

DIVERSITY OF INSECTS IN SUGARCANE FIELD AT CHINNAMANUR, THENI DISTRICT, TAMILNADU

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Abstract: Insects are the largest and most diverse group of organisms. The crops showed various responses towards insect populations. Present study was aimed at collection, identification and comparison of species richness, abundance and evenness of insect fauna in sugarcane. The field investigation from November 2015 to January 2016 in sugarcane field at chinnamanur, Theni district, India. The light trap collection yielded six orders namely *Odonata*, *Orthoptera*, *Hemiptera*, *Coleoptera*, *Lepidoptera*, and *Diptera*. A total number of 423 insects belonging to 24 species and 6 order present in sugarcane field. Sugarcane was preferred crop by majority of faunal species. Maximum diversity of faunal species was found in sugarcane field. The analysis of data in order wise distribution and biodiversity of insects revealed the predominance of coleoptera followed diptera, hemiptera, odonata, orthoptera and Lepidoptera. This investigation will be helpful in designing future integrated pestmanagement studies.

Key Words: Diversity of insects, Sugarcane, Light trap and Predominant pest.

INTRODUCTION:

Agriculture is the backbone of Indian economy, because 75% of India's population depends on agriculture or agro-industries for livelihood (Bedi,2008). Sugarcane (*Saccharum officinarum*) is an important cash crop of the world, occupying 13.5 million hectare of area in India. Sugarcane is a main source of sugar to majority of human population.(Naidu,2009).Chemically it consists of 70% water, 14% fibre, 13% sacchrose and 2-7% soluble impurities. Among the insects, ants are diverse, abundant, easily found and can be reliably sampled and monitored(Majer, 1983., Andersen, 1986., Delabia *et al* .2006).Sugarcane is known to be attacked by about 200 species of insects and non-insects in India. The estimates loss due to insect's pest is placed at 20% and 15% in sugarcane yield respectively (Avasthy P.N, 1977). Sugarcane is attacked by a variety of insect from a broad spectrum of orders, such as Lepidoptera, Hemiptera, Coleoptera, Homoptera, Orthoptera, and Isopteran (Pemberton and Williams,1969., Conlong,1994.,Carnegie and Conlong,1994., Leslie, 2004) .The light trap yielded more coleopterans than any other method. Beetles are found in almost any types of habitats on plants on the soil surface and ant nest was reported by Pedigo P. Larry (2002).

The "richness" indicates the number of species present in sugarcane field whereas "evenness" stands for the relative abundance of each species in the same field (VancalyJ.k., Agarwal S.K., Trewali and P.S Dubey 1992).Temperature influences the development, reproduction, activity and range of expanse of insects. Rainfall is the crucial factor for increase the insect population followed by temperature. Insects may survive high or low temperature during certain stage of life cycle, many insects are able to survive much lower temperature(Glen, 1954).

Today, the health of the crop is one of the major issues which farmers have to take into consideration and protecting these crops from insect pests is one of the most important subjects of present times.The main objective of this project is to collect, identify and calculate diversity, species richness and evenness of insects in the context of different ecological factors like maximum and minimum temperature, average humidity, wind speed and average rainfall.

METHODOLOGY:

Insect collection was done in the farmers' sugarcane field at Chinnamanur, Theni district, India.

Sampling techniques

Collection of insects was carried out depending upon the season in which crop was grown. During the sampling period of three months (November 2015 – January 2016) each month was divided into two phases, Phase 1 (15 days) and Phase 2 (15 days). Each study site was visited twice a month. On each day the sampling was done in twice, once in morning hrs (7 am to 9 am) and second time in evening hrs (5pm to 7pm).

Collection Method

Collection was done by sweep net hand picking and light trap method. Large insects were killed using killing jars with potassium cyanide powder. For storage and preservation the killing jars with potassium cyanide were used to kill large insects. The small insects were preserved in glass vials consisting of 70-90% ethyl alcohol. Identification and labelling was done in the laboratory using the standard keys available in taxonomic literature and manuals.

Light trap:

The light trap considered of a plastic funnel with a central light source of 100W mercury lamp. At the bottom of a funnel jar containing killing agent of formalin could be placed in a bottle. The light attracted insects passed through the funnel and got into the killer jar. The trap catches out on the same way. The collected entomofauna was counted individually (less abundant species and more abundant species). The insects collected were pooled together, identifying and population status were carried out.

RICHNESS INDICES:

The richness indices were calculated by using following formulae.

R_2 (Menhinick index, 1964)

$$R_2 = S/\sqrt{n}$$

Where S = number of species

n = Total number of individuals of all the species.

MARGALEF INDEX:

$$R_1 = \frac{S-1}{\log N}$$

S = Total number of species in a community.

N = total number of individuals observed.

RESULTS AND DISCUSSION:

The research studies were conducted from November 2015 to January 2016. A total number of 423 insects belonging to 24 species and 6 orders viz., Hemiptera, Odonata, Coleoptera, Orthoptera, Lepidoptera and Diptera collected in sugarcane field at Chinnamanur, Theni district.

TABLE-1 ABIOTIC FACTOR RECORDED DURING FORTNIGHT COLLECTION IN A SUGARCANE FIELD AT CHINNAMANUR, THENI DISTRICT.

Fortnight collection	TEMPERATURE		RAIN FALL(mm)
	Maximum	Minimum	
Nov- I	27°	26°	13
Nov- II	27°	27°	12
Dec- I	27°	25°	14
Dec- II	27°	26°	11
Jan- I	28°	27°	9
Jan- II	29°	27°	8

TABLE -2 TAXONOMIC DIVERSITY OF THE ENDOMOFAUNA IN A SUGARCANE FIELD AT CHINNAMANUR, THENI DISTRICT.

S.NO	ORDER	FORTNIGHT COLLECTION PERIODICITY						TOTAL	(%)
		1	2	3	4	5	6		
1	HEMIPTERA	12	6	14	12	15	10	69	16.3
2	ODONATA	15	12	10	6	10	11	64	15.1
3	COLEOPTERA	20	20	12	13	12	10	87	20.5
4	ORTHOPTERA	15	9	3	9	13	11	60	14.1
5	LEPIDOPTERA	15	10	4	10	4	11	54	12.7
6	DIPTERA	20	12	7	15	17	15	86	20.3

TABLE-3TOTAL NUMBER OF SPECIES DIVERSITY AND PERSENTAGE RECORDED IN SUGARCANE FIELD AT CHINNAMANUR, THENI DISTRICT.

S.NO	ORDER	NUMBER OF SPECIES	(%)
1	HEMIPTERA	3	12.5
2	ODONATA	2	8.3
3	COLEOPTERA	5	20.8
4	ORTHOPTERA	4	16.6
5	LEPIDOPTERA	8	33.3
6	DIPTERA	2	8.3

TABLE-4MONTHLY OBSERVETION OF ENDOMOFAUNA IN SUGARCANE FIELD AT CHINNAMANUR, THENI DISTRICT.

S.NO	ORDER	NOVEMBER	DECEMBER	JANUARY	TOTAL
1	HEMIPTERA	18	26	25	69
2	ODONATA	27	16	11	64
3	COLEOPTERA	40	25	12	87
4	ORTHOPTERA	24	12	24	60
5	LEPIDOPTERA	25	14	14	54
6	DIPTERA	32	22	32	86

TABLE-5ENDOMOFAUNA OF THE SUGARCANE FIELD CORRELATE TO TEMPERATURE AND RAINFALL AT CHINNAMANUR, THENI DISTRICT.

Fortnight collection	TEMPERATURE	TEMPERATURE	RAIN FALL (mm)	HEMIPTERA	ODONATA	COLEOPTERA	ORTHOPTERA	LEPIDOPTERA	DIPTERA
	Maximum (c°)	Minimum (c°)							
Nov- I	27°	26°	13	12	15	20	15	15	20
Nov- II	27°	27°	12	6	12	20	9	10	12
Dec- I	27°	25°	14	14	10	12	3	4	7

Dec- II	27°	26°	11	12	6	13	9	10	15
Jan- I	28°	27°	9	15	10	12	13	4	17
Jan- II	29°	27°	8	10	11	10	11	11	15

TABLE-6 OVERALL PRESENTATION OF RICHNESS INDICES FOR ENDOMOFAUNA RECORDED IN SUGARCANE FIELD AT CHINNAMANUR, THENI DISTRICT .

S.NO	ORDER	RICHNESS INDICES
		MENHINICK INDICES(R ²)
1	HEMIPTERA	0.361
2	ODONATA	0.244
3	COLEOPTERA	0.536
4	ORTHOPTERA	0.516
5	LEPIDOPTERA	1.089
6	DIPTERA	0.215

TABLE-7 OVERALL PRESENTATION OF MARGALEF INDICES FOR ENDOMOFAUNA RECORDED IN SUGARCANE FIELD AT CHINNAMANUR, THENI DISTRICT .

S.NO	ORDER	MARGALEF INDEX
1	HEMIPTERA	1.088
2	ODONATA	0.553
3	COLEOPTERA	2.062
4	ORTHOPTERA	1.687
5	LEPIDOPTERA	4.041
6	DIPTERA	1.034

The maximum insect pest 33.3% percentage was recorded in the order Lepidoptera. Order Coleoptera was showing 20.8% of pest percentage followed by Orthoptera was 16.6%. The Hemiptera showing 12.5%. However, the minimum pest percentage was recorded from order Odonata and Diptera was 8.33%.

The analysis of data in order wise distribution and biodiversity of insects revealed the predominance of coleoptera followed diptera, hemiptera, odonata, orthoptera and Lepidoptera.

Hemiptera: Hemiptera was the moderate order with 3 species. It contributes 69 insects that amount to 16.3% in the total entomofauna. The 6th fortnight collection yielded the maximum number of individuals that 15 during the first half of January 2016 with an average minimum temperature 26°C. Hemiptera population conceded with soar temperature maximum 27°C rainfall 13 mm.

Odonata: Odonata was the moderate order with 2 species. It contributes 64 insects that amount to 15.13% in the total entomofauna. This period experienced an rainfall 13 mm the Odonata population declined during forth half of December with least number of individuals 6. This decline in Odonata population conceded with soar temperature maximum 27°C, rainfall 14mm.

Coleoptera: Coleoptera was first in individual's strength. Among them dominance was evidenced by the present of highest number of 5 species and 87 individuals in sugarcane field. However individual's abundance is less than that of diptera, hemiptera, odonata, orthoptera, Lepidoptera.

Orthoptera: Orthoptera was the moderate order with 4 species. It contributes 60 insects that amount to 14.1% in the total entomofauna. The first fortnight collection yielded the maximum number of individuals that 15 during the first half of November with an average minimum temperature 26°C.

Lepidoptera: Lepidoptera was the commonly distributed order. Dominance was evidenced by the presence of highest number of 8 species and 54 individuals in sugarcane fields .

DIPTERA: Diptera was the moderate order with 2 species. It contributes 86 insects that amount to 20.3% in the total entomofauna. The first fortnight collection yielded the maximum of individuals that 20 during the first half of November.

DISCUSSION:

The study of insect diversity represents their adaptability to the wide range of environmental conditions. The insect dominance has been considered the influencing structure of insects 'community (Mackerrar, 1933., Water house, 1947).The number of different species with in a geographical area depends on migration and adaptation to environmental condition (Barbour *et al.*, 1998 and Groves, 2002).

Coleoptera was the most dominant order and it has high species richness. Among them dominance was evidenced by the presence of highest number of 5 species and 87 individuals in the sugarcane field.

The present study investigated a decrease in the richness of coleoptera with increasing anthropogenic disturbance. The Coleoptera constitute 40% of the entomofauna with richest diversity and inhabiting the entire ecosystem irrespective of place and time (Ambrose, 2004).Hemiptera was the moderate order with 3 species and 69 individuals in sugarcane field. In the present study denoted that minimum number of individual in November might be due to the poor rainfall and high temperature. Odonata was the least dominant order. The least dominance was evidenced by presence of 2 species 64 individuals in sugarcane field. The maximum Odonata population occurred during November 2015. Truman and Rowe (2008) reported the Odonata can be collected from places near water bodies, meadows, wood lands and the hill slides above aquatic habitats. From available literature it was evident that the Odonata were found to be maximal only during wet months and not during dry months.

Orthoptera was the least dominant order. The Orthoptera population peak in November 2015, comprised of 4 species. Vats and Mittal, (1981) observed peak density of Orthoptera in early rainy season in India. Muralirangan *et al.*,(1993) reported that higher temperature with less soil moisture hindered the density of Orthoptera population.

Lepidoptera was the commonly distributed order. Dominance was evidenced by the presence of highest number of 8 species and 54 individuals in sugarcane fields. Hensley,(1971) documented that weather conditions favourable to rapid growth of the sugarcane plant (warm temperature and abundant rainfall) invariable result in rapid increase in populations of the sugarcane borers.

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