A Comparative Study on the Assessment of Insect Species Composition in Rural and Urban Areas of Selected Districts in Kerala, India

D. S. Sruthi[1], J. Roopavathy[2]
[1]*M.Sc. Student, PG and Research Department of Zoology, Nirmala College for Women (Autonomous), Coimbatore-18, Tamil Nadu, India.*
[2]*Assistant Professor, PG and Research Department of Zoology, Nirmala College for Women (Autonomous), Coimbatore-18, Tamil Nadu, India*

Abstract **- A comparative study was conducted on the assessment of insect species composition in rural and urban areas of selected districts in Kerala, India. The present study was conducted in Kannur District (Thalassery-Urban area) and Wayanad District (Thondernad-Rural area) of Kerala State for a period of 6 months from August 2020 to January 2021. During the study period, totally 54 species of insects belonging to 7 order and 32 families were reported from rural and urban areas at Wayanad and Kannur districts of Kerala. Rural area holds highest number of species. Out of 54 species recorded presently, 30 are from rural area belonging to 7 order and 17 families and the minimum number of species are recorded from urban area when compared to rural area which include 24 species belong to 7 order and 20 families.**

Index Terms **- Insects, Species composition, Urban area, Rural area Thalassery, Wayanad.**

INTRODUCTION

Insects play critical role in ecosystem functioning. They cycle nutrients, pollinate plants, disperse seeds, maintain soil structure and fertility, control populations of other organisms, provide a major food source for other taxa and are parasites or disease vectors for many other organisms including humans. Insects are prey for a variety of organisms, including terrestrial vertebrates. The earliest vertebrates on land existed 400 million years ago and were large amphibious piscivores. Through gradual evolutionary change, insect ivory was the next diet type to evolve (Sahney, 2010)1.

Insects constitute key indicators that enable the monitoring of the impact of urbanization on biodiversity, responding sensitively to changes in habitat extent and quality and to altered management practices associated with urbanization (Clark et al., 2008; Jaganmohan et al., 2012)2,3. Insects play a key role in nutrient cycling, organic matter decomposition, pollination and soil aeration in urban ecosystems (Thompson and McLachlan, 2007)4. Yet, although arthropod taxa, such as, ants and butterflies, are abundant in urban environments, little is known about how these are distributed within a city environment (Waite, 2012)5. Most urban biodiversity research has tended to focus on large green patches of remnant forests or urban parks (Khera et al., 2009)6. Yet, there has been increasing research to show the potential for small, scattered habitats, such as green roofs, domestic gardens and community gardens, to support rich biodiversity, even in densely populated urban areas (Jaganmohan, 2012)3. Domestic gardens private patches of garden associated with residential homes are widespread across most urban locations but tend to be under researched. Although it is known that domestic gardens can contain rich insect assemblages, the factors related to variation in biodiversity remain poorly understood (Sperling and Lortie, 2010)7.

The wide range of impacts associated with urbanization indicates that it exerts a considerable effect on terrestrial biodiversity. Most studies show that species richness and evenness is reduced in highly urbanized regions, depending on the taxonomic group observed, degree of urbanization, and spatial scale of analysis (McKinney, 2008)8. For example, butterflies (Blair and Launer, 1997)9 and ground arthropods show this tendency. The present study is aimed, to study the species composition of insect fauna in two

different area in Kannur and Wayanad districts and to compare the species richness in two different areas of rural and urban.

II. MATERIALS AND METHODS

Study Area

The present study was conducted in place called Thalassery which is a known urban area lying in Kannur District and Thondernad a rural area comes under Wayanad District of Kerala State. The present study was carried out for a period of 6 months from August 2020 to January 2021. The fortnightly sampling was made from dawn to desk to access maximum insect species composition of the particular study area.

A

B

Fig. 1 Description of the study area: (A) Thondernad Rural Area (Wayanad District); (B) Thalassery Urban Area (Kannur District) of Kerala State

Collection of insects

The sampling of insects was done by using certain collection methods such as hand picking, battery-operated light trap (Mathew and Rahmathulla, 1995)10, pit fall trap (Mommertz et al., 1996)11, sticky traps (Harmon and James, 1993) and also by using collection equipments such as aerial net and sweep net. The collected insects were separated, identified, counted, and the abundance of species at each areas were recorded.

Identification methods

Pertinent details such as binomial name of insects, name of collection area and the other relevant data of the insects were recorded. The collected insects were separated, then identified by using standard key (Tikader, 1986)12 and further confirmed by Dr. R. Nagarajun, AVC College, Mannampandal, Mayiladuthuri, Tamil Nadu by analysing their morphological characteristics. The collected insects were also photographed by using a Cannon 50D and Samsung A10 camera.

III. RESULTS AND DISCUSSION

During the study period, totally 54 species of insects belonging to 7 order and 32 families were reported from rural and urban areas at Wayanad and Kannur districts of Kerala (Fig. 2-3). Rural area holds highest number of species. Out of 54 species recorded presently, 30 are from rural area belonging to 7 order and 17 families and the minimum number of species are recorded from urban area when compared to rural area which include 24 species belongs to 7 order and 20 families (Table 1 and 2).

In the present study, a total of 19 species of Lepidoptera recorded with predominance percentage composition of 35% followed by 12 species of Coleoptera (22%), 6 species of Odonata (11%), 6 species of Hemiptera (11%), 4 species of Orthoptera (8%), 4 species of Mantodea (7%) and 3 species of Diptera (6%) were noticed in the study area (Fig. 4).

The present research dealt with the comparison of insect species composition in urban area (Thalessery) of Kannur district and rural area (Thondernadu) of Wayanad district in Kerala, India. Insect biodiversity accounts for a large proportion of all biodiversity on the planet, over half of the estimated 1.5 million organism species described are classified as insects (Stork et al., 2015)13. Insects which account for over half of all living described organisms have a very significant role in the ecosystem by affecting the diversity, abundance and distribution of plant communities (Wilson, 1998)14. So far, about 67,000 species of insects have been recorded from various ecosystems in India (Nair et al., 1993)15.

In the present study, totally 54 species of insects were recorded at Kannur and Wayanad districts of Kerala belonging to 7 orders (Lepidoptera, Coleoptera, Odonata, Hemiptera, Mantodea, Orthoptera and Diptera) and 32 families. Among the insects collected, order Lepidoptera being the

Table 1: Insects recorded from Thondernad rural area (Wayanad district)

Sl. No.	Common Name	Scientific Name	Order	Family
1	Handmaiden moth	*Syntomoides imaon*	Lepidoptera	Erebidae
2	Owlet moth	*Eudocima* sp.	Lepidoptera	Erebidae
3	Unknown	*Olepa ocellifera*	Lepidoptera	Erebidae
4	Unknown	*Erebus ephesperis*	Lepidoptera	Erebidae
5	Grass moth	*Glyphodes* sp.	Lepidoptera	Crambidae
6	Lesser rice leaf roller	*Cnaphalocrocis poeyalis*	Lepidoptera	Crambidae
7	Common five ring butterfly	*Ypthima bladus*	Lepidoptera	Nymphalidae
8	Commander butterfly	*Moduza procris*	Lepidoptera	Nymphalidae
9	Dusky spotted flat	*Celaenorrhinus fusca*	Lepidoptera	Hesperiidae
10	Rice swift	*Borbo cinnara*	Lepidoptera	Hesperiidae
11	Blue tiger	*Dysphania percota*	Lepidoptera	Geometridae
12	Asian spottedswallow tail moth	*Micronia aculeta*	Lepidoptera	Uraniidae
13	Unknown	*Attacus taprobanis*	Lepidoptera	Saturniidae
14	Cup moth	*Miresa* sp.	Lepidoptera	Limacodidae
15	Marsh skimmer	*Orthetrum* sp.	Odonata	Libellulidae
16	Pied paddy skimmer	*Neurothemis tullia*	Odonata	Libellulidae
17	Blue marsh hawk	*Orthetrum glaucum*	Odonata	Libellulidae
18	Common picture wing	*Rhyothemis variegata*	Odonata	Libellulidae
19	Orange tailed marsh dart	*Ceriagrion cerinorubellum*	Odonata	Coenagrionidae
20	Long horn beetle	*Epepeotes uncinatus*	Coleoptera	Cerambycidae
21	Long horn beetle	*Olenecamtus bilobus*	Coleoptera	Cerambycidae
22	Lady beetle	*Epilachna admirabilis*	Coleoptera	Coccinellidae
23	Indian rose mantis	*Gongylus gongylodes*	Mantodea	Empusidae
24	Praying mantid	*Gonypeta punctata*	Mantodea	Empusidae
25	Praying mantid	*Hierodula doveri*	Mantodea	Empusidae
26	Unknown	*Traulia* sp.	Orthoptera	Acrididae
27	Unknown	*Xenocatantops humils*	Orthoptera	Acrididae
28	Plant hopper	*Dictyophara* sp.	Hemiptera	Dictyopharidae
29	Jwell bug	*Chrysocoris* sp.	Hemiptera	Scutelleridae
30	Bottle fly	*Calliphora* sp.	Diptera	Calliphoridae

Table 2: List of insects species reported from Thalassery urban area (Kannur district)

S. No.	Common Name	Scientific Name	Order	Family
1	Banana root borer	*Cosmopolites sordidus*	Coleoptera	Curculionidae
2	Palm weevil	*Rhynchophorus* sp.	Coleoptera	Curculionidae
3	Asian grey weevil	*Myllocerus undatus*	Coleoptera	Curculionidae
4	Click beetle	*Melanotus* sp.	Coleoptera	Elateridae
5	Clik beetle	*Melanotus castanipes*	Coleoptera	Elateridae
6	Black footed beetle	*Bolbelasmus nativus*	Coleoptera	Geotrupidae
7	Sugarcane white grub	*Lepidiota stigma*	Coleoptera	Scarabaeidae
8	Beetle	*Cerobates laevipennis*	Coleoptera	Brentidae
9	Mango stem borer	*Batocera rufomaculata*	Coleoptera	Cerambycidae
10	Wave moth	*Scopula* sp.	Lepidoptera	Geometridae
11	Moth	*Musotima suffusalis*	Lepidoptera	Crambidae
12	Noctuid moth	*Bastilla crameri*	Lepidoptera	Noctuidae
13	Nygmiine tussock moth	*Orvasca subnotata*	Lepidoptera	Erebidae
14	Moth	*Xylophanes* sp.	Lepidoptera	Sphingidae
15	Black bean aphid	*Aphis fabae*	Hemiptera	Aphididae
16	Dock bug	*Coreus marginatus*	Hemiptera	Coreidae

17	Spittle bug	*Phymatostetha deschampsi*	Hemiptera	Cercopidae
18	Long nosed plant hopper	*Dictyophara nakanosis*	Hemiptera	Dictyopharidae
19	Southern oil guard	*Teleogryllus mitratus*	Orthoptera	Gryllidae
20	Bush cricket	*Mecopoda* sp.	Orthoptera	Tettigoniidae
21	Black soldier fly	*Hermetia illucens*	Diptera	Stratiomyidae
22	Bathroom moth fly	*Clogmia albipunctata*	Diptera	Psychodidae
23	Scarlet marsh hawk	*Aethriamanta brevipennis*	Odonata	Libellulidae
24	Praying mantis	*Tarachodes nubifer*	Mantodea	Eremiaphilidae

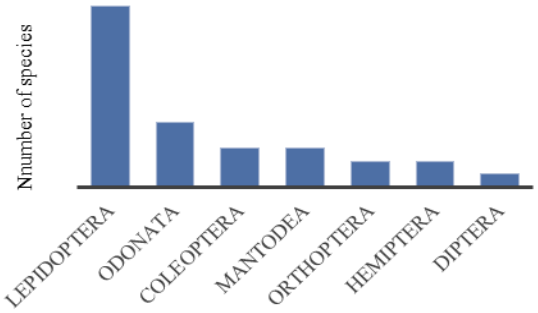

Fig. 2 Order-wise distribution of identified insect species from rural area (Thondernad, Wayanad district, Kerala)

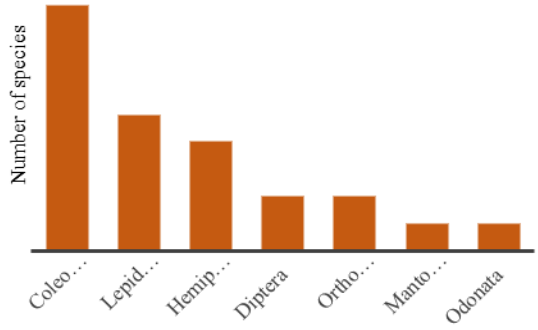

Fig. 3 Order-wise distribution of identified insect species from urban area (Thalassery, Kannur district, Kerala)

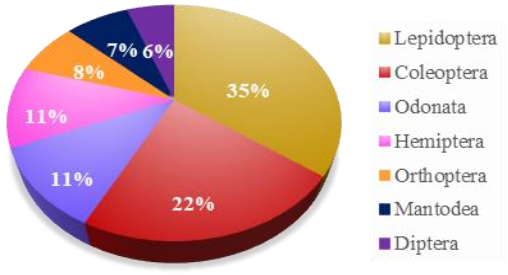

Fig. 4 Order-wise percentage composition of identified insect species from rural and urban area in Wayanad and Kannur districts, Kerala dominant in rural area and Coleoptera being the dominant in urban area.

A study on insect fauna of Neyyar Wildlife Sanctuary, Kerala, India, made by Mathew et al. (2007)16 recorded 53 species of butterflies, 90 species of moths, 22 species of beetles, 20 species of bugs, 17 species of bees and wasps, 6 species of dragon flies, 6 species of grasshoppers and 21 unidentified species of flies (Mathew et al., 2007)16. The study shows that Lepidoptera being the dominant followed by Hemiptera, Hymanoptera, Odonata and Orthoptera. Similar result was observed in the present study. But no species of bees and wasp was recorded from the study area. A total of 19 species of Lepidoptera (35%), 12 species of Coleoptera (22%), 6 species of Odonata (11%), 6 species of Hemiptera (11%), 4 species of Orthoptera (8%), 4 species of Mantodea (7%) and 3 species of Diptera (6%) were noticed in the study area. According to Mathew et al. (1998)17 a maximum number of species collected belonged to the Order Lepidoptera and Coleoptera. The lepidopteran families such as Pyralidae, Noctuidae and Geometridae and the coleopteran families like Chrysomelidae, Cerambycidae and Tenebrionidae were the most dominant in their study on insect biodiversity in disturbed and undisturbed forests in the Kerala parts of Western Ghats. Current study also found that Lepidoptera being the highest and Lepidopteran families such as Noctuidae, Geometridae, Coleopteran, Chrysomelidae and Cerambycidae were recorded to be dominant. The same result was reported from the present study.

Barratt et al. (2015)18 have studied the biodiversity of Coleoptera and other invertebrates in urban gardens in a New Zealand city and they reported over 1400 Coleoptera. Staphylinidae, Curculionidae, and Carabidae which were abundantly reported Coleoptera. Likewise, the urban area of the current study comprises Coleoptera as the first dominant order followed by Curculionidae the most abundantly collected Coleopteran order. A study was conducted on the diversity and abundance of insect species at

Kota Damansara Community Forest Reserve in order to determine the richness of the forest insect fauna. A total of 774 insects from 13 Orders and 79 Families were recorded. This study shows that Coleoptera (42.63%), Hymenoptera (17.96%), Diptera (10.08%) and Orthoptera (10.85%) were the most dominant Orders in the Forest Reserve (Patel, 2015). The study reveals Coleoptera the most dominant. Similar result was also observed from the urban study site of the present study.

The forest reserve has diverse vegetation and habitats. The vegetation's diversity and richness indirectly affect insect species diversity and abundance. The structure of vegetation between the different zones could be affecting the existing of insect diversity (Nair et al., 1993)19. The wide range of impacts associated with urbanisation indicates that it exerts a considerable effect on terrestrial biodiversity. Most studies show that species richness and evenness is reduced in highly urbanised regions, depending on the taxonomic group observed, degree of urbanisation, and spatial scale of analysis (McKinney, 2008)8. The general pattern of biodiversity decrease in cities is probably due to the fact that over 80% of land in city cores is covered by buildings and pavements, with the remaining area used for lawns, trees, and shrubs (Blair and Launer, 1997)9, thus fragmenting the landscape and homogenising vegetation composition (Faeth et al., 2012)20. Different sites within an area, even in close proximity, may have highly variable insect populations due to subtle differences in environmental factors or plant composition and numbers may fluctuate greatly within the sites. The various environmental factors such as temperature, humidity, rainfall, vegetation and food sources directly affecting the diversity and distribution of insect populations.

There are 112 species of moths were identified belonging to 16 families and 8 Super families. The most species rich family was Erebidae with 35 species under 31 genera belonging to 7 subfamilies followed by Noctuidae with 17 species and Sphingidae and Geometridae with 12 species (Mathew et al., 2018)21, in his study-the moths (Lepidoptera: Heterocera) of Vagamon hills (Western Ghats), Idukki district, Kerala, India. Likewise in the current study the most species rich family was Erebidae and shares 6 common families.

Lundquist and Zhu (2019)22 in his work on Aquatic insect diversity in streams across a rural–urban land-use discontinues, suggest that urbanization in this medium-sized city negatively impacts stream insect richness, but the change of community assemblages is not homogenous across the urban landscape. Connectivity between upstream rural sites and downstream urban sites may provide some relief from the impacts of urbanization in smaller cities. Present study also reported less species diversity in urban area. Similarly, the study on the invertebrate fauna of a physically modified urban river (Beavan et al., 2001)23 demonstrated that, typical urban river is affected by various factors relating to water quality problems, physical habitat modification (for flood prevention) and flashy flows. These restrict macro invertebrate biodiversity such that a few tolerant taxa may dominate, and more sensitive organisms may be completely absent. It is demonstrated that considerable variation in invertebrate species, abundance, diversity and tolerance exists between different urban rivers, sites on the same river and individual sites at different sampling times.

IV. CONCLUSION

The outcome of the present study clearly inferred that the order Lepidoptera was found to be predominant group of insects when compared to other species which might be due to higher reproduction potential of the particular group of species. Further, the present study conclude that the rural area was served as a suitable breeding site for the insects due to prevailing favourable environmental and habitat conditions such as temperature, humidity, food, soil nature and occurrence of rich vegetation when compared to urban area where no more vegetation are there besides unfavourable environmental conditions prevailed. Based on the present findings it is clearly understood that restoration and vegetation should be done wherever possible so that the insect's population will be increased as it is good source of ecological and societal welfare.

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