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A Preliminary Study on the Biodiversity of Insects Collected from A College Campus: Thiruvananthapuram District, Southern Kerala

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Abstract: ***Insects, the most diverse group of organisms plays a major role in ecosystem function. The present survey was aimed to prepare a checklist of insects found in and around our college campus since there was no known published checklist of insect in Christian college campus till date. Therefore, this is the first study which reports the abundance and distribution of insects in the Christian college campus, Kattakada, Thiruvananthapuram. In this study, a total of 599 individual of insects from 14 orders were collected. Based on the data, Hymenoptera (19.37%) with highest diversity index of H'=0.318 were the most dominant insects in the college campus, followed by Lepidoptera (17.20%), Coleoptera (16.53%) and Hemiptera (9.35%). Compared to other orders, the rarest insect order was Mecoptera with relative abundance, Pi = 0.005. Overall biodiversity indices show relatively high biodiversity in the present campus area.***

Keywords: Insect, biodiversity, diversity index, species abundance

1. Introduction

Biodiversity, one of the most fascinating aspects of biology encompasses functioning, intact plant and animal communities and the processes that affects them [9]. Insects are extremely diverse and important to ecosystems [20], [5] and they are what make the ecosystems tick, remarked [18]. Understanding the extent of insect diversity is one of the major challenges in modern ecology. They have permeated the diverse and essential natural processes that sustain biological systems, making up over 75% of known species of animals [3]. Thus, the diversity and ecological importance of insects makes them very valuable for studies of biodiversity. Similarly, Insects have great potential for understanding ecosystems and as measures of ecosystem health, but the incompleteness of knowledge and the limitation of resources increase the difficulty of work on insect biodiversity [3].

Now a days India is occupying a significant space, documenting nearly 7 percent of global faunal diversity [6]. There are about 7, 51,000 known species of insects, which is about three-fourth known species of plants and animals on the planet [2]. The structure of insects has allowed them to exploit niches in almost all the habitats of the world. There are 1.4 millions species of insects described in the scientific literature which is 80% of life currently recorded on earth [20], [4].

The insects are responsible for many processes in the ecosystem and its loss can have negative effects on entire communities [18]. It is suggested that conservation of natural resources and biodiversity has become urgent issues in recent years for attaining an environmentally sustainable future [2]. While a lack of data has historically excluded the use of many taxa as possible indicators [18]. Therefore, careful targeting of any study is essential. Keeping in view the diverse and characteristic feature of insects, the present survey was aimed to describe some aspects of insect diversity found in and around our college campus since there was no known published checklist of insect in Christian college campus till date.

2. Materials and Methods

2.1 Study Area

The present study was conducted in the Christian College campus, Kattakada which is located at 8°30'30.6'N and 77°5'6.72'E respectively. The college is located in a sprawling area of rustic land, 20 km east of Thiruvananthapuram city and core of Agasthyavanam Wildlife Sanctuary is only 10 km away from it. Kattakada is the entry point to the mountain ranges (Western Ghats) and the nerve centre of the eastern parts of the district. The entire campus covering an area of more than 16 acres blessed with green vegetation having garden lands, botanical garden, large trees, shrubs, herbs and grasses of different types.

2.2 Methodology

The study involved field visits to the entire campus from September 2016 to February 2017. The findings presented here are based on random survey and observations were made from morning 9am to evening 5.30pm. The insects were collected by netting, hand picking and trapping. The insect preservation was avoided.

3. Result

This is the first study which reports the abundance and distribution of insects in the Christian College campus, Kattakada, Thiruvananthapuram. Diversity study of the insect in the present campus can be utilized as an indicator of changing environmental conditions in the campus. In this study, a total of 599 individual of insects from 14 Orders were collected. They are from the order of Blattodae (roaches and cockroaches), Coleoptera (beetles), Dermaptera (earwigs), Diptera (flies), Hemiptera (plant-bug),

Hymenoptera (wasps, bees and ants) Lepidoptera (moth and butterfly), Mantodae (mantis), Mecoptera (scorpionflies), Neuroptera (owlflies), Odonata (dragonfly and damselfly), Orthoptera (grasshoppers and crickets), Thysanura (lepisma) and Trichoptera (caddisfly). The total number of insects recorded and the percentage of insect's orders were presented in Table 1 below.

Table 1: Total number of insects and the percentage of insect order in the present campus

No.	Insect Order	Total (Approx.)	Percentage
1	Blattodae	15	2.50%
2	Coleoptera	99	16.53%
3	Dermaptera	7	1.17%
4	Diptera	53	8.85%
5	Hemiptera	56	9.35%
6	Hymenoptera	116	19.37%
7	Lepidoptera	103	17.20%
8	Mantodae	30	5.00%
9	Mecoptera	3	0.50%
10	Neuroptera	24	4.01%
11	Odonata	32	5.34%
12	Orthoptera	41	6.84%
13	Thysanura	13	2.17%
14	Trichoptera	7	1.17%
Overall insects recorded		599	100%

Table 2: Relative abundance and Shannon-Wiener Index Diversity (H') in the area

No.	Insect Order	n	Relative abundance (Pi)	ln "Pi"	Pi * ln (Pi)
1	Blattodae	15	0.025	-3.687	-0.092
2	Coleoptera	99	0.165	-1.8001	-0.298
3	Dermaptera	7	0.012	-4.4494	-0.052
4	Diptera	53	0.088	-2.4250	-0.215
5	Hemiptera	56	0.093	-2.3699	-0.222
6	Hymenoptera	116	0.194	-1.6417	-0.318
7	Lepidoptera	103	0.172	--1.761	-0.303
8	Mantodae	30	0.050	-2.9941	-0.150
9	Mecoptera	3	0.005	-5.2966	-0.027
10	Neuroptera	24	0.040	-3.2172	-0.129
11	Odonata	32	0.053	-2.9295	-0.157
12	Orthoptera	41	0.068	-2.6817	-0.184
13	Thysanura	13	0.022	-3.8303	-0.083
14	Trichoptera	7	0.012	-4.4494	-0.052
	Number of Individuals (N)	599			
	Species Richness (S)	14			
	Shannon-Wiener Index of Diversity (H')	2.280			

The diversity index was calculated by using the Shannon – Wiener diversity index (1949).
Diversity index, $H' = -\sum Pi \ln Pi$ Where $Pi = n / N$
n = number of individuals of one sample
N = total number of all individuals in the sample ln = logarithm to base e

Based on the results, Hymenoptera, with highest diversity index of H'= 0.318 were the most diverse and abundant order among collected insects. Lepidoptera and Coleoptera were ranked as second and third after Hymenoptera, respectively. The overall insect biodiversity indices of Shannon-Weiner index were 2.280. The Relative abundance and Shannon-Weiner index diversity were illustrated in Table 2.

4. Discussion

Great insect diversity is indeed an intrinsic part of the Earth's ecosystem [18]. However, the insect fauna of India is vast [9]. It's worth mentioning that the absolute numbers provided are an underestimate of the total diversity as many microhabitats were not sampled. Our results showed that Hymenoptera (19.37%) were the most dominant insects in the college campus, followed by Lepidoptera (17.20%), Coleoptera (16.53%) and Hemiptera (9.35%). The rarest insect order was Mecoptera with relative abundance (Pi) 0.005. Similarly, a comprehensive account of insect diversity of a selected area of Thrissur District in Kerala has been provided by Usha and John (2015), [24]. Altogether, 58 species and 529 individual insects belonging to nine orders and 38 families were recorded from the same area. A preliminary study on abundance and diversity of insect fauna in Gulbarga District, Karnataka, India was conducted by Belamkar and Jadesh (2012), [1]. A total of 11,318 insects from 6 orders, 26 families and 54 species were recorded. In an intensive study made by Quadros *et al.* (2009) in IIT Bombay campus, a total of 302 types of insect types important natural pest controllers. From 14 orders were recorded [15]. On the basis of number of families recorded among the insect orders in the campus, the Lepidoptera was the most dominant. Patel *et al.* (2015) in Jabalpur Community Forest Reserve, a total of 774 individual insects from 13 orders were recorded during the study [14].

Hymenoptera is one of the most diverse orders of insects, including over 115,000 described species representing 84 families. Hymenoptera are not only diverse in terms of structure, size, and numbers of species, but also in their habits and life histories. Some are phytophagous (plant-feeding), while others are herbivorous, predatory, or even parasitic. Many Hymenoptera lead a solitary lifestyle, while some of the bees, ants, and wasps show some of the highest degrees of social organization of any animals. Lepidoptera are commonly known as 'butterflies' and 'moths'. The various publications on Butterflies and Moths of India have been published by Wynter-Blyth (1957) [26], Marshall and De Niceville (1882) [10], Mathew and Rahamathulla, 1993 [11], Tiple *et al.* 2006 [22], Tiple *et al.* 2007 [23], Tiple, 2012 [21].

The Coleoptera (beetles) are the largest single order of insects, they total a staggering 360 000 named species with 125 different families. Many beetles are regarded as major pests of agricultural plants and stored products. They attack all parts of living plants as well as processed fibers, grains, and wood products. Scavengers and wood boring beetles are useful as decomposers and recyclers of organic nutrients. Predatory species, such as lady beetles, are important biological control agents of aphids and scale insects.

The Hemiptera is the largest and by far the most successful of the hemimetabolic insects (where the young look like wingless adults). There are at least 80,000 named species globally. Hemipterans are important as they are Dipterans are one of the major success's of the insect world, and the

145,000 species (about 160 families) are reported. Dipterans (flies) have been of incredible importance to mankind all over the world, this is because many of the primary diseases of humanity are transmitted by flies. Odonates are primarily aquatic insects and their life history is closely linked to specific aquatic habitats. This habitat specificity makes them a good indicator of wetland health. India with its unique geography and diverse bioclimatic regions, support a rich Odonate fauna. Adult Odonates feed on mosquitoes, blackflies and other blood-sucking flies and act as an important biocontrol agent of these harmful insects In addition to the direct role of predators in ecosystem, their value as indicators of quality of the biotope is now being increasingly recognized [12], [17].

The other orders that were sighted in the campus included the Neuroptera, Orthoptera, Mecoptera, Thysanaura, Trichoptera, Mantodae, Blattodae, and Dermoptera are also ecologically important as indicator species. Several groups of insects are known to exhibit and live in social groups. This arrangement is beneficial to the faunal forms as they can create a better impact on the environment. The most well known social insect is the Honey bee that has a high economic importance. The honey bee can also indicate the productivity of the ecosystem. During the study, insects living in colonies representing three orders including Hymenoptera, dipteral and Hemiptera were observed [15].

Biodiversity study of insects is focused directly on the variations at the species of insects. Employing different methods of sampling is crucial to provide a comprehensive data on insect diversity. Shannon-Weiner index of species diversity is commonly used to ascertain the species diversity [8]. Similarly, assessment of species diversity should focus on species richness, species abundance and species evenness [9]. The survival of a large number of endemic species in a community or habitat warrants frequent monitoring of the ecological processes besides adoption of appropriate conservation strategies in order to safeguard its rich genetic diversity [20].

Compared to vertebrates and many plants, insects usually have relatively short life spans, rapid generation times and often high reproductive output, meaning that populations can fluctuate greatly, both temporally and spatially. Knowledge of how to conserve insects often suffers from a dearth of information. This applies to understanding both the status of species or populations and, to a somewhat lesser extent, how to mitigate threats to them [13]. Generally, species tend to have high extinction rates in fragmented habitats [7], [19], [16]. Therefore, it is suggested that as with many other organisms, the best strategy is to protect large tracts of land, rather than many small, widely spaced patches of high-value habitat [19]. That said, minimum habitat sizes for insects are often smaller than for vertebrates, so efforts to protect even small areas may have a significant payoff in terms of insect conservation.

The biodiversity (diversity index, species abundance) of insect fauna in the present campus is mainly due to the rich vegetation in this area as vegetation plays an important role for the existence of insect fauna in a community as it provides the main source of food etc. for insects. This diversity has been modified at times and has tried to sustain itself in changing circumstances. The outcome of the study can be used constructively in planning sustainability of both man and natural environment. The various insect orders that were identified during the brief study have only highlighted the potential magnitude of biodiversity on the campus. The estimated numbers insects on the Campus are the products of the mosaics of critical habitats and the corridors that link them. Thus it is important to maintain this connectivity in order to sustain the rich insect biodiversity on the campus, a system of monitoring the critical habitats and indicator species has to be evolved [25]. Overall, our results highlighted that a small compact area like a segregated college campus supports a diverse insect species.

5. Conclusion

This study was an attempt to analyse some aspects of biodiversity of insects from Christian College campus. Since it is a preliminary study, a lot of research is necessary in this regard and further collections are essential for getting a detailed record of the faunal diversity of insects and development of standard monitoring procedures for assessing the environmental stability in this area.

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