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Assessment of Diversity of Insects Attracted by Artificial Light Traps in Selected Two Sites of Ottapalam Taluk, Palakkad, Kerala, India

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Renuka V T[1*], Dhivya R[2]

[1]Post Graduate Student, [2]Assistant Professor [1, 2]PG and Research Department of Zoology, Nirmala College for Woman, Coimbatore, Tamilnadu, India*

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ABSTRACT

Terrestrial insects are the most diverse groups of animals and they contribute a large extent to biodiversity. Sampling using a light trap is commonly used in insect biodiversity studies. A Preliminary Study of the diversity of insects attracted by artificial light traps was carried out in selected two sites viz., Vaniyamkulam and Ambalapara Village located at Ottapalam Taluk, Palakkad, Kerala, India from October 2020 to January 2021. Portable light traps were assembled using locally available materials for attracting insects. External morphology of insects and standard taxonomic keys were used to identify the insects. Results showed that a total of 25 species of insects belonging to 17 families and 24 genera were recorded in the present study. Among the species, identified family Geometridae is the largest family that is dominated by more species in the study area. The dominant family Geometridae comprised of seven species followed by family Ixodidae and Chrysomelidae both comprised of two species each.

1. INTRODUCTION

Insect biodiversity is known for its large proportion of biodiversity on the planet, with over 1,000,000 insect species. The recent estimate of total insect diversity shows variation from 5-80 million species of insect. Beetles (coleopteran) make up 40% of described insect species, but some entomologists suggest that flies (Diptera) and Hymenoptera (wasps, bees, and ants) could be as diverse or more so. Five orders of insects stand out in their levels of species richness: Hymenoptera, Diptera, Coleoptera, Lepidoptera, and Hemiptera [1].

Despite their central ecological role in natural and subnatural habitats, insects are arguably the most ubiquitous component of animal biodiversity in the terrestrial ecosystem. They are very relevant to areas such as agriculture, public health, and biotechnology and we can estimate how many species of insects are there on earth [2-3]. It is a fact that biodiversity in the temperate regions of the world, specifically in developed countries, is relatively well known compared with tropical areas, and thus, the current numbers of global insect diversity are generally based on temperate species [4].

In tropical regions, the extremely high diversity of insects and the no availability of specialized taxonomists are the main reasons for not producing comprehensive species lists of insects [5], either in tropical regions or temperate areas, cryptic species seem to be the major problem as they require expert taxonomic assistance [6]. Traditional taxonomic approaches of insect inventories involve a multidisciplinary team of taxonomists to identify thousands of morpho-species but the process requires high cost and manpower, especially considering tropical areas [7], and thus, alternative approaches must be used to improve our knowledge on insect diversity. As part of the ongoing advancements in biology, bioinformatics, and molecular biology, several tools are being currently used to create inexpensive automated species identification that can replace or at least complement traditional biodiversity assessment of insects based on morphology [8-9].

Lights could have adverse effects on the population of the insect by a variety of mechanisms, including mortality caused by exhaustion or disruption of biological cycles or attraction of predators. It is therefore important to understand the properties of light that cause insect attraction, and whether it affects only a few or a large number of species, to develop means to

minimize both the impact of lights on the number of species affected and on particular species. Studies on the adverse effects of varying light intensities on the spatial distribution of flying insect communities are very rare. In this regard, the present study was carried out to study the light insect diversity [10].

2. MATERIALS AND METHODS

2.1 STUDY AREA

Biodiversity in recent years has acquired considerable importance as a focal point of discussion like some other global issues [11]. It means the variability among the living organisms from all sources, diversity within species, between species, and of ecosystems [12]. For the present study two sites in Ottapalam located in Palakkad district, Kerala, India was chosen. The selected area for the study was one among the several intermittent streams of the village called Vaniyamkulam I and Ambalapara. Both are beautiful villages with rivers and paddy fields and are agricultural villages in the Palakkad district. The light insects were observed during the period from October 2020 to January 2021.

SITE 1: VANIYAMKULAM I

Vaniyamkulam I village is located in Ottappalam Taluk of Palakkad district in Kerala, India. It is situated 7 km away from Ottappalam and 39 km away from Palakkad. As per 2009 stats, Vaniyamkulam is the gram panchayat of Vaniyamkulam I village. The total geographical area of Vaniyamkulam I village is 1548 ha. There are more or less 3,813 houses in Vaniyamkulam I village. Shoranur is the nearest town which is approximately 6 km away from Vaniyamkulam I. It is located at 10.792 latitudes and 76.3232 longitudes in Ottapalam taluk, in Palakkad district, Kerala. The altitude is 35 meters above sea level. The temperature varies between 22- 40 degrees Celsius.

SITE 2: AMBALAPARA

Ambalapara is a small beautiful village in the Ottappalam Block of Palakkad District in Kerala State, India. It comes under Ambalapara Panchayath. It belongs to Central Kerala Division. It is located 35 km towards west from District headquarters Palakkad 307 km from State capital Thiruvananthapuram is surrounded by Pazhayannur Block towards South, Shoranur Block

towards west, Sreekrishnapuram Block towards North, Pattambi Block towards west Ottappalam, Shoranur, Perinthalmanna, Palakkad are the nearby Cities to Melur.

2.2 COLLECTION TECHNIQUE

The collection technique adopted in the present study was a slightly modified method by Joshua *et al*., [13]. Assembling of portable light traps was done using locally available materials. A funnel fitted with a container was used to collect the insects. The light source for the trap was a mercury vapor lamp of 165 Watts. The light traps were installed in a residential area of two selected sites viz., Site I - Vaniyamkulam I and Site II - Ambalapara. The traps were run between October 2020 and January 2021 at 21-day intervals from 6.00 p.m. to 6.00 a.m. The insects for every collection day were photographed using the mobile phone Redmi Note 7S for biodiversity count and then released.

2.3 IDENTIFICATION OF COLLECTED INSECTS

It was not possible to identify all the collected insects up to the species level. Therefore, based on external morphology, insects were identified. The insects collected under this study were subsequently identified either by the investigators or by referring to experts in institutions. Literature also helped for the identification of insects photographed. Taxonomic keys of Mayr [14] were also used for identification.

3. RESULT AND DISCUSSION

Insects or Insecta (from Latin insectum) are the largest groups within the arthropod phylum. Baseline knowledge on the diversity and distribution of insects over spatiotemporal scale is the key to biodiversity conservation.

The present work aims at studying the diversity and distribution of insects that were attracted to light in the selected site of the Palakkad district such as Vaniyamkulam and Ambalappara. Results of insects diversity of the present study are given in Table no 1.

Table No 1: Diversity Of Insects Identified In The Two Study Sites

SL NO	SCIENTIFIC NAME	FAMILY	COMMON NAME	SIGHTINGS (C, O, R)
1	*Idaea dimidiate*	Geometridae	Single dotted wave	O
2	*Idaea aversata*	Geometridae	Riband wave	O
3	*Eupithecia miserulata*	Geometridae	Common eupithecia moth	O
4	*Chloroclystis catastreptes*	Geometridae	Brown carpet moth	O
5	*Pasiphila rectangulata*	Geometridae	Green pug	C
6	*Lomogratha bimaculata*	Geometridae	White-pinion-spotted	C
7	*Rhodometra sacraria*	Geometridae	Common rhodometra moth	C
8	*Ixodes scapularis*	Ixodidae	Black-legged tick	R
9	*Dermacentor variabilis*	Ixodidae	American dog tick	R
10	*Acanthoscelides obtectus*	Chrysomelidae	Bean weevil	R
11	*Galeruca tanaceti*	Chrysomelidae	Leaf beetle	C
12	*Boisea trivittata*	Rhotalidae	Boxelder bug	C
13	*Atteva aurea*	Attevidae	Ailanthus webworm	O
14	*Creatonotos gangis*	Erebidae	Baphomet moth	O
15	*Scirpophage incertulas*	Crambidae	Yellow stem borer	O
16	*Trichoptera*	Limnephilidae	Caddisfly	C
17	*Eudryas grata*	Noctuidae	Beautiful wood nymph	C
18	*Tineola bisselliella*	Tineidae	Common cloths moth	O
19	*Ectobius vittiventris*	Ectobiidae	Amber wood cockroach	C
20	*Lepisma saccharina*	Lepismatidae	Silver fish	C
21	*Aedes albopictus*	Culicidae	Asian tiger mosquito	C
22	*Nemophora degeerella*	Adelidae	Long horned moth	C
23	*Tetragnatha Montana*	Tetragnathidae	Silver stretch spider	C
24	*Camponotus atriceps*	Formicidae	Carpenter ant	C
25	*Forficula auricularia*	Forficulidae	Common earwig	R

3.1 DIVERSITY OF INSECTS IN THE SELECTED TWO STUDY SITES

The present study was carried out within a four-month duration (from October 2020 to January 2021) in the places of the house such as work area, sit out, and places where maximum light is obtained. A total of 25 species of insects belonging to 24 genera and 17 families were recorded from the study area.

From the results obtained from the present study, it could be stated that Family Geometridae was dominant among the 19 families with 7 species. The species were *Idaea dimidiate, Idaea aversata, Eupithecia miserulata, Chloroclystis catastreptes, Pasiphila rectangulata, Lomogratha bimaculata, Rhodometra sacraria*. Following the family Geometridae, family Ixodidae is comprised of two species viz., *Ixodes scapularis* and *Dermacentor variabilis*. It was also found that the family Chrysomelidae is comprised of two species as *Acanthoscelides obtectus* and *Galeruca tanaceti*.

All other families viz., Rhotalidae, Attevidae, Erebidae, Crambidae, Limnephilidae, Noctuidae, Tineidae, Ectobiidae, Lepismatidae, Culicidae, Adelidae, Tetragnathidae, Formicidae, Forficulidae showed the presence of one representative each viz., *Boisea trivittata, Atteva aurea, Creatonotos gangis, Scirpophage incertulas, Trichoptera, Eudryas grata, Tineola bissselliella, Ectobius vittiventris, Lepisma saccharina, Aedes albopictus, Nemophora degeerella, Tetragnatha montana, Camponotus atriceps,* and *Forficula auricularia* respectively.

Geometridae, Chrysomelidae, and Ixodidae were the more frequently sighted groups during the study. Status of all species was categorized depending on the direct sighting during the study. In the present study, 12 species were spotted commonly. They are *Boisea trivittata, Trichoptera, Galeruca tanaceti, Eudryas grata, Pasiphila rectangulata, Lomogratha bimaculata, Ectobius vittiventris, Lepisma saccharina, Aedes albopictus, Nemophora degeerella, Tetragnatha montana,* and *Camponotus atriceps.*

Eight species such as *Atteva aurea, Creatonotos gangis, Scirpophage incertula, Idaea dimidiata, Idaea aversata, Eupithecia miserulata, Chloroclystis catastreptes,* and *Tineola bisselliella* showed occasional appearance. Five species such as *Ixodes scapularis, Rhodometra sacraria, Dermacentor variabilis, Acanthoscelides obtectus, Forficula Auricularia* showed rare sightings.

3.2 DIVERSITY OF INSECT SPECIES IDENTIFIED IN SITE 1-VANIYAMKULAM

This site is perhaps the best site for studying the diversity of insects. The results of insect diversity in site Vaniyamkulam were presented in Table 2. In the present study, it could be found that out of the 19 species belonging to 13 families were identified.

Table No 2: List Of Species Identified In Site 1- Vaniyamkulam

SL NO	SCIENTIFIC NAME	FAMILY
1	*Idaea dimidiate*	Geometridae
2	*Idaea aversata*	Geometridae
3	*Eupithecia miserulata*	Geometridae
4	*Chloroclystis catastreptes*	Geometridae
5	*Pasiphila rectangulata*	Geometridae
6	*Lomogratha bimaculata*	Geometridae
7	*Rhodometra sacraria*	Geometridae
8	*Ixodes scapularis*	Ixodidae
9	*Galeruca tanaceti*	Chrysomelidae
10	*Boisea trivittata*	Rhotalidae
11	*Atteva aurea*	Attevidae
12	*Creatonotos gangis*	Erebidae
13	*Scirpophage incertulas*	Crambidae
14	*Trichoptera*	Limnephilidae
15	*Eudryas grata*	Noctuidae
16	*Tineola bisselliella*	Tineidae
17	*Ectobius vittiventris*	Ectobiidae
18	*Lepisma saccharina*	Lepismatidae
19	*Aedes albopictus*	Culicidae

In the present study at the site Vaniyamkulam, Family Geometridae was the dominant family that comprised of 7 species (*Idaea dimidiate, Idaea aversata, Eupithecia miserulata,*

Chloroclystis catastreptes, Pasiphila rectangulata, Lomogratha bimaculata, and *Rhodometra sacraria*) and all other species belong to different families.

3.3 DIVERSITY OF INSECT SPECIES IN SITE 2 - AMBALAPARA

The results of insect diversity in site 2 Ambalapara are presented in Table no 3. In site Ambalappara all together 9 species belonging to 8 different families were reported.

Table No 3: List Of Species Identified In Site 2 - Ambalapara

SL NO	SCIENTIFIC NAME	FAMILY
1	*Acanthoscelides obtectus*	Chrysomelidae
2	*Galeruca tanaceti*	Chrysomelidae
3	*Dermacentor variabils*	Ixodidae
4	*Nemophora degeerella*	Adelidae
5	*Tetragnatha montana*	Tetragnathidae
6	*Camponotus atriceps*	Formicidae
7	*Forficula Auricularia*	Forficulidae
8	*Boisea trivittata*	Rhotalidae
9	*Trichoptera*	Limnephilidae

The dominant family in site 2 Ambalapara was the family Chrysomelidae with two species viz., *Acanthoscelides obtectus* and *Galeruca tanaceti*. The nine species identified were *Acanthoscelides obtectus, Galeruca tanaceti*, *Dermacentor variables, Nemophora degeerella, Tetragnatha montana, Camponotus atriceps, Forficula auricularia, Boisea trivittata,* and *Trichoptera.*

Indeed, natural areas with a low level of artificial light are valuable to maintain a healthy ecosystem and balanced insect diversity. In rural areas sky was clear and light intensity from artificial sources was lower than in urban areas. This phenomenon proved good for insect diversity and populations. A total of 28 species of insects belonging to 20 families were recorded in the present study. Of which Geometridae is the largest family that contributes more number of species followed by Ixodidae and Chrysomelidae. Similar work was done by Bian [15]. The phototactic responses of two major tea pests, *Ectropis obliqua* and *Empoasca onukii*, and of 10

dominant natural enemies in tea gardens were evaluated. Species diversity and abundance of insects caught by light traps can change according to the light source, for example, LED bulb, compact fluorescent bulb, or incandescent bulb as reported by Antony and Sebastian [16].

The effects of environmental (e.g. exposure time of light, polarization, weather and season and light intensity) and physiological (e.g. age and adaptation to the dark, sex and mating status) factors as well as anthropogenic activities (e.g. intensive agricultural practices), are prominent examples that may affect insect population in rural and urban areas [17]. Long-term exposure of nocturnal insect communities to artificial light can lead to changes compared to communities that are less exposed to light [18].

Nocturnal insects are highly sensitive to light and their behavioral responses like defense against predation, dispersal, oviposition sites, foraging, location of food, hosts, resting sites, and mate searching are governed by vision [15]. The behavioral responses of insect species are very much related to light intensity, photoperiodism, and circadian periodicity. Nocturnal behavior of insects, their growth, and physiology can be disrupted by the use of artificial light at night (ALAN) [19]. However, the reason for this phototactic behavior, especially for ALAN in nocturnal insects remains unclear and may be driven by multiple factors [20].

Artificial light has been implicated as a causal factor of global moth declines due to its negative effects on moth life cycles and behaviors [21]. In addition, moths are under-represented in assessments of biodiversity loss [22]. Where research has been conducted, it is difficult to discern the effects of AL from the influence of urbanization since the two typically co-occur [23]. However, the number of moths caught by light traps has been shown to decrease in the presence of other light sources, including artificial light [24].

Studies on the effect of light intensity have been focused on larger vertebrate animals and birds, and only a few studies have been on the effect of light intensity on the insect population. The current study confirmed that the composition and abundance of the insects are influenced by artificial light intensity. The behavior of insects in response to light is also affected by light quality, sky quality, and external shape of the light source [15, 20, 25, 16].

SUMMARY

Insects are important because of their diversity, influence on agriculture and, human health, natural resources, and ecological role. They disperse seeds, control populations of other organisms, pollinate plants, maintain soil structure and fertility, cycle nutrients, and provide a major food source for other taxa. Natural darkness during the time of night is beneficial for different species of insect and the entire wildlife. On the other hand, well-lighted locations at night would hurt the insect population, and this statement has been proved in this study. The right type of light and the intensity required for urban life are suggested to be considered carefully. Insects (Geometridae) are the largest family under the order Lepidoptera. In the present study conducted in Vaniyamkulam and Ambalapara village, Palakkad, Kerala, a total of 25 species of insects belonging to 24 genera and 17 families were recorded. During the study, the Geometridae was the most dominant family in terms of species richness followed by Ixodidae and Chrysomelidae. The present study yielded valuable information on insect species availability in these regions. Finally, to sum up, this study provided a significant contribution in the field of Ecology and provided information on insect diversity in the selected study site.

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