

Study of population dynamics of Syrphid fly (Order- Diptera, Family- Syrphidae) in ITM University Gwalior.

ABSTRACT

An intriguing ecological interaction can exist between aphids and syrphid flies, particularly in the setting of millet crops. Aphids (Order Hemiptera: Family Aphididae) are a problem variety of crops, including all types of millets. Syrphid flies (Order Diptera: Family Syrphidae) naturally prey on aphids when they are in their larval stage. Syrphid fly larvae are referred to as "aphid lions" or "hoverfly larvae." Aphids are the main source of food for these larvae, and they manage the aphid population in millet crops. Therefore, syrphids are used as natural enemies and biological control agents and syrphid flies are advantageous insects in agriculture. The present study was conducted to find out the population dynamic of syrphid flies in agricultural farms and the campus of ITM University. The maximum number of larvae were collected from the Turari campus and were as a minimum found in CRC 2. The population of syrphid flies and larvae depends on the climatic conditions and the availability of foods and their prey.

KEYWORDS: Syrphid fly, biodiversity Pearson's correlation, population dynamics

1. INTRODUCTION

Flower flies (Diptera: Syrphidae) are a large and diverse group of insects. Many species are important pollinators of flowering plants. In addition, the immatures of numerous species are predators of destructive aphids and other pests (Gilbert, 1981). These flies are expert fliers and can hover or fly backward, ability possessed by few insects other than syrphid flies. The adults mainly feed on nectar and pollen. The females must consume pollen since they need the proteins and amino acids of the pollen for maturation of their eggs. Nectar has only a small amount of these substances but much sugar. It is the fuel for the flies, enabling them to fly and hover

Comment [a1]: 1.add the research method set out in this study
2.Confirm the statement regarding syrphid fly larvae populations depending on climatic conditions? summer or winter?
3.What kind of food availability affects syrphid fly larvae populations?
4.Which plants dominate?
5.What are the prey types that dominate in influencing the syrphid fly population?

Comment [a2]: The references used in the introduction need to be updated for the last 5 years (2020-2024) to emphasize the importance of studying the population dynamics of Syrphid fly.

actively. Being regular visitors of flowers, hoverflies are important pollinators of various plants including vegetables and fruit trees (e.g. Asteraceae, Brassicaceae, Rosaceae) and select the flowers mainly by their colours. Compared with the adults, the larvae are important predators, feeding primarily on aphids that attack citrus, subtropical fruit trees, grains, corn, alfalfa, cotton, grapes, lettuce and other vegetables, ornamentals, and many wild host plants of the aphids. Three large ecological groups can be distinguished: predators, miners and decomposers (living on dead organic material - saprophagous larvae). All species of the subfamily of Syrphinae have zoophagous larvae. Their main preys are aphids (greenflies). The larvae of Microdontinae are associated with hymenopterans. The Microdontinae larvae are supposed to be zoophagous living in ant nests. Eumerus and Merodon larvae are plant eating (phytophagous) but miners in nature. The larvae of the remaining Eristalinae species are saprophagous organisms; they live in various habitats (running or stagnant water, mud, compost heaps, rotten wood etc.) feeding on dead organic substances. Hoverflies can be found in every biotope but not in deserts. Each species tends to prefer a certain type of habitat and is limited to a distinct range within the country. In general, within a genus the needs and behavior of the species are similar. As a result, one tends to associate certain genera with particular habitats. For example Chrysogaster, Eristalinus, and Mesembrius (all with aquatic or semi-aquatic larvae) are typical found in wetlands, many tiny Paragus species live in grassland whereas species of Baccha, Melanostoma and Xylota prefer woodlands. Within a given habitat the hoverflies have an irregular distribution. Some prefer the low vegetation (like Melanostoma and Paragus), others can be observed in the tree canopies (like Mallota and Spheginobaccha). There are also differences in the horizontal distribution of the adults at a site since important structural components like certain flowers or egg laying sites

cannot be found everywhere within a habitat (Stubbs and Falk, 2002). The hoverflies can be efficient predators in cereal crops such as wheat, rice and corn.

Aphids alone cause tens of millions of Dollars of damage to crops worldwide every year; because of this aphid-eating hover flies are being recognized as important natural enemies of pests, and potential agents for use in biological control some adult syrphid flies are important pollinators.

Flies that visit or hover on flowers are not all referable to flower flies or hover flies, but those that do it usually by hovering for some time with a shrill hum are regarded flower flies or hover flies or Syrphidae (Datta and Mukherjee, 2004). The family includes small to rather large (3-18 mm), bristle less, brightly coloured flies, may be striped, banded or spotted yellow on a blue, black or metallic ground colour. Head variable, usually as broad as or a little broader than the thorax, thorax rather large and robust, moderately arched, rarely with bristles, abdomen variable in shape, composed of five or six visible segments, rarely four, wings comparatively large, most of which have a false or spurious vein, extending longitudinally and slightly diagonally between the third (R4+5) and (M1+2) longitudinal veins. The systematic study of the family Syrphidae has gradually progressed from the 17th century and presently 6,107 species under 209 genera reported from the world (Pape and Evenhuis, 2013, Miranda et al. 2013). In India, 357 species under 14 tribes of three subfamilies are reported (Ghorpade, 2014). This study thus may provide an insight into the pollination biology of this important group in future as well as modern taxonomic approach may serve as important tool for their easy identification.

MATERIAL AND METHODOLGY

Study selection

The study was conducted in ITM University Gwalior. ITM University Gwalior is located 6 kms from Gwalior city at Jhansi highway NH 75. The altitude of the study area is about 197m above

Comment [a3]: add Map of locations (The Case Study Area)

sea level and its position is 26° to 14° N latitude and 78° to 18° E longitudes Annual rainfall of 664.4 mm, with temperature varies from 5 to 45°C.

Methodology

Collection of samples

Larvae of syrphyid fly were collected from Sithuli campus, SRC1 SRC 2 and Turai campus. Sample were collected from available crops and its was different from season to season. In winter season the syrphyid fly was on mustard crop, cabbage cauliflower, marigold and in rainy and summer season it was collected from maize, sorghum and other vegetables.

Methods employed

The sample culture was maintained in the entomology laboratory School of Agriculture ITM university Gwalior .

The plant samples were placed in sample container containing Aphid colony and available Syrphid larvae, both Aphid and Syrphid larvae counted at each three replication of individual host plant samples.

The sample container were covered with muslin cloth and tied with plastic rubber to provide aeration to the emerging insects. On the second day of collection aphid colony was provided and continued until pupation. Pupa were separated till the adult emerge. Finally labeling was done such as date of collection with the name of the host sample.

Statistical analysis

The data were analyzed statistically using Pearson's correlation coefficient to measure the strength of linear relationship of biotic (host plants) and a-biotic (temperature, humidity, rainfall and cloudiness) factors with the abundance of hoverflies through SPSS 22 version software.

Data of climatic factors

The data of weather variables i.e. Temperature, humidity, of studied localities were collected from the Department of Land resources and environment

Comment [a4]: Explain how syrphyid fly larvae samples were collected for each location? crop? and season? or

Comment [a5]: 1.How many sample cultures are maintained in the entomology laboratory of the Faculty of Agriculture, ITM Gwalior University? Explain in methods.
2.How to determine the plant samples placed in the sample container, is it 1 whole plant or part of the plant biomass or how? need to be clarified in the method.
3.visualization (Figure) of aphid colonies and Syrphid larvae to pupae and to imago can be added to add anatomical evidence to this study

RESULTS

Mean no. of syrphid flies population

The larvae of syrphid fly were collected and counted from different localities of Gwalior like Sithuli campus, CRC1, CRC2 and The population mean was recorded monthly with average minimum and maximum temperatures in degree centigrade and average relative humidity. The data were placed on Table 1. The population was recorded from available crops collected at the month of maximum December, January and February.

Temperature is main driving force for availability of syrphid fly in different months. And different type cropping pattern also type vegetation that attract the aphids on which syrphid fly feeds on it. Pearson's correlation coefficient analysis revealed that negative but not significant correlation i.e. with minimum and maximum temperature for all experimental site. Sithuli ($r=0.078$) ($p=0.922$), duranta ($r=-0.111$) ($p=0.889$) but positive and not significant correlation for cowpea i.e. ($r=0.373$) ($p=0.627$) for the month of October. On November according to Pearson's correlation it was positive and not significant correlation i.e. sorghum ($r=0.607$) ($p=0.393$) of temperature and relative humidity with abundance of hover flies. While on December temperature with abundance population correlated strong positive and not significant i.e. ($r=0.961$) ($p=0.069$) but negatively correlated in okra ($r=-0.052$) ($p=0.948$). In the month of January overall population of syrphid fly was negative and not significantly correlated. While positive Pearson's correlation for sorghum and mustard on February. For the month of March result revealed negative, positive for duranta and not significant correlated for the available host range.

Table 1. Population of syrphid fly on different

Comment [a6]: 1.add a discussion section
2.add some supporting variables such as OFF Populations: Temporal and Spatial Differences, etc.
3.add discussion on the relevance of the Approach in the research and
4.discussion related to activities in the study such as Spraying and others

Comment [a7]: Prey-related data on Syrphid fly populations, as stated in the abstract are not visible?

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Comment [a8]: can be changed the way the data is displayed in the form of a graph so that it is more informative

<i>month</i>	<i>Sithuli campus</i>	CRC 1	CRC 2	Turari campus	METHROLOGY		
					Ave T° min	Ave T° max	RH
<i>Aug</i>	8.07	7.75	10.5	10.6	22.20	37.5	81.23
<i>sep</i>	7.33	6.15	12.25	13.12	21.50	34.5	79.93
<i>oct</i>	10.33	8.2	12.6	13.1	21.5	32.5	76.50
<i>Nov</i>	13.75	12.1	13.2	14.5	18.5	27.5	75.63
<i>Dem</i>	15.25	13.2	14.1	16.5	10.5	24.5	84.86
<i>Jan</i>	10.15	14.1	12.75	13.5	8.5	20.5	67.39
<i>Feb</i>	15.5	14.75	13.12	14.5	13.5	25.5	60.5
<i>March</i>	8.4	6.2	3.5	4.5	16.5	35.5	61.25
<i>April</i>	2.2	1.1	1.5	2.5	24.5	41.5	62.5
<i>Correlation with average temperature</i>							
<i>r</i>	-0.761	-0.914	-0.627	-0.672			
<i>P0.5</i>	0.0172	0.0003	0.07	0.047			
<i>Covariance</i>	-19.84	-25.4	15.25	-19.6			
<i>r</i>	0.2204	0.1242	0.5778	0.568			
<i>P0.5</i>	0.5688	5.3167	0.1032	0.1106			
<i>Covariance</i>	8.8486	5.3167	24.98	25.512			

According to present study the relation between pollinators (including hoverflies) and climatic factors usually vary with geographical distribution, Carvolho et al.(1991) also reported a positive correlation between temperature and number of syrphids in tropics, while in sub-tropical areas of world this relation could be negative as reported by (Sajjad et al.2010).Our result was also in

accordance with the findings of (Sajjad et al. 2010) and climatic factors (temperature, relative humidity) were negatively correlated with hoverfly abundance.

Correlation of syrphid fly larvae population on different hosts with temperature and relative humidity

Comment [a9]: add and explain the correlation between all the variables used in the study so that their relationship to the population dynamics of Syrphid fly is clear.

Table 2. Pearson correlation of average population of syrphid larvae on different host plants with Temperature and Relative humidity

	Ave Temp	Ave RH
AP Okra	0.103	0.213
AP Duranta	0.524	0.251
AP Sorghum	0.283	-0.169
AP Bean	-0.548	0.530
AP Cabbage	0.273	-0.617
AP Cowpea	0.418	-0.252
AP Cauliflower	-0.240	-0.704
AP Maize	0.486	-0.166
AP Mustard	-0.240	-0.708

- Sign indicates negative correlation

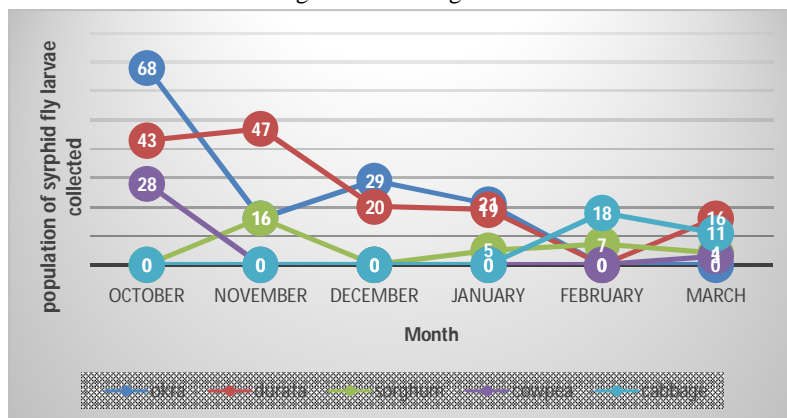


Figure 1 Syrphid fly population of different crops from October 2018 up to March 2019

CONCLUSION AND RECOMMENDATION

COCLUSION

The present studies were concluded that population dynamics of syrphid flies on HAC farm. In research domain no previous study on syrphid fly in Gwalior were found. During the study period of six months (October 2018 up to March 2019), the population was high during month of October on plants of okra, duranta. According to our finding that the temperatures were correlate positively with the population of syrphid flies. And the abundance of syrphid population dramatically affected with the season vegetation cover around the farm.

Comment [a10]: 1.add quantitative data on how temperature is positively correlated with syrphid fly population ($r = ?$ or linear equation ?) to clarify the correlation between the two.
2.Are there any data that explain how syrphid fly population abundance is dramatically affected by the seasonality of vegetation cover around farms, while the research method is still laboratory scale and the research location is not in the farm area?Need to change this statement based on the focus of the research study
3.it is necessary to add recommendations that are offered to improve this research

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Comment [a11]: 1.The references used are too few and need to be updated for the last 5 years.
2.need to check the writing of references based on the templete used