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Biodiversity of Insects in Sugarcane field at a Vadipatti, Tamil Nadu, India

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Abstract

Sugarcane is highly important cash crop and sugar production in the country mostly depends on this crop. Sugarcane is known to be attacked by about 200 species of insects and non insects in India. The light trap collection yielded seven orders namely Odonata, Orthoptera, Hemiptera, Homoptera, Coleoptera, Lepidoptera, and Hymenoptera. Homoptera was the prominent order with 6 species. Insignificant values are observed with the help of Correlation and Regression. Coleoptera was the richer in terms of number of individuals (102) and odonata was least recorded with less number of individuals (33). The present study reveals that the most of the light trap collected insects were pest of sugarcane agroecosystem. Many predators and parasite of the orders Odonata, Orthoptera, Hemiptera, Homoptera, Coleopteran, Lepidoptera and Hymenoptera were also found in sugarcane field at A.Vadipatti, Periyakulam Taluk, Theni District. Even though, many insects are found in the sugarcane agro ecosystem, many insects were found to be the pest of sugarcane crop.

Keywords: Biodiversity of insects, predominant pest, light trap collections.

Introduction

Sugarcane (*Saccharum officinarum*) is an important cash crop of the world, occupying 13.5 million hectare of area in India. 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[1]. Stem borer ensities are regulated by indigenous parasitoids in host plants. However, since the establishment of extensive sugarcane plantations in South Africa, some borer species, such as *Eldana saccharina* Walker (Lepidoptera: Pyaralidae), have become serious pest in the sugarcane field due to a lack of natural enemies and the high quality food sources[2].

Insects comprise more than half of earth's diversity of spices May, 1992. Insects are found in different types of environment and they occupy little more than two thirds of the known species of insect and pests. As many species are strictly seasons and prefer only particularly set of habitats[3] they are god indicates of habitat quality. The number of known species of Orthoptera from the world is about 20,000 out of these 1750 species nearly 10% of the world fauna are known from India[4]. Attempts to decrease the magnitude of pest losses primarily through serious environmental and public health problems[5]. Sugarcane is known to be attached by about 200 species of insects and non insects in India[6]. The estimates loss due to insect's pest is placed at 20 and 15% in sugarcane yield respectively[7].

Biodiversity encompassing all living organisms represents the biological wealth of a Nation and is one of the important cornerstones of sustainable development of the world. More recently, Gadarger *et al.*[8], Kumar and Mishra[9] and Milton *et al.*[10], monitored ant species richness along elevational gradient in low land forests and in agro ecosystem[11]. Milton 2003 investigated when management of agro forest cases the emerging ecosystem type in uncertain as their species composition and relative abundance may differ. Though various meteorological factors changes (temperature, rainfall, humidity, decomposition rates of litter) are variation in the availability of food resources are the important factors in triggering seasonal activity of insects and pests in sugarcane field was reported by Tran[12], Vineesh[13], Anu[14] and Danks[15]. Many temperate zone insect species have shifted their distributions in response to recent climatic changes was reported by Balliste *et al.*[16], Jepsen *et al.*[17], and Tran *et al.*[18].

Distributions of insects fauna is closely related to the type of vegetation in a particular region or habitat. Robinson[19], reported group of insects are known to decline in number during the winter season. Unfortunately the abundance that is lower than that observed during the summer season.

Methodology

Location of the study area: Insect collection was done in the sugarcane field at A. Vadipattyi at Periyakulam Taluk, Theni district, India.

Climates: Climate is generally hot in summer and cool in winter. The bulk of rainfall is mainly due to the North East monsoon (October to December) and South West (June to August) monsoon.

Light trap: The light trap considered of a metal funnel with a central light source of 100W mercury lamp. At a bottom of a funnel jar containing killing agent of formalin could be place in

bottle. The light trap is 50 cm or 0.5m and m height. The light trap was set on near the sugarcane field. The light trap was run once in fifteen days for a period of 3 months (December 2012 and February 2013). The light trap was regularly switched on at 18.00 hours evening and switched off at 6.00 hours (in the nest day morning). 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.

Storage of insects: The collected specimens were stored in vials containing formalin solution. Collected insects were identified with the help of related taxonomic materials. The insects for each and every collection day were treated separately and were put into vial for biodiversity count.

Results and Discussion

Taxanomic Distribution and Biodiversity: A total number of seven species in order viz., Odonata, Orthoptera, Hemiptera, Homoptera, Coloeptera, Lepidoptera and Hymenoptera were collected from November 2012 to January 2013 in a sugarcane field at A. Vadipatti, Periyakulam Taluk, Theni District, India. The order wise species richness as well biodiversity of insects given below:

Table-1
Abiotic factos recorded during fortnight collection in sugarcane field at A. Vadipatti, Periyakulam Taluk, Theni District

Fortnight collection	Temperature (^{o}c)			Rainfall (mm)
	Maximum (^{0}C)	Minimum (^{0}C)	Average (^{0}C)	
November I	38	24	31	1.0
November II	15	13	14	3.2
December I	28	26	27	2.8
December II	29	27	28	1.3
January I	25	27	26	1.0
January II	27	29	27.5	1.5

Table-2
Taxonomic diversity of the entomofauna in sugarcane field at A. vadipatti, Periyakulam Taluk, Theni district

Order	Fortnight collection periodicity						Total	(%)
	1	2	3	4	5	6		
Odonata	3	2	8	7	5	8	33	5.77
Orthopoda	13	18	23	9	21	7	91	17.60
Hemiptera	16	23	13	18	15	---	85	16.44
Homoptera	11	7	8	10	23	12	71	13.73
Coleoptera	42	14	9	13	24	---	84	16.24
Lepidoptera	---	6	7	15	28	18	104	20.11
Hymenoptera	9	8	16	4	---	12	49	9.47
Total	94	78	75	76	116	57	517	99.36

Table-3
Total number of species diversity and percentage recorded in sugarcane field at A. Vadipatti, Periyakulam Taluk, Theni District

Order	Number of Species	Percentage (%)
Odonada	4	19.04
Orthropoda	3	14.28
Hemiptera	1	4.76
Homoptera	6	28.57
Coleoptera	1	4.76
Lepidopptera	4	19.04
Hymenoptera	2	9.52
Total	21	99.97

Table-4
Monthly observation of entomofauona in sugarcane field at A.Vadipatti, Periyakulam Taluk, Theni District

Order	November	December	January	Total
Odonata	3	13	8	24
Orthopoda	21	18	26	44
Hemiptera	13	8	13	21
Homoptera	18	13	41	72
Coleoptera	29	17	26	72
Lepidoptera	12	14	17	43
Hymenoptera	15	13	10	38

Table-5
Entomofauna of the sugarcane field correlate to temperature and rainfall at A Vadipatti, Periyakulam Taluk, Theni District

Fortnight collection	Temperature		Rainfall	Odo	Ortho	Hemi	Homo	Coleo	Lepi	Hyme
	Maximum	Minimum								
November I	38	27	1	3	13	16	11	42	---	9
November II	15	13	3.2	2	18	23	7	14	6	8
December I	28	26	2.8	8	23	13	8	9	7	16
December II	29	27	1.3	7	9	18	10	13	5	4
January I	25	27	1	5	21	15	23	24	28	---
January II	27	29	1.5	8	7	---	12	---	18	12

Table-6
Biodiversity of entomofauna in sugacane field at a Vadipatti, Periyakulam, Theni District

Order	Total
Odonata	33
Orthoptera	91
Hemiptera	85
Homoptera	71
Coleoptera	102
Lipitoptera	74
Hymenoptera	49

Table–7
Total number of species diversity of entomofauna in sugarcane fileld at a Vadipatti, Periyakulam Taluk, Theni District.

Order	No of Species
Odonata	4
Orthoptera	3
Hemiptera	1
Homoptera	6
Coleoptera	1
Lipidoptera	4
Hymenoptera	2

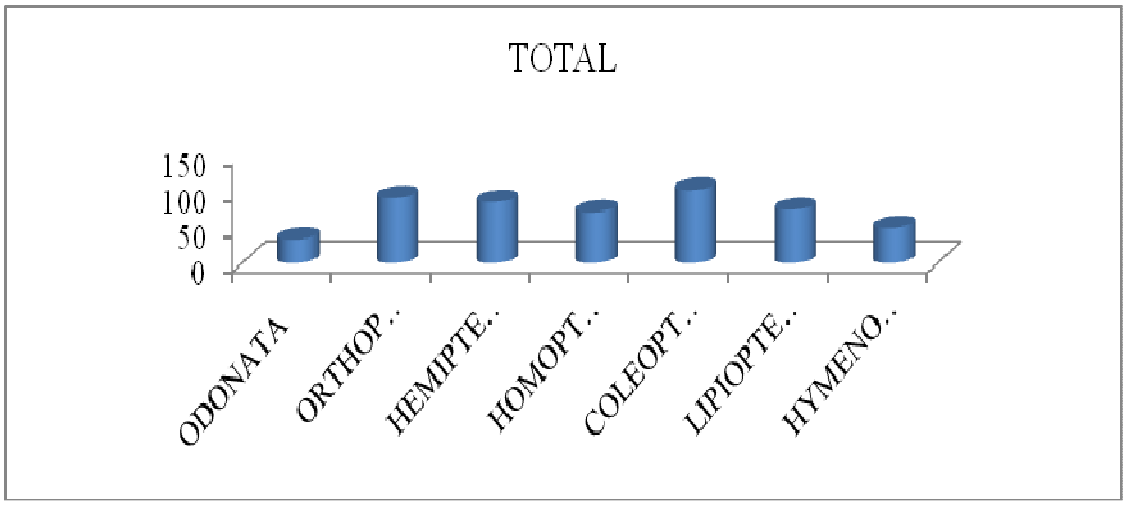

Figure-1
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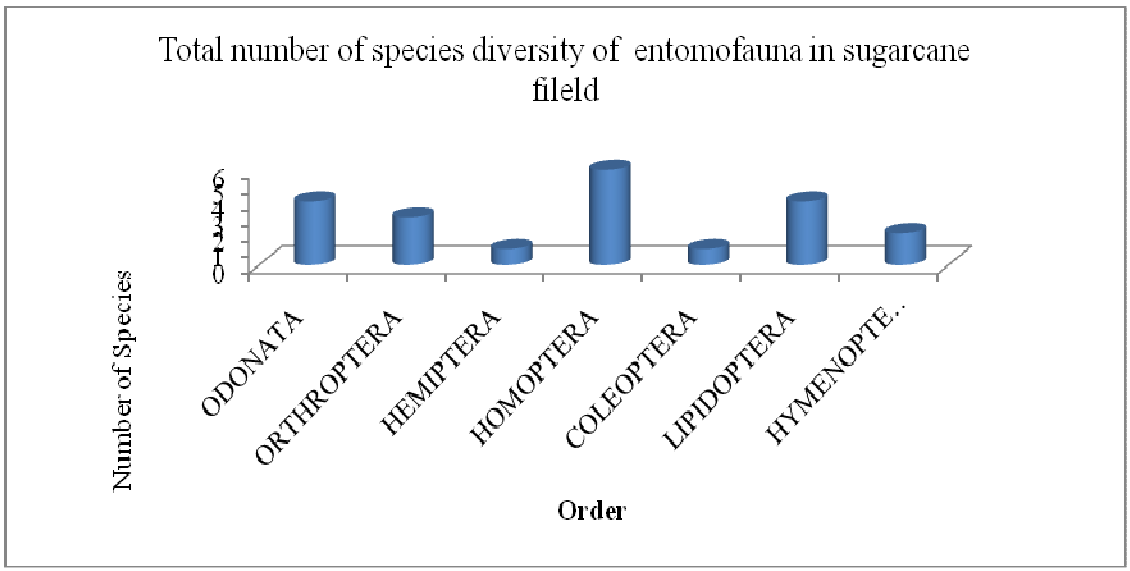

Figure-2
Total number of species diversity of entomofauna in sugarcane fiels

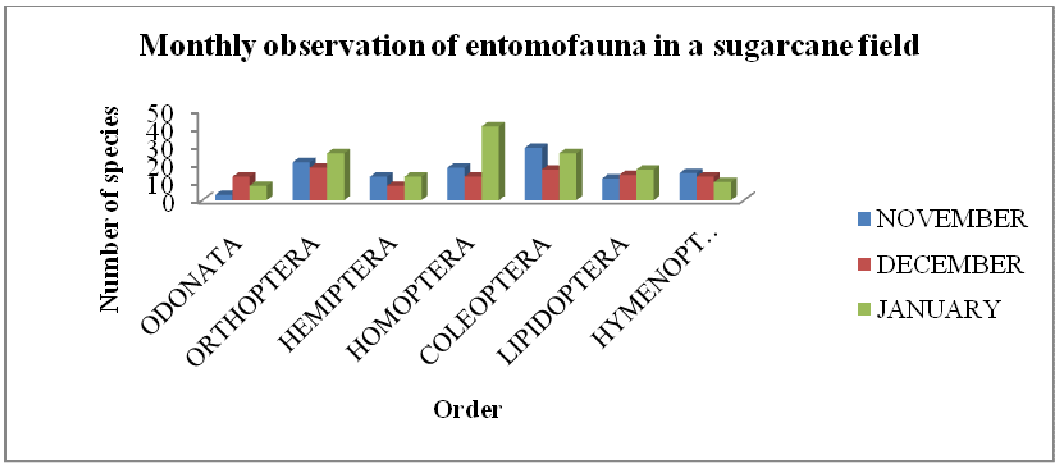

Figure-3
Monthly observation of entomofauna in a sugarcane field

Table–8
Monthly observation of entomofauna in a sugarcane field at A. Vadipatti Periyakulam Taluk Theni District

Order	November	December	January
Odonata	3	13	8
Orthoptera	21	18	26
Hemiptera	13	8	13
Homoptera	18	13	41
Coleoptera	29	17	26
Lipidoptera	12	14	17
Hymenoptera	15	13	10

The overall Distribution and Diversity of Insects: Total number of 487 insects belonging to 21 species and 7 order viz, collected from November 2012 to January 2013 from sugarcane field at A. Vadipatti, Theni District.

Odonata: Odonata was the moderate order with 4 species. It contributes 33 insects that amount to 6.76% in the total entomofauna. The 6th fortnight collection yielded the maximum number of individuals that 8 during the second half of January 2013 with an average minimum temperature 27.5°C. This period experienced an average rainfall 1.4mm the Odonata population declined during first half of November 2012 with least number of individuals 3. This decline in Odonata population conceded with soar temperature maximum 29°C.

Orthoptera: Orthoptera was the moderate order with 3 species. It contributes 91 insects that amount to 14.8% in the total entomofauna. The 3rd fortnight collection yielded the maximum number of individuals that 26 during the first half of December with an average minimum temperature 27°C. This period experienced an average rainfall 1.4mm the Orthoptera population declined during first half of November 2012 with least number of individuals 3. This decline in Orthoptera population conceded with soar temperature maximum 29°C.

Hemiptera: Hemiptera was the moderate order with 1 species. It contributes 85 insects that amount to 4.76% in the total entomofauna. The 2nd fortnight collection yielded the maximum number of individuals that 23 during the second half of November 2012 with an average minimum temperature 27°C. This period experienced an average rainfall 1.4mm the Hemiptera population declined during first half of November 2012 with least number of individuals 13. This decline in Hemiptera population conceded with soar temperature maximum 28°C. interestingly this duration experienced poor rainfall 4mm.

Homoptera: Homoptera was the moderate order with 6 species. It contributes 71 insects that amount to 28.57% in the total entomofauna. The 5th fortnight collection yielded the maximum number of individuals that 6 during the second half of January 2013 with an average minimum temperature 27°C. This period experienced an average rainfall 1.4mm the Homopterapopulation declined during first half of November 2012 with least number of individuals 8. This decline in Homoptera population conceded with soar temperature maximum 29°C.

Coleoptera: Coleoptera was the moderate order with 1 species. It contributes 84 insects that amount to 19.04% in the total entomofauna. The 1st fortnight collection yielded the maximum number of individuals that 42 during the second half of January 2013 with an average minimum temperature 27°C. This period experienced an average rainfall 1.4mm the Coleoptera population declined during first half of November 2012 with least number of individuals 9. And the 6th fortnight contains individuals. This decline in Coleoptera population conceded with solar temperature maximum 29°C.

Lepidoptera: Lepidoptera was the moderate order with 4 species. It contributes 74 insects that amount to 15.9% in the total entomofauna. The 5th fortnight collection yielded the maximum number of individuals that 28 during the second half of January 2013 with an average minimum temperature 27°C.

This period experienced an average rainfall 1.4mm the Lepidoptera population declined during first half of November 2012 with least number of individuals 6, there is no individuals in 1st fortnight collection. This decline in Lepidoptera population conceded with solar temperature maximum 29°C.

Hymenoptera: Hymenoptera was the moderate order with 2 species. It contributes 49 insects that amount to 10.6% in the total entomofauna. The 3rd fortnight collection yielded the maximum number of individuals that 16 during the second half of December 2012 with an average minimum temperature 27°C. This period experienced an average rainfall 1.4mm the Hymenoptera population declined during first half of November 2012 with least number of individuals 6, and there is no individual in 1st fortnight collection. This decline in Hymenoptera population conceded with solar temperature maximum 29.C.

Discussion: The analysis of data in order wise distribution and biodiversity of insects revealed the predominance of Odonata followed Orthoptera, Hemiptera, Homoptera, Coleopteran, Lepidoptera, Hymenoptera. The largest abundant order was Coleoptera. The least abundant orders were Odonata, Homoptera, Hemiptera and Hymenoptera. The number of different species with in a geographical area depends on migration and adaptation to environmental condition[20,21]. A significant relationship between rainfall and abundance, which should not be surprising, given the large number of groups involved and the many direct and indirect ways in which weather could separately influence the abundance of insects in sugarcane field[22].

Homoptera: Homoptera was the most dominant order. Dominance was evidenced by the presence of highest number of 6 species and 71 individuals in sugarcane fields at A. Vadipatti. However individual's abundance less than that of Hemiptera. Correlation and regression calculated for Homoptera. The present study noted that maximum number of individuals of insects in January and minimum number of individuals of insects in December might be due the inverse relationship between increased rainfall and the sugarcane borer found in the field, because the larvae drown in the flooded tunnels. In addition to rainfall, cold winter temperatures are reported to depress the survival of larva.

Orthoptera: Orthoptera was the commonly distributed order. Dominance was evidenced by the presence of highest number of 3 species and 91 individuals in sugarcane fields at A. Vadipatti. However individual's abundance less than that of homoptera. Correlation and regression calculated for Homoptera.

Hemiptera: Hemiptera was fourth the individual's strength. Dominance was evidenced by the presence of highest number of 1 species and 85 individuals in sugarcane fields at A. Vadipatti. However individual's abundance less than that of Homoptera. Correlation and regression calculated for Hemiptera. The maximum number of individuals of insects in January, November and minimum number of individuals of insects in December might be due to the *M. Communis* pupate in the spring with maximum flight activity during the summer. Hemiptera live predominantly in water surface, the minimum number of individuals in December might be due to the poor rainfall and high temperature.

Coleoptera: Coleoptera was the commonly distributed order. Dominance was evidenced by the presence of highest number of 1 species and 102 individuals in sugarcane fields at A. Vadipatti. However individual's abundance less than that of homoptera. Correlation and regression calculated for homoptera. The maximum number of individuals of insects in November and minimum number of individuals of insects in December might be due to rich foliage, which attracted the leaf feeding coleopteran and other insects which served as prey for predatory insects.

Lepidoptera: Lepidoptera was the commonly distributed order. Dominance was evidenced by the presence of highest number of 4 species and 74 individuals in sugarcane fields at A. Vadipatti. However individual's abundance less than that of Homoptera. Correlation and regression calculated for Homoptera. The maximum number of individuals of insects in January and minimum number of individuals of insects in November might be due to whitefly attack because humidity rises during these months.

Hymenoptera: Hymenoptera was the commonly distributed order. Dominance was evidenced by the presence of highest number of 2 species and 49 individuals in sugarcane fields at A. Vadipatti. However individual's abundance less than that of Homoptera. Correlation and regression calculated for Homoptera. The maximum number of individuals of insects in November and minimum number of individuals of insects in December might be due to larvae are present in the summer and because of summer oviposition there is a large increase in larval populations in the fall. Ant can constitute up to 20% of the animal biomass in tropical forest and play essential roles in ecosystem functioning [24]Karunakaran, Geetha Nayak and Prasad, 2007.

Conclusion

The present study was carried out in the sugarcane agro ecosystem at Theni District for a period of three months from November 2012 to January 2013. Fortnight collections of insects were carried out using light trap. The light trap collection yielded seven orders namely Odonata, Orthoptera, Hemiptera, Homoptera, Coleoptera, Lepidoptera, and Hymenoptera. Homoptera was the prominent order with 6 species. Odonata and Lepidoptera was contain as 4 species. Hemiptera and Coleoptera contain 1 species. Orthoptera contain 3 species and hymenoptera contain 2 species. Insignificant values are observed with the help of Correlation and Regression.

Coleoptera was the richer in terms of number of individuals (102) and odonata was the least recorded with less number of individuals (33). The present study reveals that the most of the light trap collected insects were pest of sugarcane agroecosystem. Many predators and parasite of the orders Odonata, Orthoptera, Hemiptera, Homoptera, Coleopteran, Lepitoptera and Hymenoptera were also found in sugarcane field at A.Vadipatti, PeriyakulamTaluk, Theni District. Even through, many insects are found in the sugarcane agro ecosystem, many insects were found to be the pest of sugarcane crop.

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