg, Senckenberg Deutsches Entomologisches Institut (SDEI). Available from: <https://sdei.de/ecatsym/> [Accessed 24th November 2020].
- Tomalak, M. (2008) Susceptibility of soil-dwelling developmental stages of rose-infesting sawflies to entomopathogenic nematodes. *IOBC/WPRS Bulletin*, 31, 331.
- Tozlu, E., Kotan, R. & Tozlu, G. (2017) The investigation of *Beauveria bassiana* (Ascomycota: Hypocreales) as a biocontrol agent of rose-stem sawfly, *Syrista parreyssii* (Spinola, 1843) (Hymenoptera: Symphyta; Cephidae) larvae. *Fresenius Environ Bull*, 26, 7091–7100.
- Tozlu, G. & Calmasu, O. (2015) Investigations on the biology and ecology of the rose-stem sawfly (*Syrista parreyssii* (Spinola, 1843) (Hymenoptera: Symphyta; Cephidae) in Erzurum, Turkey. *Annals of Agrarian Science*, 13, 37–50.
- Zwakhals, K. C. & Blommers, L. H. (2020) Perilissine wasps (Ichneumonidae, Ctenopelmatinae) reared from sawflies (Tenthredinidae) in the Netherlands. *Entomologische Berichten*, 80, 97–104.

## تنوع و فراوانی جامعه زنبورهای تخم‌ریز اره‌ای (Hymenoptera: Symphyta) در دشت گل دیم داراب، استان فارس، جنوب غربی ایران

عباس محمدی خرم آبادی<sup>۱\*</sup> و محمد خیراندیش<sup>۲</sup>

۱ بخش تولیدات گیاهی، دانشکده کشاورزی و منابع طبیعی داراب، دانشگاه شیراز، شیراز، ایران.

۲ بخش گیاهپزشکی، دانشکده کشاورزی، دانشگاه شهید باهنر کرمان، کرمان، ایران.

\* پست الکترونیکی نویسنده مسئول مکاتبه: [mohamadk@Shirazu.ac.ir](mailto:mohamadk@Shirazu.ac.ir)

| تاریخ دریافت: ۱۲ آذر ۱۳۹۹ | تاریخ پذیرش: ۱۶ فروردین ۱۴۰۰ | تاریخ انتشار: ۱۹ فروردین ۱۴۰۰ |

**چکیده:** زنبورهای تخم‌ریز اره‌ای (Hymenoptera, Symphyta) یک گروه مهم از آفات گل محمدی (*Rosa damascena* P. Mill. (Plantae: Rosaceae) محسوب می‌گردند. این مطالعه به شناسایی و بررسی تنوع گونه‌های زنبورهای تخم‌ریز اره‌ای ساکن دشت گل محمدی دیم شهرستان داراب، استان فارس با سطح زیر کشت ۵۲۹۰ هکتار به عنوان بزرگ‌ترین دشت گل محمدی دیم جهان، در سال ۱۳۹۸ پرداخته است. نمونه‌برداری با نصب چهار تله مالیز در نقاط مختلف دشت گل و در طول فصل‌های بهار و تابستان انجام شد. پس از تخلیه بطری‌های تله‌ها به فاصله زمانی هر دو هفته یکبار، جداسازی، اتاله و شناسایی نمونه‌ها صورت گرفت. تخمین حداکثر غنای گونه‌های زنبورهای تخم‌ریز اره‌ای با استفاده از روش تنک سازی بر اساس داده‌های فراوانی و نمونه محاسبه گردید. در مجموع، ۱۳۳ فرد در قالب ۵ گونه از زنبورهای این زیرراسته جمع‌آوری و از دو خانواده Argidae، یک گونه *Arge Allantus* (*Allantus*) Tenthredinidae و *cingulata* Jakowlew, 1891 (*Cladius pectinicornis* (Geoffroy, 1785) *wiennensis* (Schrank, 1781) *Macrophyta* *Tenthredo marginella* Fabricius, 1793 *diaphenia* Benson, 1968 مورد شناسایی قرار گرفتند. گونه *A. wiennensis* با فراوانی ۶۳٫۹٪ افراد شکار شده به عنوان گونه غالب تعیین شد. گونه‌های *T. marginella* و *M. diaphenia* به ترتیب با ۲۶٫۳٪ و ۸٫۲۷٪ در رتبه‌های بعدی فراوانی قرار گرفتند. دو گونه *C. pectinicornis* و *A. cingulata* هر کدام دارای یک فرد در بین افراد جمع‌آوری شده بودند. دوره پرواز حشرات بالغ گونه غالب، *A. wiennensis* در دو دوره مشخص و سایرین در یک دوره ثبت گردید. تخمین غنای گونه‌ای نشان داد که با افزایش نمونه‌برداری در دشت گل داراب، ۶-۸ گونه زنبور تخم‌ریز اره‌ای قابل کشف خواهند بود. تفاوت جامعه زنبورهای تخم‌ریز اره‌ای دشت گل محمدی دیم داراب با سایر مناطق ایران و جهان مورد بحث قرار گرفت.

**واژگان کلیدی:** گل محمدی، آفت، فون، جامعه