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Determination of the Biodiversity and Fauna of Hoverflies (Dip:Syrphidae) in Bardaskan (Khorasan-e Razavi province)

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Abstract

Hoverflies (Dip: Syrphidae) are one of the most important natural enemies of aphids. The larva is a predator of aphids and plays an important role in biological balance. During 2002-2004, in order to identify fauna of hoverflies, some specimens of adults were collected with a Malaise trap and sweeping net in Bardaskan (west Khorasan). Data were analyzed using the Margalov (Dmg) and Shanon-Winer (H') indices. The Maximum diversity and abundance of species in Bardaskan was recorded in the 4th week (Dmg=10.141, H'=2.746). Results: 13 species belonging to 8 genera were identified. Among them, two species, *Syritta flaviventris* and *Scaeva latimaculata* are recorded for the first time from Khorasan Province.

Keywords: Syrphidae; Hoverfly; Predator; Biodiversity; Khorasan; Iran

بررسی تنوع زیستی و فون مگس‌های گل (Dip:Syrphidae) درشهرستان برداسکن (خراسان رضوی)

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چکیده

مگس‌های گل (Dip:Syrphidae) یکی از مهمترین دشمنان طبیعی شته‌ها می‌باشند. لارو اغلب آنها شکارگر شته‌ها بوده و نقش مهمی در تعادل بیولوژیکی وکنترل طبیعی آنها ایفا می کنند. در بررسی‌های به عمل آمده طی سال‌های ۸۲-۸۰ روی فون مگس‌های گل این منطقه، ۱۳ گونه متعلق به ۸ جنس از دو زیر خانواده با استفاده از تله مالیز و تور حشره گیری جمع آوری و شناسایی گردیدند. تنوع زیستی گونه‌های این خانواده طی۱۷ هفته به کمک نمونه‌های حاصل از تله مالیز و بر اساس شاخص‌های مارگالف (Dmg) و شانون - وینر (H') مورد مطالعه قرار گرفت. حداکثر تنوع و فراوانی مگس‌های گل در منطقه برداسکن، در هفته چهارم (Dmg=10.141 و H'=2.746) مشاهده گردید. اکثر گونه‌های مورد مطالعه شکارگر شته‌ها بودند. از میان گونه‌های شناسایی شده ۲ گونه *Syritta flaviventris* و *Scaeva latimaculata* برای فون استان خراسان جدید می‌باشند.

کلید واژه‌ها: Syrphidae ، مگس گل، شکارگر، تله مالیز، خراسان ، ایران.

Introduction

Syrphidae, the hoverflies of Europe and flower flies of America, comprise one of the largest families of Diptera. Out of 6000 identified species from all continents, 1590 species have been identified from the Palaearctic (Sommaggio, 1999) whereas more than100 species have been identified from Iran (Sadeghi, 2003).

Their size varies from 4 to 35mm and can be distinguished easily from all other Diptera by the 'vena spuria' which is located in the middle of the wing, between the radial and median veins. Many hoverfly species have a pleasant appearance, which is usually enhanced by the presence of coloured markings. Many species resemble the Hymenoptera, (such as Vespidae and Apoidae) since they can make themselves look like dangerous model species in response against predators (Stubbs, Steven1996; Golding, 2001).

The hoverflies are excellent fliers; the thoracic muscles responsible for the wing beat (up to 250 beats per second) comprise about 15% of the total body weight (Gilbert, 1989). Adults often feed from the nectar and pollen of flowers, especially the females which need pollen and its protein to mature their ovaries. In contrast to the homogeneous alimentary habits of adults, the larvae of hoverflies show a huge variation in feeding habits, such as phytophages, mycophages, saprophages and zoophages. Four taxa are predominantly zoophages; the subfamily Syrphinae, the tribe Pipizini, and the genera *Volucella* and *Microdon* (Sommaggio, 1999). The larvae of Syrphidae species which feed greedily (e.g. *Episyrphus balteatus*) eat from 660 to 1140 aphids in their larval stage. *Merodon* and *Eumerus* are phytophages; *Cheilosia* feeds on fungi that develop on fruits, like *Amanita muscaria* (Gittings, 2003) whereas some of them like *Myathropa* and *Malota* are saprophagous larvae (Sommaggio, 1999). Comparing numerous work in other countries, only a little work has been carried out on the Syrphidae family in Iran which are, (Farahbakhsh, 1962; Peck, 1988; Modarres, 1995; Golmohammadzade, 2001; Dousti, 2001; Gharaei, 2001; Poor rabi, 2001 and Sadeghi, 2003). Due to the priority of flora and dependence of hoverflies on agricultural ecosystems in Bardaskan, the present study has been carried out in order to identify probable species and their diversity on the flora.

Material and Methods

The present study was carried out during 2002-04 in Bardaskan in the west of Khorasan Province. Bardaskan is located on the border of a salt desert in the south and the Dashte Kavir desert in the west, so it has a desert-like climate with a few limited species of plants such as *Alhagi, Salsola, Ferula, Tamarix* and *Haloxylon*. The height of Bardaskan above sea-level is 1100 meters and its annual rainfall is reported to be 145 millimeters.

The samples were collected using a Malaise trap and sweeping net from wheat, barley, alfalfa fields, orchards and places close to the creeks. In order to investigate the biodiversity of different species of hoverflies a Malaise trap was placed between a wheat and alfalfa fields neighboring a small pine forest. Samples were collected over 17 weeks, from March to Julay 2003, daily and counted on the basis of each species. The species collected were identified with the help of Bei-Bienko, Vockeroth and Stubbs identifications keys. The biodiversity of species was investigated by recording the number and abundance of species on the basis Shanon-Winer and Margalov indices (Dousti, 2001).

3. Conclusion

A) Fauna of Hoverflies

The species of the Milesiinae identified constitute approximately half of the fauna of

hoverflies in Iran, whereas the rest belong to the Syrphinae. The Syrphinae species are considered to be more important because of their hunting nature in the larval stages. Out of 13 species of hoverflies collected belonging to two subfamilies Syrphinae and Milesiinae, two species of *Syritta flaviventris* and *Scaeva latimaculata* are reported for the first time from Khorasan Province. The most prevalent species in this region were: *Eupeodes corollae* (Faloricius, 1794), *E. nuba* (Wiedemann, 1830), *Sphaerophoria scripta* (Linnaeus, 1758), *S. rueppellii* (Wiedemann, 1830) and *Episyrphus balteatus* (Degeer, 1776). The larvae of 11 species out of 13 the species identified are aphidophagus and 2 are saprophagous (Table 1).

B) Biodiversity of Hoverflies

In the light of the samples recorded, the greatest abundance of hoverflies in Bardaskan area was in the 4th week, whereas the lowest are from the 8th to 11th weeks (Table 2, Figure 1).

The obtained results from the Margalov and Shanon-Winer indices, show a greater diversity of species in the 3rd, 4th and 5th weeks of April than in other periods. The diversity of species in the 4th week is the highest (Dmg=10/141, H´=2/74, Figure3) as the steeply ascending curve of the diagram follows a sharp descent, and this reveals the lowest diversity.

The maximum coefficient diversity (H´m) and the resultant diagram also show an increasing tendency in the diversity of species up to the 4th week (Figure 2). This diagram shows the same changes as does the Shanon-Winer index. The distance between the two diagrams (H´ and H´m) shows evenness (E). The least distance found between coefficient diversity and maximum coefficient diversity is observed in the 4th week. In other words, during these weeks, the species identified show close biodiversity and refer to their abundance (Figure 4). Although in the 9th week with a decrease in temperature, an increase occurs in the evenness, it only lasts for a short time and the general tendency is descending. The fact that the desert-like Bardaskan with a short period of spring and a long period of summer with the gradual increase in temperature and the growth of the species of the Compositae family, and also wheat, barely and alfalfa, large colonies of aphids constitute a valuable food source for the larval growth of aphidophagus species of hoverflies. As the steeply ascending and concave shape of the Margalov and Shanon-Winer indices indicate, the poor collection of species (11 species from 13) of hoverflies is due to the agricultural ecosystem.

The results reported by Marcus Garcia (1987), comparing several localities with different characteristics in the western mountains of Central Spain, show that diversity in hoverflies depends on climatic conditions and the three mentioned ecological factors, namely, altitude, vegetation and opening grade, were important for the distribution of hoverflies. As the findings reported by Speight (1975) show in the above loculities there are even more species of hoverflies than in the homogenous vineyards. The presence of heterogeneous fauna around agricultural ecosystems is an important factor for the presence of different species of hoverflies.

Due to the highly diversified habitat requirements of their larvae, hoverflies are particularly negatively affected by a reduction in landscape diversity. In particular, the introduction of extensive monocultures destroyed many elements of traditional landscapes, e.g. ponds, hedgerows, small woods, etc. As these sites are the habitats of many larvae of Syrphidae, studies of their hoverflies populations can provide a good indication of environmental stress and loss of landscape diversity.

Table 1. The Hoverflies identified in Bardaskan area:

Row	Tribe Subfamily	Species	Preferred environment	Larva feeding habit	Flight period	Emigration
1	Syrphinae Paragini	*Paragus bicolor* (Fab,1794)	bare ground or low plants	Aphidophagus	Apr. Aug.	
2	Syrphini	*Chrysotoxum intermedium* (Mei,1822)	Farms, Orchards	Aphidophagus	Apr. Aug.	
3		*Eupeodes corollae* (Fal,1794)	Farms, Orchards, grassland	Aphidophagus	Apr. Sep.	
4		*E. nuba* (Wie,1830)	Farms, Orchards, open ground	Aphidophagus	Apr. Sep.	
5		*Episyrphus balteatus* (Deg,1776)	Most of the habitat	Aphidophagus	May. Nov.	Migrant
6		*Scaeva albomaculata* (Maq,1842)	Farms, dry grassland	Aphidophagus	Apr. Nov.	Migrant
7		*Sc. latimaculata* (Bru,1923)	Farms, Grassy, hedgerows	Aphidophagus	Apr. Nov.	Migrant
8		*Sphaerophoria rueppellii* (Wie,1830)	Wetland, open ground, Farms	Aphidophagus	Apr. Oct.	Migrant
9		*S. scripta* (Lin,1758)	Open ground, grassland, Farms	Aphidophagus	Apr. Oct.	Migrant
10		*Syrphus ribesii* (Lin,1758)	Farmland, orchards	Aphidophagus	Apr. Nov.	Migrant
11		*S. vitripennis* (Mei,1822)	Forest,field hedges,orchard	Aphidophagus	Apr. Nov.	Migrant
12	Milesiinae Xilotini	*Syritta flaviventris* (Maq,1842)	Wetland, pools in marsh	Saprophagous	Apr. Nov.	
13		*S. pipiens* (Lin,1758)	Wetland, margin freshwater	Saprophagous	Apr. Nov.	

Table 2. Indices of diversity in Bardaskan area.

Week	No. Species (S)	Number (N)	Margalov Ind. (DMg)	Shanon-Winer Ind.		
				H'	H'_M	E
1	2	5	0.698	0.721	1	0.721
2	5	17	4.92	2.183	2.321	0.940
3	7	31	8.948	2.711	2.8	0.965
4	7	49	10.141	2.746	2.8	0.978
5	6	37	7.841	2.211	2.58	0.855
6	5	30	5.96	1.784	2.32	0.768
7	4	21	3.9	1.595	2	0.798
8	3	12	2.158	1.292	1.58	0.815
9	4	11	3.124	1.789	2	0.894
10	3	5	1.398	1.370	1.58	0.864
11	0	0	0	0	0	0
12	1	1	0	0	0	0
13	1	3	0	0	0	0
14	0	0	0	0	0	0
15	0	0	0	0	0	0
16	0	0	0	0	0	0
17	0	0	0	0	0	0

$Dmg = S - 1(LogN)$

$H' = (NLogN - f_i Logf_i)/N$

$H'_{Max} = LogS$

$E = H'/H'_{Max}$

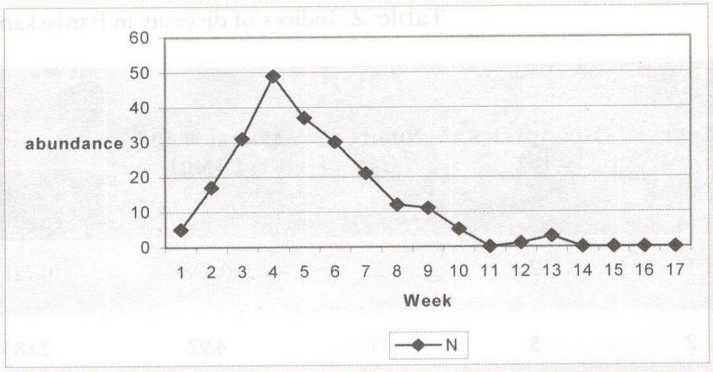

Figure 1. Diagram of abundance variety of hoverflies.

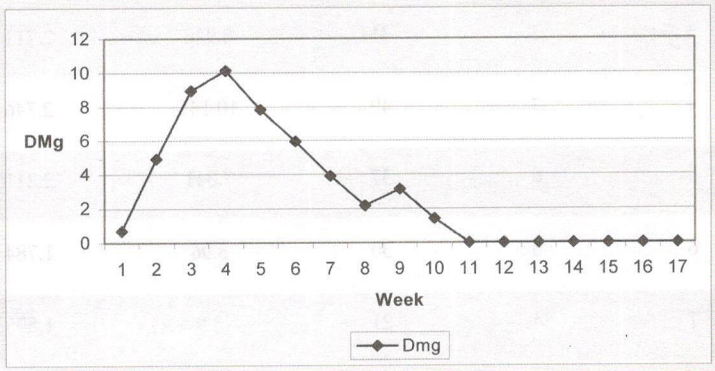

Figure 2. Diagram of richness variety of hoverflies with Margalov indices.

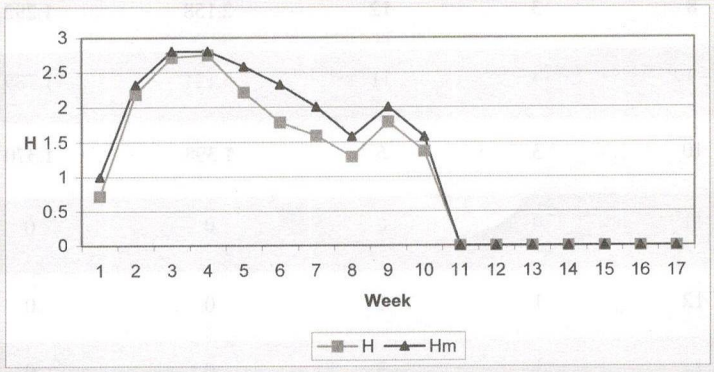

Figure 3. Diagram of richness variety of hoverflies with Shanon-Winer indices.

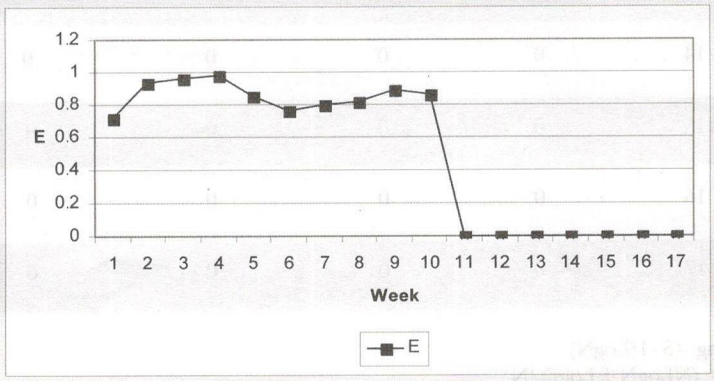

Figure 4. Diagram of the variety of evenness in hoverflies.

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