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Biodiversity of syrphid flies (Syrphidae: Diptera) from Poonch district of Azad Kashmir, Pakistan

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Syrphid flies (Syrphidae: Diptera) represent a component of insects that contributes to the plant pollination. This work has studied the abundance, diversity and species richness of syrphid flies at Poonch district of Azad Kashmir, Pakistan. A total of 979 specimens of syrphid flies was collected using Entomological sweep nets and Mailase traps from fruit trees (apples, apricots, peaches, pears and plumsand) at ten different localities (Alisojal, Banjosa, Datoot, Hajira, Hussainkot, Khaigala, Paniola, Rawalakot, Singola and Topa) of district Poonch. Six species belonging to three subfamilies and five genera were identified. The maximum abundance of *Eristalis tenax* was recorded from Hussainkot and minimum abundance recorded from Rawalakot.

Key Words: Diversity, evenness, fruit crops**,** syrphid flies, richness, Poonch

Introduction

The true flies (Diptera) are large group of insects with an estimated number of 1.6 million species, and therefore form one of the largest assemblages of organisms on the planet (Hammond, 1992). There is a long term plant-pollinator interaction and they have been co-evolved through million of the years (Waser *et al*., 1996). They adopted their life cycles and visitation patterns according to flowering patterns of plant species (Freitas and Sazima, 2003). Family Syrphidae is one of the most geographically diverse families and is found in most worldly and many aquatic ecosystems (Speight, 2003). Thompson (2006) reported 6000 species that are cosmopolitan in distribution. Syrphid flies as pollinators associated with flowering season during spring in oriental region and they are very rarely present in whole summer and winter in hot and arid parts of Asia (Sajjad and Saeed, 2010). Syrphid flies have great

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economic importance due to their role in pollination. Gharali *et al.* (2002) studied the fauna of Syrphid flies from Iran and reported that Syrphid flies are common pollinators almost wherever flowers are found, being absent only in truly rain fed areas and Polar region. In some agro-ecosystems, such as orchards, they out-perform native bees in pollinating the fruits (Gilbert, 1981). The adult syrphid flies usually feed on nectar and pollen of flowering plants. Syrphid flies as pollinators have a wide range of adaptations for visiting different flower types. (Ssymank, 2001) reported that up to 80% flora may be visited by syrphid flies. (Sajjad and Saeed, 2010; Sutherland *et al*., 1999) reported that syrphid files and other pollinators preferably visit flowers of white and yellow colour.

Some of the syrphid fly larvae play an important role as biocontrol agents, for example, the larvae of main genera *Sphaerophoria*, *Episyrphus*, *Syrphus* and *Baccha*, are predaceous on aphids, coccids and other soft bodied insects and thus can play an important role as bio-control agents or the suppression of pest insects on various crops (Chandler, 1968; Chambers *et al*., 1985; Chambers and Adams, 1986; Luna and Colley, 2000) and Sommagio

The taxonomy of this important group of insects has been extensively explored from many countries (Brunetti, 1923) India (Vockeroth, 1969) Canada. Little work on order has been reported from Pakistan (Arif, 2001; Sajjad, 2010). Saleem *et al*. (2001) identified 12 species belonging to 10 genera under the two subfamilies Syrphinae and Milesinae from Peshawar, Pakistan. Sajjad and Saeed (2009) reported four new species of *Eristalinus* from Multan, Pakistan. Sajjad *et al*. (2010) studied seasonal variation in abundance and composition of Syrphid fly communities in Multan, Pakistan. Sajjad *et al*. (2012) analyzed the spatial variation in pollinator communities and reproductive performance in *Prosopis juliflora* from Southeren Punjab of Pakistan.

From Azad Jammu & Kashmir fauna of syrphid flies was not explored and this study was designed to prepare an inventory of distributional diversity of syrphid flies from different localities of district Poonch in spring 2011.

Material and methods

Study Area

The district Poonch is mostly mountainous for being lying at the foot hills of Himalayas with thick lush green forests, precious minerals, fast flowing rivers and is streams. Most of the area of the State receives monsoon rains with average rainfall up to 1300 mm annually. Rawalakot is beautiful saucer-shaped valley and its altitude 5393ft. During summer, the place becomes full of green

grass and beautiful flowers including many varieties of roses, wild medicinal plants, pine trees, and other very important flora. The North and North western mountainous areas are extremely cold in winter and snow may fall in the months of December and January some time temperature fall in minus. The rainy season lasts from April through June while in summer with temperature varies from 60 ˚F (16 ˚C) to 75 ˚F (24 ˚C).

Fly Sampling

Field surveys were undertaken in ten locations of district Poonch of Azad Kashmir. The detailed survey of these localities was conducted during 20th March to 7th May 2011. The ten localities of district Poonch were Hajira, Singola, Topa, Paniola, Rawalakot, Alisojal, Khaigala, Hussainkot, Datoot and Banjosa. The localities were selected depending on the road links available and at least 10-15 kilometers apart from each other. Each locality was visited four times with one week's interval depending upon the weather conditions preferably sunny days were chosen for the collection. Maximum area of each locality was covered during the sampling. Selected localities with their latitude, longitude and altitude are given in (Table, 1).

Specimens from the wild flowers were also collected. The collection, stretching, pinning, labeling and preservation methods for the study of syrphid flies were according to (Gullan and Cranston, 2004, 2010). The identification of the specimens up to the species level was done by the following keys of Brunetti (1923), Vockeroth (1969), Stubbs and Falk (1996), Van Veen (2004), Speight (2005) and DeGroot and Govedic (2008).

Table 1: Coordinates, altitude and flowering period of the selected fruit trees at different studied localities in Poonch (AJ, Alisojal; BJ, Banjosa; DT, Datoot; HJ, Hajira; HS, Hussainkot; KG, Khaigala; PN, Paniola; RW, Rawalakot; SG, Singola; TP, Topa)

Localities	Latitude (N)	Longitud (E)	Altitude (Feet)	Name of Fruit Trees	Flowering Period	
					Date of Initiation	Date of Closing
AJ	33°52'30.13"	73°50'32.10"	8845	Apple, Apricot, Peach	5th April 2011	26th April 2011
BJ	33°48'35.92"	73°48'56.05"	6520	Apple, Apricot, Peach, Plum	8th April 2011	28th April 2011
DT	33°52'24.06"	73°41'52.12"	6254	Apple, Apricot, Peach, Pear	20th April 2011	4th May 2011
HJ	33°46'06.36"	73°54'01.06"	3076	Apple, Peach, Pear	20th March 2011	3rd April 2011
HS	33°48'38.08"	73°4734.16"	6525	Apple, Apricot, Peach, Pear	23rd April 2011	7th May 2011
KG	33°50'42.10"	73°49'44.88"	5747	Apple	1st May 2011	3rd May 2011
PN	33°55'15.05"	73°41'12.80"	4608	Apple, Apricot, Peach	14th April 2011	25th April 2011
RW	33°51'42.18"	73°45'33.70"	5370	Apple, Apricot, Peach, Pear	25th March 2011	8th April 2011
SG	33°53'56.94"	73°48'02.79"	5950	Apple, Apricot, Peach, Pear, Plum	24th March 2011	7th April 2011
TP	33°50'12.59"	73°24'58.39"	6696	Apple, Apricot, Peach, Pear, Plum	26th March 201	9th April 2011

Statistical Analysis

The relative abundance was calculated by using the formula:

$$R= ni/N*100$$

Where R is the relative abundance (%), "ni" is the number of individuals of the "ith" species and "N" is the total number of specimens. The rank lists were prepared from each locality according to the maximum abundance with the help of which the diversity indices were calculated.

Results

A total of 979 individuals representing six species in five genera and three subfamilies were collected over 40 collecting periods from the ten localities in Poonch District. Relative Abundance (%) was also calculated (Table. 2).

The calculated values of diversity, richness and evenness at different studied localities are given in table (2). The Shannon-Wiener's diversity index in different selected localities were ranged from 2.219 (Hussainkot) to 6.609 (Alisojal) (Table. 2). The Margalef's index ranged from 0.991 (Hussainkot) to 1.329 (Rawalakot). The Nakamura's index (RI) from sampled localities of district Poonch are remaining all sampled localities (0.833) (Table. 2).

Table 2: Syrphid species, subfamilies and their abundance, Shannon-Wiener's index (H'), Margalef's index (D), and Nakamura's index (RI) in different studied localities of Poonch district (AJ, Alisojal; BJ, Banjosa; DT, Datoot; HJ, Hajira; HS, Hussainkot; KG, Khaigala; PN, Paniola; RW, Rawalakot; SG, Singola; TP, Topa)

Rank	Species	Subfamily	Total abundance	% Abundance	AJ	BJ	DT	HJ	HS	KG	PN	RW	SG	TP
1	*Eristalis tenax*	Milesiinae	685	69.97	91	72	84	7	150	44	61	6	83	87
2	*Episyrphus balteatus*	Syrphinae	191	19.51	31	5	9	63	0	0	3	36	22	22
3	*Eupeodes latifasciatus*	Syrphinae	44	4.49	1	0	6	21	0	0	1	0	2	13
4	*Eristalis solitus*	Milesiinae	42	4.29	0	22	10	0	3	3	0	0	1	3
5	*Eristalinus sepulchralis*	Milesiinae	16	1.63	0	4	1	0	2	1	7	0	0	1
6	*Chrysotoxum baphyrus*	Chrysotoxinae	1	0.10	0	0	0	0	0	0	0	1	0	0
Total abundance			979		123	103	110	91	155	48	72	43	108	126
Number of Species			6		3	4	5	3	3	3	4	3	4	5
H'					6.609	5.586	5.844	5.148	2.219	3.477	4.599	2.974	6.019	6.126
D					1.039	1.083	1.065	1.108	0.991	1.291	1.169	1.329	1.067	1.029
RI					0	0.833	0.75	0	0	0	0.833	0	0.833	0.75

Discussion

In our research study six species of family Syrphidae were identified from study area and their diversity richness and evenness was calculated. As this area of Azad Jammu & Kashmir has micro climatic and hilly topography due to which a wide and diverse type of flora is present which owes to insect pollinators for their survival and propagation. Among the study area Hajira posses warmer condition as compared to Banjosa where spring commence later than Hajira and flowering of fruit plants and other flora get delayed due to high altitude and severe weather conditions characterized by the heavy snowfall and frost. Some species as *Chrysotoxum baphyrus* was collected only from Rawalakot (Table. 2) which is at higher elevation than Hajira and lower than Alisojal, Datoot, Paniola. *Eristalis tenax* is not more abundant in Hajira and Rawalakot but in all other localities it is evenly distributed (Table. 2). *Episyrphus balteatus* was not found at Khaigala and Hussainkot, also very fewer specimens were caught from Banjosa, Paniola and Datot. *Eupeodes latifasciatus, Er. solitus* and *Eristalinus sepulchralis* are moderately abundant at some localities and totally absent at some collection localities (Table.2). According to Shannon-Wiener's diversity index (H') the calculated values showed that there is a big difference in the diversity of area which means the Syrphid flies are not well scattered in all chosen localities of district Poonch. However, the maximum diversity values calculated from Alisojal (6.609) and minimum diversity values calculated from the Hussainkot (2.219) (Table. 2). The yielded values of Margalef's index (D) shown that richness of syrphid flies in the study area is not significantly different. The yielded values Nakamura's index (RI) indicate that the evenness of Hajira and Banjosa was slightly higher than remaining all sampled localities of district Poonch. It may be due to rich flora of habitat. Increasing pressure of population in Azad Kashmir require economic liberalization by encouraging the cash crop farming and cultivation of fruits, vegetables, floriculture practices which are all owes to such type of pollinator insects for propagation. The region of Azad Jammu and Kashmir is rich in diverse type of flora and fauna and have very suitable environment for the production of vast variety of fruits and vegetables which can fulfill the needs of increasing population. Pollination by insects is a key ecosystem service but it is largely neglected in AJ and K, this study is a first attempt to explore the fauna and calculate the diversity of syrphid flies from localities of district Poonch of AJ andK. Therefore, we recommend that further exploration of the fauna and continuous monitoring of the family Syrphidae may be carried out to detect any spatial and temporal changes in the diversity of this family in this area of study as well as plant pollinator interaction which is essential plant-pollinator diversity and survival for long time. Dipteran pollinators are largely

neglected in this area hence this research work will give base line for researchers.

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