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Seasonal variations in the population of Vespidae (Insecta: Hymenoptera) of Swat Pakistan

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Abstract

Wasps belonging to the family Vespidae were collected from April, 2016 to November, 2016. The collection was made from different localities of District Swat and a total of 1397 specimens belonging to the family Vespidae were captured. The members of the subfamily Vespinae made their appearance in the month of April and their population increased up to the month of September and then gradual decrease in the population occurred. Some species of the Vespinae like *Vespa velutina* were collected from April to November. The Polistinae species first appeared in the area in the month of May increases in number up to September and then decline suddenly. The members of the Polistinae were recorded from May to October. The individuals belonging to the subfamily Eumeninae were only collected in the Months of July, August and September.

Keywords: Vespidae, Polistinae, Eumeninae, Vespa, Wasp, Swat

1. Introduction

The family Vespidae (Hymenoptera) is a diverse and cosmopolitan but predominantly tropical family^[1]. Adult wasps can be recognized due to their specific coloration, generally brown or black but sometimes also have white or yellow markings^[2]. The family is divided into six subfamilies, of which the two Polistinae and Vespinae contains the highly social species, the solitary species are included in the subfamilies Eumeninae, Eupragiinae and Masarinae while Stenogastrinae are in between the solitary and the social wasps^[3].

Although a great majority of the people consider wasps as pest and hate them due to their stings, they are beneficial to humans. The Wasps are generalist predators and prey on a variety of insect pests like flies, spiders, bugs and caterpillars^[4]. The wasps are good pollinators and also used as food in some countries like Japan^[5].

Enough evidence is available which shows that seasonal fluctuation occurs in wasp populations^[6]. Various studies carried out in the tropical regions suggest that the wasp populations fluctuate during the year^[7, 8]. It has also been observed by various investigators that in spring or early summer the fertile female wasp become active and initiate the process of nest building, in the late summer the population reaches to its maximum apex and in the fall declines due to the death of the sterile females and drones^[9].

2. Materials and Methods

2.1 Study Area

District Swat is located from 34° 34' to 35° 55' North latitudes and 72° 08' to 72° 50' East longitudes in Pakistan. It is an important tourist area and visitors around the world come here to enjoy the matchless beauty of nature^[10]. The months of May, June and July are the hottest months in terms of temperature while December, January and February are the coolest months of the year. In these three months temperature ranges between 0 °C to -2.4 °C. Maximum rain fall occurs from January to September. The most humid months were January, February, March, April, July, August and September (Table 1).

2.2 Collection and Preservation

Various localities of the district Swat, Pakistan were visited regularly from March to December, 2016. The wasps specimens were collected by active search in the crop fields, parks, fruit markets and gardens with the help of hand net. In the field, just after catching the wasps specimens were killed with the help of insecticide spray (Mortein) in the net. The specimens were labeled with full data like date and locality of the specimen with altitude, latitude and longitude and preserved in the insect box. In the boxes phenolphthalein balls were used as preservative.

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Table 1: Month wise five years (2011-2016) Mean Temperature, Precipitation and Relative humidity of District Swat.

Month	Mean Temperature (°C)		Precipitation (mm)	Relative Humidity (%)
	Maximum	Minimum		
January	11.2	-2.4	111.4	69.7
February	12.7	-1.3	172.6	69.2
March	16.2	3.0	242.2	66.4
April	22.4	7.7	167.9	57.4
May	27.6	11.6	88.5	47.9
June	32.5	15.7	51.3	41.7
July	31.4	19.3	145.8	60.3
August	30.2	18.5	160.0	69.2
September	29.0	13.6	81.9	64.1
October	25.0	7.6	53.7	59.5
November	20.0	2.5	50.7	59.4
December	14.0	-0.9	90.8	67.4

Source: Pakistan Metrological Department.

2.3 Identification

For the visualization of taxonomically important characters Stereoscope (Labomet CZM4-4X) was used. Identification was performed with the help of latest available literature like Social wasps of India and adjacent countries [11]; Vespinae check list of the world [12]; Catalogue of the Vespidae wasps of Iran [13]; a catalogue of the Eumeninae (Hymenoptera: Vespidae) of the Ethiopian region [14]; new records of vespidae wasps from Yemen with synonymy in Belonogaster (Hymenoptera: Vespidae: Polistinae and Eumeninae) [15].

3. Results

During the study a total of 1397 specimens were collected representing the three subfamilies Eumeninae, Polistinae and Vespinae of the family Vespidae. The first collection was made in the month of April by capturing 34 specimens belonging to two species both of the subfamily Vespinae, *Vespa tropica* and *Vespa velutina*. These specimens were collected from the bottle brush plants visiting the flowers. These early collected specimens were large in size and

perhaps the queens which have come out from the hibernation due to increase in temperature and photoperiod. The specimens of both these species collected in the third week of June and there after contained small specimens which seemed to be the workers. The population of the Vespinae increased up to the month of September and then ceased down with complete disappearance in December. *Vespula flaviceps* were collected in large number in October due to the reason that their nests are underground and the hive is covered by grasses having rich in insect fauna used as prey by the wasps. At the end of September, the grasses are harvested for the purpose of fodder and hence the wasps are exposed and easily visible.

The members of the subfamily Polistinae first appears in the month of May as eight specimens belonging to the subfamily were collected from mint field. Like Vespinae the population of Polistinae also increases with the increase in temperature and maximum number (354) of specimens were collected in the month of September. Although the specimens of the subfamily were collected in the month of October but the number was less (157), excluding *Polistes stigma*, showing that the abundance is on decline. The *Polistes stigma* build small paper nests in the grasses and the grasses are harvested in the month of October as fodder which destroy its habitat and they disperse and hence become easily visible in spite of their small size. Due to this reason its maximum number was collected in the month of October. The last collected specimens of other species were blackish dark in color and predominantly male.

The members of the subfamily Eumeninae are solitary and no such seasonal variation as in the case of Vespinae and Polistinae was observed. The specimens of the subfamily first appear in the area in the month of July as 21 specimens belonging to four genera were collected in July. It is having the same abundance in the month of August and same number (21) of specimens was collected in August. The abundance of the subfamily declines in the month of September and only nine specimens were collected in September with complete disappearance in October (Table 2).

Table 2: Number of Specimens of different species of the family Vespidae collected from April to November.

Subfamily	Species	April	May	June	July	Aug	Sep	Oct	Nov	Total
Polistinae	<i>Polistes wattii</i>	0	2	14	25	26	73	19	0	159
	<i>Polistes flavus</i>	0	1	18	59	48	81	35	0	242
	<i>Ropalidia cyathiformis</i>	0	0	0	0	0	2	8	0	10
	<i>Ropalidia brevata</i>	0	0	0	0	0	2	0	0	2
	<i>Polistes stigma</i>	0	0	0	0	0	40	51	0	91
	<i>Polistes indicus</i>	0	0	5	6	16	18	0	0	45
	<i>Polistes olivaceous</i>	0	5	15	28	74	121	91	0	334
Vespinae	<i>Polistes rothneyi</i>	0	0	6	23	15	17	4	0	65
	<i>Vespa mandarinia</i>	0	0	0	0	0	0	0	1	1
	<i>Vespula flaviceps</i>	0	0	0	0	0	8	62	0	70
	<i>Vespa orientalis</i>	0	0	0	0	2	7	0	0	9
	<i>Vespa tropica</i>	4	3	2	3	2	8	5	0	27
Eumeninae	<i>Vespa velutina</i>	30	28	50	42	54	57	27	3	291
	<i>Delta species</i>	0	0	0	4	2	3	0	0	9
	<i>Antepipona species</i>	0	0	0	1	1	0	0	0	2
	<i>Rhynchium species</i>	0	0	0	14	14	3	0	0	31
	<i>Antodynurus flavescens</i>	0	0	0	2	4	3	0	0	9
Total		34	39	110	207	258	443	302	4	1397

4. Discussion

The results of the study show that the vespidae wasp populations of the area undergo seasonal variations in abundance. Various biotic and abiotic components of the ecosystem effect the wasps abundance and distribution [16].

The most important ecological factors which effect the populations of wasps are temperature and humidity [17]. During the cold the workers and drones die while the queen undergoes hibernation [9]. The months of December, January, February and March are very cold in the area and the fertile

females are on hibernation so no collection was made during these months. With the increase in temperature and photoperiod the hibernating females became active and started nest building^[9]. Only 34 specimens were collected, with the start of the spring, in the month of April from the bottle brush plants. These specimens were large in size and easily identified as queens. With the increase in temperature and availability of food, the populations of wasps also increased reaching to its maximum in the month of September. In the late summer the colony reaches to its maximum size^[14] and hence the highest number (443) of wasp specimens were collected in the month of September when both temperature and humidity were optimal for the wasp population. As evident from the results, the wasp populations decrease with the decrease in temperature.

5. Conclusion

It is evident from the study that the abundance of wasps starts rising from May reaching to maximum in September. During this time other insects population also increases which serve as prey for the wasps and their larvae. The decline in abundance is rapid and the wasps disappear with the approach of cold in the months of November and December.

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7. Conflict of Interest

The authors declare that there is no conflict of interests regarding the publication of this article.

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