

## Study on Humbleflies Species Biodiversity (Diptera: Bombyliidae) in the Western Margin of the Caspian Sea Coastline

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### ABSTRACT

In order to evaluate the Bombyliid species diversity in Guilan province, statistical sampling was performed from designated stations in the desired areas. Totally 20 species belonging to 11 genera were collected as below;

*Callostoma soror* Loew, 1873, *Conophorus pseudaduncus* Paramonov, 1929, *Exoprosopa amseli* Oldroyd, 1961, *Exoprosopa dispar* Loew, 1869, *Exoprosopa efflatounbeyi* Paramonov, 1928, *Exoprosopa grandis* (Wiedemann in Meigen, 1820), *Exoprosopa kirgizorum* Paramonov, 1928, *Exoprosopa pectoralis* Loew, 1862, *Hemipenthes subvelutinus* Zaitzev, 1966, *Heteralonia megerlie* (Meigen, 1820), *Heteralonia suffuse* Klug, 1832, *Thyridanthrax elegans* (Wiedemann in Meigen, 1820), *Thyridanthrax griseolus* (Klug, 1832), *Thyridanthrax punctum* (Loew, 1854), *Veribubo misellus*, Loew 1869, *Lomatia belzebul* (Fabricius, 1794), *Parageron lutescens* (Bezzi, 1925), *Usia bicolor* Macquart, 1855, *Phthiria pulicaria* (Mikan, 1796) and *Phthiria vagans* Loew, 1846.

Most of the collected species were from the genus *Exoprosopa* Macquart, 1840 with relative frequency 54.83 %. According to Shanon-winner index 1.97 the highest species diversity was related to the Darestan region.

**Key words:** Biological control, Darestan region, Guilan province, Caspian sea, insects, pollination.

## INTRODUCTION

Diptera is considering as one of the major as well as biggest orders in insects classification, with great importance in several fields like agriculture, ecology and veterinary medicine (Ghafouri Moghaddam & Gharali, 2014; Robertson et al, 2020). These insects have a variety of diets, including eating meat, vegetarianism, caries, and eating blood (Ramirez, 2018). From the biological pest control aspect, some families of diptera such as Tachinidae, Syrphidae, Cecidomyiidae are playing role as predator (Driesche & Bellows, 1996). On the other hand, some species of families Sciaridae, Anthomyiidae, Cecidomyiidae and Tephritidae are considered as important agricultural pests (Latibari, Moravvej, Heller, Rulik, & Namaghi, 2015).

The order diptera is divided into two sub-orders: Nematocera (mosquitoes) and Brachycera (flies). The Bombyliidae family is belonging to superfamily Asiloidea, suborder Brachycera (Evenhuis, 2002). The efficiency of some Bombyliidae species in biological control and IPM is remarkable. Most Bombyliids species are found in the Middle East and the Horn of Africa, where is native to migratory locusts (Hull, 1973). Most of Bombyliid species predate the locust's egg capsule, thus preventing their unnecessary outbreak (Shah, Godonou, Gbongboui, Hossou, & Lomer, 1998). It is one of their beneficial roles in the natural regulation of these insects (Yeates & Greathead, 1997). The Bombyliidae family divided to 100 genera included at least 45,000 described species worldwide. Unfortunately, there are few studies have been done on Bombyliidae family. However, more studies have been done in neighboring countries in Turkey, Oman, Iraq and Saudi Arabia (Greathead, 1980). Guilan province is located in the north part of Iran, in south-west margin of Caspian Sea, which is contain extensive green and first-class pastures with abundant vegetation (Akhani, Djamali, Ghorbanalizadeh, & Ramezani, 2010) Since a serious study on Bombyliidae biodiversity has not been done in this region so far, it is expected to find interesting data about this family in the mentioned area. Due to the important role of most Bombyliidae species both in the pollination and natural regulation of pests, considering the high agricultural capacity in Guilan province, not only investigation on Bombyliid fauna but also the determination of their species diversity will be useful, as a basis for other related entomological studies about Bombyliidae in the similar ecological regions. The first principle in entomological studies is the investigation of insect fauna and biodiversity in the region, which is more than usual for Bombyliidae flies, due to their wide efficiency in biological pests control and IPM (Iperti, 1999).

## MATERIAL AND METHODS

### Sampling and collection methods

Sampling was done mainly from rangelands in different locations in Guilan province (Table 1 and Fig. 1). To collect larger species, flowering plants were sweeping net, especially plants such as ox-tongue flowers (to collect the Bombyliidae; Latreille, 1802 species). Other genera, due to their spawning behavior in areas free of vegetation on the soil, were collected during spawning using a net and used to collect smaller species.

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Table 1. Coordinates of sampling locations in Guilan province.

Locality	Geographical Coordinates	Date
Amlash	37°5'29.88"N, 50°11'12.98"E	2019.08.28, 2019.08.30
Bivarzen	36°40'57.19"N, 49°34'39.57"E	2019.04.17, 2019.04.21
Damash	38°26'32.45"N, 48°34'53.26"E	2019.06.26, 2019.06.29
Heiran Pass	36°42'12.85"N, 49°47'17.57"E	2019.05.27, 2019.05.31
Jirandeh	36°48'34.96"N, 49°24'57.98"E	2019.07.23, 2019.08.20
Rudbar- Darestan	36°48'34.96"N, 49°24'57.98"E	2019.08.07, 2019.08.09
Rudbar- Lockhee	37°5'29.88"N, 50°11'12.98"E	2019.06.04, 2019.06.07
Rustam Abad-Jokin	36°40'57.19"N, 49°34'39.57"E	2019.06.11, 2019.06.19



Fig. 1. The sampling localities in Guilan province.

### Preparation and storage of samples

For larger species at the sampling site, to prevent hair loss and hair loss, they were killed with cyanide and these insects were cut with fine needles. Also, large species can be immersed in 96% alcohol and after transfer to the laboratory, they can be taken out of alcohol and dried and removed. For smaller species collected from pan traps, the samples were collected in 96% alcohol after collection from traps and stored in the freezer.

### Species identification

The available scientific sources; Paramonov (1928), Engel (1932-1937), Zaitzev (1966), Linder (1975) and Greathead & Evenhuis (2001) have been consulted to identify species. The identifications have been confirmed by Dr. Rahim Abdollahi Mesbah (University of Tehran).

## Statistical analysis

All of collected insets were sorted out according to their species/location. Their frequency data were analysed using Shannon's Weiner diversity index to compare abundance and species richness among different localities in the study areas.

## RESULT AND DISCUSSION

Totally 20 species belong 11 genera were collected, identified and illustrated (Table 2). According to dynamic populations of collected samples, *P. vagans* with the highest occurrence frequency between collected flies, is considered as dominant species (Fig. 2). Also, the highest species biodiversity index; Shanon-winner have been seen in Darestan station (Fig. 3).

Table 2. Species frequency/Shanon-winner index in each location.

Species	Amlash	Bivarzen	Damash	Locations Heiran Pass	Jirandeh	Rudbar-Darestan	Rudbar- Lockhee	Rustam Abad-Jokin
<i>Exoprosopa amseli</i>					3	7		3
<i>E. kirgizorum</i>					6			15
<i>E. efflatounbeyi</i>						4		
<i>E. pectoralis</i>							3	
<i>E. grandis</i>						1		
<i>E. dispar</i>					2			2
<i>Thyridanthrax punctum</i>						1		
<i>T. elegans</i>	8		4					
<i>T. griseolus</i>						6		
<i>Lomatia belzebul</i>			5					
<i>Usia bicolor</i>	25			40		5		
<i>Parageron lutescens</i>							1	
<i>Conophorus pseudaduncus</i>				1				
<i>Heteralonia megerlie</i>				1				
<i>H. suffuse</i>							3	
<i>Callostoma soror</i>	5							
<i>Veribubo misellus</i>						3		
<i>Hemipenthes subvelutinus</i>					10	2		6
<i>Phthiria vagans</i>	20	100	100	30	20	10	20	10
<i>Phthiria pulicaria</i>				1				
Shanon Winner index	0	0.67	0.83	1.38	0.79	1.31	1.97	1.21

The results showed that the highest and lowest densities and biodiversity of Bombyliid flies in sampling related to Guilan province, in the western margin of the Caspian Sea coastline. The Bombyliid species are placed as important members of

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biodiversity, playing an impressive role in the natural ecosystem counterbalance; as partly primary consumers, an essential part of food-chains with predation pests, and mostly with pollination. even though there are exerting unprecedented pressures like human-made ones, on ecosystems all over the world, and such pressures may affect all the species (El-Hawagry & Gilbert, 2014).

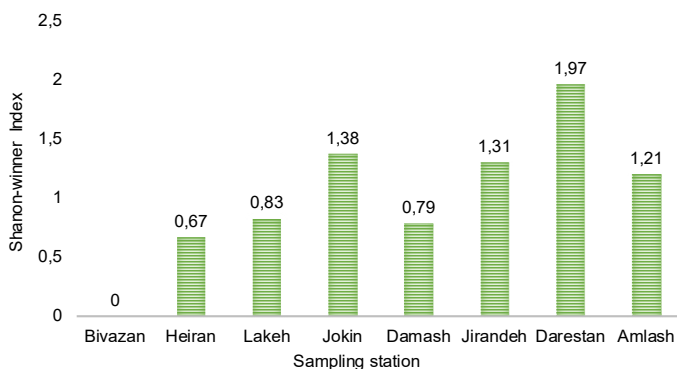


Fig. 2. Relative frequency for each species.

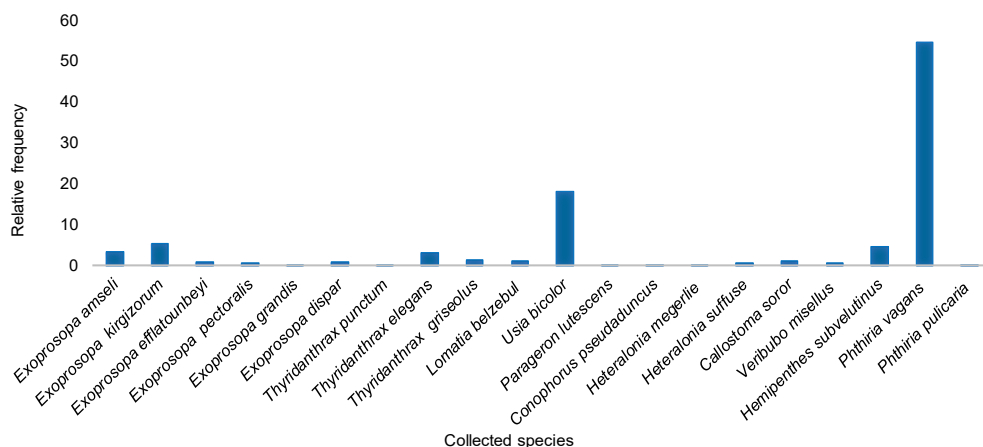


Fig. 3. Shanon-Winner Index amount for each station.

The greatest threats to beneficial insects (natural enemies) are habitat fragmentation and destruction, intensification of agricultural practice with over-use of pesticides and herbicides which is the main reason for increasing the pests population by supporting their resistance to their control methods (Tschumi et al, 2016; Heidari Latibari, Moravej, Ghafouri Moghaddam, Barahoei, & Hanley, 2020). Despite Guilan province being known for its rich biological diversity in flora and fauna, but the preservation of its habitats have received scant attention. Nevertheless, most of its biodiversity, including Bombyliidae species, is still unexplored because of a significant lack of

national research capacity. This study has substantially increased the knowledge of Bombyliidae diversity in an important agricultural region in Iran. Previous studies have listed limited species of the present species in Iran. However, the number of species found in our study was so lower than in comparable studies outside of Iran. This most likely reflects the region's relatively low diversity of this family. Based on our own results. Aim to increase our biodiversity knowledge about insect fauna, especially on beneficial groups like Bombyliidae, capacity building in the area at various levels is needed. we hypothesize that the diversity of Bombyliidae in the agroecosystems is substantially higher than is currently known. Lack of specialists and organized projects on insect biodiversity in the margin of the Caspian Sea, are among the identified gaps.

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