

Diversity and Relative Abundance of Insects in Cucurbits from Mappillaiurani, Thoothukudi District, Tamil Nadu

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Abstract The present survey was conducted to estimate the diversity and relative abundance of insects in cucurbits from Thoothukudi District, Tamil Nadu. In total 20 species belonging to 5 orders, 12 families and 16 genera has been reported between December 2017 and February 2018. The maximum number of families was reported in the Order Hemiptera (Family : Apidoidae, Miridae, Aleyrodidae, Coreidae, Pentatominae and Dinidoridae) followed by the Order Coleoptera (Family : Chrysomelidae and Coccinellidae), Lepidoptera (Family : Sesiidae and Crambidae), Diptera (Family : Tephritidae) and Orthoptera (Family : Tettigonidae). Insect population was more number in January followed by February and December whereas predators are presents 26% of the collected insects. The result of the present study gives baseline information on the diversity and abundance of insect in cucurbits from Mappillaiurani, Thoothukudi District.

However, an additionally extensive survey is needed to determine dynamics of insect populations.

Keywords Insects abundance, Crops, Cucurbits, Mappillaiurani, Hemiptera.

Introduction

Cucurbits form an important and large group of vegetable crops belongs to the family Cucurbitaceae. It consists of 122 genera and 940 species which are distributed in tropical or subtropical regions of the world (Mabberley 2008). In India, Chakravarthy (1982) reported 36 genera and 100 species of cucumbers. Cucurbits are cultivated from tropical to subtemperate zones in an area of 8.5 million hectares throughout the world. The total production is about 17.9 million ton according to FAO. In India, the total area of cucurbits is about 0.5 million ha which includes 12% of the total vegetable growing area. Jeffrey (1990) described some kinds of cucurbit species are stable crops and a few taxa also grown as ornamental plants (Rahman 2013). The uses of cucurbits are different and also used as food source in pumpkin (*Cucurbita pepo*), melon (*Cucumis melo*), cucumber (*Cucumis sativus*), water melon (*Citrullus lanatus*), bottle gourd (*Lagineria siceraria*) and sponge gourd (*Luffa*

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cylindrica). In 20 different kinds of cucurbits are cultivated as vegetables in India. Most of them are very useful for human health, purification of blood, removal of constipation, good for digestion, and a rich source of energy (Rahman et al. 2008). Earlier 6 families, 29 genera and 58 species of native bee visitors of cucurbit crops were reported in Yucatan, Mexico. Mokam et al. (2014) recorded a total of 66 insect morphospecies belonging to 37 families and 5 orders in the Southern part of Cameroon. Fayyaz et al. (2016) reported 9 orders and 20 species of insects in pumpkin plantations in District Haripur, Pakistan. Further, no studies on species diversity and abundance and host range of insects in cucurbits from Thoothukudi District. Hence the present study was aimed to document species diversity and abundance of insects in the cucurbits in the study area.

Materials and Methods

A survey was carried out to find the different insect fauna of Mappillaiurani in Thoothukudi District, Tamil Nadu. Mappillaiurani is located at 8.8362°N and 78.1550°E and has an average elevation of 4m and with temperature of about 32°—39°C. The insect collections of cucurbits were done in fortnightly basis during December 2017 to February 2018 from the fields of cucurbits in Mappillaiurani, Thoothukudi District. The insect sampling was carried out in early hours of the day because insects are active and are easily observed at early sun rise. The diversity of insects was studied by using components of mechanical methods namely aerial, arboreal and ground net. The insects were identified based on the Dichotomous Key (Mayr 1976) and were preserved in 70% formalin. The data collected from these methods used for the study different diversity indices.

Margalef's species richness, d

This statistical measure was proposed by Margalef (1968) to measure species richness. It is a measure of the number of species present, making some allowance for the number of individuals.

$$d = (S - 1) / \log_e N$$

Where, S-number of species, N = the total number of

organisms of all species.

Pielou's evenness, J'

This species evenness was done by Pielous Index (Pielou 1975) and it is a measure of equitability and how evenly the individuals are distributed among the species.

$$J' = \frac{H'}{\log_2 S} \quad \text{or} \quad \frac{H'}{\ln_2 S}$$

Where, H' - Shannon – Wiener diversity function, S- total number of species.

Shannon – Wiener's diversity index, H'

Shannon Index (H') is one of the several diversity indices used to measure diversity in categorical data. It incorporates both species richness and equitability components

$$H' = \frac{3.3219(N \log - \sum ni - \log ni)}{N}$$

Where, n_i – number of individuals of species “i”; N –total number of individuals of all species.

Simpson's dominance index, D

This statistical measure was proposed by Simpson (1949) and measures biodiversity which takes into account both species richness, and an evenness of abundance among the species present.

$$D = \frac{\sum n(n-1)}{N(N-1)}$$

Where, n = the total number of organisms of a particular species; N = the total number of organisms of all species.

Results and Discussion

The insect species collected from Mappillaiurani in Thoothukudi District are presented in the Table 1. During the present study period, 12 families belonging to 5 orders were reported during December 2017

Table 1. Diversity of insect fauna along with host in Mappillaiurani, Thoothukudi district, Tamil Nadu.

Common name	Order	Family	Scientific name	Host
Red pumpkin beetle	Coleoptera	Chrysomelidae	<i>Aulacophora foveicollis</i>	Cucumber
Black cucurbit beetle	Coleoptera	Chrysomelidae	<i>Aulacophora frontails</i>	Cucumber gourds
Pumpkin beetle	Coleoptera	Chrysomelidae	<i>Aulacophora hilaris</i>	Cucumber
Stripped cucumber beetle	Coleoptera	Chrysomelidae	<i>Acalymma vittatum</i>	Cucumber
Spotted cucumber beetle	Coleoptera	Chrysomelidae	<i>Diabrotica undecimpunctata</i>	Sponge gourd
Squash lady beetle	Coleoptera	Coccinellidae	<i>Epilachna borealis</i>	Cucurbits
Hadda beetle	Coleoptera	Coccinellidae	<i>Epilachna vigintioctopunctata</i>	Cucumber
Melon fly	Diptera	Tephritidae	<i>Bactrocera cucurbitae</i>	Cucumber
Squash vine borer	Lepidoptera	Sesiidae	<i>Melittia cucurbitae</i>	Cucumber
Stem borer	Lepidoptera	Sesiidae	<i>Melittia eurytion</i>	Pumpkin
Green peach aphid	Hemiptera	Aphidoidea	<i>Myzus persicae</i>	Pumpkin
Melon aphid	Hemiptera	Aphidoidea	<i>Aphis gossypii</i>	Cucurbits
Silverleaf whitefly	Hemiptera	Aleyrodidae	<i>Bemisia tabaci</i>	Sponge gourd
Squash bug	Hemiptera	Coreidae	<i>Anasa tristis</i>	Cucurbits
Melonworm moth	Lepidoptera	Crambidae	<i>Diaphania hyalinata</i>	Cucumber
Green sting bug	Hemiptera	Pentatominae	<i>Chinavia hilaris</i>	Gourds
Fourlined plant bug	Hemiptera	Miridae	<i>Poecilocapsus lineatus</i>	Cucurbits
Tranished plant bug	Hemiptera	Miridae	<i>Lugus lineolaris</i>	Bottle gourd
Cucurbit sting bug	Hemiptera	Dinidoridae	<i>Coridius janus</i>	Pumpkin
Grasshopper	Orthoptera	Tettigonidae	<i>Phaneroptera gracillis</i>	Cucurbits

to February 2018. The total number of families, genus and species collected in different orders are detailed in the Table 2. The maximum number of families was reported in the order Hemiptera (Family : Apidoidea, Miridae, Aleyrodidae, Coreidae, Pentatominae and Dinidoridae) followed by the Order Coleoptera (Family : Chrysomelidae and Coccinellidae), Lepidoptera (Family : Sesiidae and Crambidae), Diptera (Family : Tephritidae) and Orthoptera (Family : Tettigonidae). The order Hemiptera was the diverse group represented by 2 families and 8 species while Orthoptera represent 1 number of families and species. The present findings are in agreement with earlier workers like Fayyaz (2016) reported 9 orders belonging to 16 families in pumpkin plantations. Prakash (2002), Kumar (2006) reported 27 insect species in which 16 belonged to Hemiptera, 4 each

to Diptera, Lepidoptera and Coleoptera. Sajjanar et al. (2004) recorded 24 insect's visitors in which 14 belonged to Hemiptera, 4 to Diptera, 2 to Coleoptera and 4 to Lepidoptera in the flowers of cucumber. Earlier 16 species of insects belonging to 8 species to Hemiptera, 3 each to Diptera and Coleoptera and 2 to Lepidoptera were reported in the pumpkin crop during flowering Manjula (2007) recorded 22 species of insect pollinators are visited in which 15 species belong to order Hemiptera, 5 to Diptera and 2 to Lepidoptera in summer gourds. Ramesh (2009) reported 21 species of insect pollinators in the ridge gourd crop during flowering in which 12 species belongs to Hemiptera, 4 to Diptera, 3 to Coleoptera and 2 to Lepidoptera. Three types of nets like aerial, arboreal and ground net are used to catch insect populations are presented in the Table 3.

Table 2. Total number of Families, Genus and Species collected in different orders.

Order	Family	Genus	Species
Coleoptera	2	4	7
Diptera	1	1	1
Hemiptera	6	8	8
Lepidoptera	2	2	3
Orthoptera	1	1	1

Table 3. Diversity of insect collection in different nets.

Net	Order	Family	Genus	Species
Aerial net	Lepidoptera	2	2	3
Aerial net	Orthoptera	1	1	1
Arboreal net	Coleoptera	2	4	7
Arboreal net	Diptera	1	1	1
Arboreal net	Hemiptera	5	7	7
Ground net	Hemiptera	1	1	1

Table 4. Relative abundance of insect orders during December 2017 to February 2018.

Sl. No.	Insects	December	January	February
1	<i>Aulacophora foveicollis</i>	85	104	93
2	<i>Aulacophora frontalis</i>	86	97	89
3	<i>Aulacophora hilaris</i>	68	75	71
4	<i>Acalymma trivittum</i>	52	63	55
5	<i>Diabrotica undecimpunctata</i>	47	54	51
6	<i>Epilachna borealis</i>	43	48	42
7	<i>Epilachna vigintioctopunctata</i>	39	55	45
8	<i>Bactrocera cucurbitae</i>	–	37	34
9	<i>Melittia cucurbitae</i>	29	36	33
10	<i>Melittia eurytion</i>	73	110	78
11	<i>Myzus persicae</i>	82	98	76
12	<i>Aphis gossypii</i>	–	89	110
13	<i>Bemisia tabaci</i>	–	45	38
14	<i>Anasa tristis</i>	29	31	35
15	<i>Daphania hylinata</i>	–	9	11
16	<i>Chinavia hilaris</i>	26	32	28
17	<i>Poecilocapsus lineatus</i>	28	32	27
18	<i>Lugus lineolaris</i>	16	17	14
19	<i>Coridius janus</i>	–	38	32
20	<i>Phaneroptera gracillis</i>	–	8	11

The abundance of insect population was reported throughout the study was shown in the Table 4. The present study showed the Order Coleoptera represents more number of abundance while Orthoptera are low in abundance. These results were differ from Fayyaz (2016) in which Chrysomelidae was the most abundant family in terms of number of specimens while hymenoptera was the most diverse in terms of highest number of families (4). Sharma et al. (2013), Clarke and Warwick (2001) reported taxonomic documentation of insect pest fauna of vegetable ecosystem collected in light trap in which the most abundant order was found in Lepidoptera. Rashid et al. (2014) reported red pumpkin beetle of the family Chrysomelidae and these were found in higher number indicating red pumpkin beetle. Insect population was more number in January followed by February and December whereas predators are presents 26% of the collected insects and the monthly

occurrences of insect were given in the Table 5. The present findings are in conformity with the results of Fayyaz (2016) reported the insect population abundance in October followed by September and dropped towards the July and August. Diversity index of insect population during the study period were calculated and presented in the Table 6. Rashid et al. (2014) reported red pumpkin beetle to be a main pest of the cucurbits and it attacks every stage and it will lead to heavy loss to all cucurbits except bitter gourd. Saljoqi and Khan (2007) reported the relative abundance of red pumpkin in which highest number of natural enemies or predators collected from the cucurbit plants were belonging to order Hymenoptera, Hemiptera and Coleoptera. The presence of these insects may be indicative their significance as natural enemies of pest species. Highest number of red pumpkin beetle was reported in months of August, September and

Table 5. Monthly occurrences of insect orders.

Order	Dec-17	Jan-18	Feb-18
Coleoptera	+	+	+
Diptera	–	+	+
Hemiptera	+	+	+
Lepidoptera	+	+	+
Orthoptera	–	+	+

Sl. No.	Indices	December	January	February
1	Margalef's species richness, d	1.983	2.721	2.761
2	Pielou's evenness, J'	0.8953	0.8416	0.8484
3	Shannon–Wiener's diversity index, H'	2.528	2.823	2.831
4	Simpson's dominance index, D	0.913	0.9335	0.9336

October (Fayyaz 2016). Hence the present study concludes that the Order Hemiptera was found in higher number indicating main pest of the cucurbits. The present study gives insight information on the diversity and abundance of insect in Cucurbits from Mappillaiurani, Thoothukudi District and there is a need for the long term study to determine dynamics of insect populations.

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