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STATUS OF LEPIDOPTERAN DIVERSITY AT ASOKAPURAM LOCALITY, ALUVA, KERALA, SOUTH INDIA

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Abstract

The insect order Lepidoptera comprises both butterflies and moths. There are over 180,000 Lepidoptera species described, divided into 126 families and 46 superfamilies. 10% of the total number of living creatures described. It is one of the most common and well-known insect orders on the planet. Butterflies are an important category of insects that can function as sensors of environmental change. Butterflies are insects from the order Lepidoptera's macrolepidopteran clade Rhopalocera. Except for Antarctica, there are around 18,500 species of butterflies. Moths are a paraphyletic group of insects that contain all non-butterfly members of the order Lepidoptera, with moths constituting the great bulk of the order. Moths are expected to number over 160,000 species. The majority of moth species are nocturnal, however there are crepuscular and diurnal species as well. Asokapuram is a tiny hamlet located east of Aluva. The current analysis was carried out to identify the Lepidopterans in the area for 6 in diverse habitats surrounding the area. During the inquiry, a total of 46 lepidopterans were noted, 27 of which were recognised, 13 of which were various species of butterflies and the remaining 14 were different species of moths.

Key words: Asokapuram, Lepidoptera, Moths, Odonata, Simpson index

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1. Introduction

The variety of species in the tropical zones is well recognised (Mathew and Rahamathulla, 1993). Insects play an important part in the maintenance of vital life support systems in their natural settings (Wells etal., 1983). Our understanding of the insect fauna of the Indian area is based on the research of pioneers such as Hampson (1891), Lefroy (1909), and Mathew and Rahamathulla (1995). Currently, insects account for around 80% of all known creatures, with lepidopterans accounting for 112, 000 species, which include both butterflies and moths (Hutchins, 1972; Gunathilagarajet al., 1998; Nair, 2001 and 2002). Lepidopteran insects are diverse in nature, serving as both crop pests and pollinators. In Hampson's (1894) dissertation on the fauna of India, Lefroy (1909) counted 10,000 species of lepidopterans, of which 8,000 were moths and 1,500 were butterflies.

Kerala is recognised for its diverse habitats, which range from high mountains with lush tropical evergreen forests to coastal lowlands with riverine and mangrove vegetations. Kerala is recognised for its diverse habitats, which range from high mountains with lush tropical evergreen forests to coastal lowlands with riverine and mangrove vegetations. Although most faunal surveys were conducted in the north and north-eastern areas of India, publications by older scientists such as Sir George Hampson (Lepidoptera), Guy Marshall (Coleoptera), Maulik (Coleoptera), and De Niceville (Butterflies) include references to species discovered in Kerala. Larsen (1987, 1988) conducted a detailed study on the butterflies of the Nilgiri mountains; Mathew and Rahamahulla (1993, 1995) conducted a study on the butterflies and moths of Silent Valley; Mathew (1992) conducted a study of insect fauna in the Malayattoor forests; and Cherian conducted a study of insects in the hydal areas of Idukki (1983). These investigations have revealed that the Kerala portion of the Western Ghats is particularly rich in species variety, with numerous areas designated as biodiversity "hotspots." However, due to different anthropogenic disturbances, many places in this region are under significant anthropogenic pressure, and many species are likely to become extinct if suitable conservation efforts are not implemented. The main disturbances in these regions include fires, planting programmes, forest cutting for fodder and firewood, and cattle grazing. Documenting floral and faunal diversity and assessing the impact of various disturbances on species diversity patterns are critical components of any conservation effort. The current study attempts to gather baseline data on species diversity patterns in chosen "biodiversity hotspots," as well as to examine the impact of various forest disturbances on biodiversity.

Ernakulam is the location of Aluva. Asokapuram is a tiny rural area east of Aluva, located between 10.0837° N and 76.3609° E and administered by Choornikara Grama Panchayat. A review of the diversity of lepidopterans in this region revealed that more lepidopterans are located in marsh fields, an area dominated by wild flowers and shrubs, and buildings with attractive flowers, or in agricultural fields. A total of 27 distinct lepidopterans were discovered in a 3km radius in shrubby regions, crop fields, marshy areas, and gardens. And the number of insects is falling as a result of habit destruction in the area for various reasons (Verma & Arya, 2022).

With the publication of Carl Linnaeus' Systema Naturae in 1758, which introduced the binomial system of identifying species, Indian butterflies began to be carefully examined and properly named. This was an innovative method of issuing unique scientific names to each species of organism on the planet based on a genus name followed by a species name, which would facilitate scientific communication. This was especially important since the natural world around Linnaeus was quickly growing as European conquests reached remote corners of the globe, introducing previously unknown species from other regions. Linnaeus' binomial method was an instant success: tens of thousands of species were named using it, and its popularity spread quickly throughout Europe. The approach has now formed the foundation of taxonomic nomenclature for all life on Earth. Linnaeus' work was quickly followed by two sets of books containing descriptions of dozens more Indian butterfly species, one written by Linnaeus' pupil Johan Christian Fabricius and the other by Pieter Cramer, a Dutch trader and amateur entomologist. These three taxonomists described almost 350 butterfly taxa from the Indian subcontinent.

More recent works on insect diversity in the Kerala part of the Western Ghats include the recording of 242 species of insects from Silent Valley by the Zoological Survey of India (ZSI, 1986), a detailed study on the butterflies of the Nilgiri mountains by Larsen (1987, 1988), the recording of 208 species of insects, mostly dipterans, from the hydal areas of Idukki forests (Cherian, 1983), a study of insect fauna in the Malayattoor (Mathew et al. 1998).

Lepidoptera is one of the world's most common and well-known insect orders. Butterflies are classified as "flagship taxa" in biodiversity inventories (New etal., 1995; Lawton et al., 1998). According to Larsen (1997a; b; c), butterflies are the most researched group of insects. Butterflies have been researched extensively since the early 18th century, and around 19,238 species have been recognised worldwide (Heppner, 1998). Papilionidae, Pieridae, Danaidae, Satyridae, Nymphalidae, Amathusiidae, Acraeidae, Erycinidae and Lycaenidae, and Hesperiiodea were the 10 families of

butterflies. Except for Hesperiids, all butterflies are classified as belonging to the superfamily Papilionoidea under the suborder Rhopalocera, with the latter classified as belonging to the superfamily Hesperiioidea under the suborder Grypocera. So far, 1,504 butterfly species have been identified on the Indian subcontinent (Smetacek P, 1992; Gaonkar, 1996). Gunathilagaraj et al. (1998) identified 334 butterfly species in the southern Western Ghats and 150 in the Eastern Ghats. They are most common in the tropics, where there is a distinct latitudinal gradient (Shields, 1989; Larsen, 2005). The Western Ghats' moth variety has received little attention in recent decades. Although substantial, the pioneering work of Hampson (1891, 1892, 1894, 1895, 1896) and Bell and Scott (1937) need a thorough updating and more recent surveys. Agriculturally important species have received some attention (Adiroubane & Kuppammal, 2010; Jha et al., 2017; Nagaharish et al., 2017). However, most non-pest moth species' diversity and dispersal patterns are poorly known. There have been few research that have looked at regional moth diversity in southern India, and particular studies on Kerala moth diversity are given here. During a five-month investigation, Mathew and Rahamathulla (1995) discovered 318 species of moths in the Silent Valley National Park. During a three-year survey, Sudheendrakumar and Mathew (1999) discovered 277 species of moths in the Parambikulam Wildlife Sanctuary. During a two-week investigation, Mathew et al. (2004a) discovered 128 different species of moths at Shendurney Wildlife Sanctuary. During a two-month investigation, Mathew et al. (2004b) discovered 87 species of moths at Peppara Wildlife Sanctuary. Mathew et al. (2005) identified 113 moth species in the Peechi-Vazhani Wildlife Sanctuary. During a two-month investigation, Mathew et al. (2007) discovered 90 species of moths at Neyyar Wildlife Sanctuary. During a year of surveying, Mathew et al. (2018) discovered 112 species of moths in the Vagamon Hills, Idduki. Mathew and Menon (1984) identified 155 Pyralid moth species in Kerala. Larsen (1987, 1988) conducted a detailed study on the butterflies of the Nilgiri mountains; Mathew and Rahamahulla (1993, 1995) conducted a study on the butterflies and moths of Silent Valley; Mathew (1992) conducted a study of insect fauna in the Malayattoor forests; and Cherian conducted a study of insects in the hydal areas of Idukki (1983).

Early 1800s A golden time in the finding and naming of Indian butterflies began in the 1820s with the publication of Thomas Horsfield and Frederic Moore's A Catalogue of the Lepidopterous Insects in the Honorary East-India Company's Museum. Horsfield and Moore both had extensive careers, and together they studied Indian butterflies for about 90 years, describing over 500 species. Indeed, Moore holds the record for describing more butterfly taxa from the Indian

subcontinent than any other butterfly taxonomist in history, albeit several of his species descriptions were published as collaborations, and therefore authorship was shared with other taxonomists. The golden age of butterfly taxonomic discovery on the Indian subcontinent was from from 1840 to 1900, when the bulk of the species and subspecies that are now considered taxonomically valid were reported. The insect community's makeup directly reflects the health of the environment (Thomas & Thomas, 2022). Apart from Moore, the majority of this study was done by British Raj entomologists like as Hewitson, Doubleday, Horsfield, Westwood, and de Nicéville, while continental European entomologists such as Kollar, C. Felder, and R. Felder also contributed significantly.

2. Materials and Methods

Collecting insects is one of the finest methods to learn about them. Insect sampling is another method for estimating the quantity and number of species in a given region. There are numerous techniques to gather insects. The most basic and often used way is to utilise an insect net or light traps. Other ways include using an aspirator, a beating sheet, pitfall traps, and bait traps, among others. It is preferable to gather and release the insects after the research, and only if necessary should the insects be collected and killed. The lepidopterans (both butterflies and moths) were gathered from the Asokapuram neighbourhood using a bug net and a light trap during a 6-month period (June). The captured insects were photographed and numbered before being released back into the environment. A small number of specimens were kept for identification purposes. The insects were captured using a standard-sized bug net (nets have a 3-foot (91 cm) smooth oak handle that is 3/4″ (2 cm) in diameter). Net rings are galvanised steel, 8 gauge, and 12″ or 15″ (30 or 38 cm) in diameter. Light traps and mesh (mesh size is roughly 24 x 20 per inch). The nets were used in dense foliage and in the air for around 5 or more times until the creature was captured. At night, light traps were utilised to capture nocturnal animals. The number of lepidopterans found in each sampling was counted. Species were identified using the manuals of Adrian J Ebell (1872), Wynther-Blyths (1979), Hampson and George Francis (1990), and Cotes and E.C. (1887).

Fig. 1 Map of Asokapuram

Were identified using the manuals of Adrian J Ebell (1872), Wynther-Blyths (1979), Hampson and**.** The collected lepidopterans were released into the wild after counting and photography. Minimum numbers of specimens were retained for the purpose of identification.

Simpson's index is a well-known biodiversity indice. It was initially presented in 1949 by British statistician Edward.H.Simpson. The index assumes that the proportion of people in a given location reflects their relevance to diversity. It considers both the number of species present and the relative abundance of each species. The Simpson index measures the likelihood that two randomly chosen individuals in the environment are members of the same species.

Simpson index D,

$$D = 1-\Sigma\, n(n-1) / N(N-1)$$

Where, N=the total number of organisms of all species

n= the total number of organisms of a particular species

D ranges from 0 to 1, with one representing infinite diversity and 0 representing no diversity

3.Observation and Results

The tropical areas are well-known for their abundance of species variety (Mathew and Rahamathulla, 1993). Insects play an important part in the maintenance of key life support systems in their natural settings (Wells etal., 1983). Our understanding of the insect fauna of the Indian area is based on the research of pioneers such as Ha mpson (1891), Lefroy (1909), and Mathew andRahamathulla (1995). Currently, insects account for around 80% of all known creatures, with lepidopteransa accounting for 112, 000 species, which include both butterflies and moths (Hutchins, 1972; Gunathilagaraj et al., 1998; Nair, 2001 and 2002). Lepidopteran insects are diverse in nature, serving as both crop pests and pollinators. In Hampson's (1894) dissertation on the fauna of India, Lefroy (1909) counted 10,000 species of lepidopterans, of which 8,000 were moths and 1,500 were butterflies. Kerala has recorded 316 species out of the total 1500 species found in India. Kerala is recognised for its diverse habitats, which range from high mountains with lush tropical evergreen forests to coastal lowlands with riverine and mangrove vegetations. Despite the fact that the majority of the faunal surveys were conducted in the north and north-eastern areas of India, the publications of previous scholars such as Sir George Hampson (Lepidoptera). Guy Marshall (Coleoptera), Maulik (Coleoptera), and De Niceville (Butterflies) all have references to Kerala-specific taxa. In the area, 46 lepidopterans were discovered, 27 of which were recognised. Thirteen of the 27 recognised species were butterflies belonging to five families, while the remaining 14 were moths belonging to four families. The majority of the butterfly species were discovered in locations with an abundance of wildflowers and gardens, as well as shrubby and swampy environments. The moths were usually found in metropolitan areas due to their love to light. The discovery of these and other insects in the area indicates that the surrounding areas are healthy. :

Table No.1. Identified Butterflies

Sl.No.	**Scientific name**	**Family**	**Common name**
1	*Mycalesis perseus*	Nymphalidae	Bush Brown
2	*Potanthus sps.*	Hesperiidae	Dart skipper
3	*Eurema hecabe*	Pieridae	Common grass yellow
4	*Papilio clytia*	Papilionidae	Common mime

5	*Junonia lemonias*	Nymphalidae	Lemon Pansy
6	*Melanitis leda*	Nymphalidae	Common evening brown
7	*Papilio polymnestor*	Papilionidae	Blue mormon
8	*Euploea core*	Nymphalidae	Indian common crow
9	*Jamides celeno*	Lycaenidae	Common cerulean
10	*Catopsilia Pomona*	Pieridae	Lemon emigrant
11	*Talicada nyseus*	Lycaenidae	Red pierrot
12	*Neptis hylas*	Nymphalidae	Common sailor
13	*Pachliopta aristolochiae*	Papilionidae	Common Rose

Table . 2 Diversity index of Butterflies (Simpson index)

Sl.No.	**Scientific name**	**No.of species (n)**	**n(n-1)**
1	*Mycalesis perseus*	5	20
2	*Potanthus spp.*	2	2
3	*Eurema hecabe*	4	12
4	*Papilio clytia*	8	56
5	*Junonia lemonias*	3	6
6	*Melanitis leda*	2	2
7	*Papilio polymnestor*	1	0
8	*Euploea core*	1	0
9	*Jamides celeno*	5	20
10	*Catopsilia pomona*	5	20
11	*Talicada nyseus*	2	2
12	*Neptis hylas*	4	12
13	*Pachliopta aristolochiae*	4	12
		N= 46	Σn(n-1)= 164

N(N-1)= 2070

Simpson index D,

$$D = 1-\{\Sigma n(n-1)/N(N-1)\}$$

$$= 1- \{164/2070\}$$

$$= 1-0.07$$

$$= 0.93$$

The diversity index for the butterflies is 0.93.

Table . 3 Identified mothes

Sl.No.	Scientific name	Family
1	*Amata cyssea*	Erebidae
2	*Haritalodes derogate*	Crambidae
3	*Dysgonia stuposa*	Erebidae
4	*Asota producta*	Erebidae
5	*Pergesa acteus*	Sphingidae
6	*Scopula luridata*	Geometridae
7	*Spoladea recurvalis*	Crambidae
8	*Asota plana*	Erebidae
9	*Eudocima phalonia*	Erebidae
10	*Semiothisa elenora*	Geometridae
11	*Creatonotos gangis*	Erebidae
12	*Olepa ocellifera*	Erebidae
13	*Erebus ephesperis*	Erebidae
14	*Hyblaea puera*	Hyblaeidae

Table . 4 Diversity index of moths (Simpson index)

S.No.	Scientific name	No.of species(n)	n(n-1)
1	*Amata cyssea*	2	2
2	*Haritalodes dergata*	1	0
3	*Dysgonia stuposa*	3	6

4	*Asota producta*	4	12
5	*Pergesa acteus*	1	0
6	*Scopula luridata*	1	0
7	*Spoladea recurvalis*	1	0
8	*Asota plana*	2	2
9	*Eudocima phalonia*	1	0
10	*Semiothisa elenora*	1	0
11	*Creatonotos gangis*	3	6
12	*Olepa ocellifera*	1	0
13	*Erebus ephesperis*	1	0
14	*Hyblaea puera*	5	20

Total number of species (N) = 27
N(N-1) = 27*(27-1)
= 27*26
=702
Σn(n-1) = 42
Simpson index D = 1- Σn(n-1)/N(N-1)
= 1-{42/702}
= 1-0.059
= 0.941

The species diversity of the moths is 0.941.

4. Discussions

In the area, there is a diverse range of insects of several orders and families. The locality's lepidopteran diversity was used in the study. Approximately 46 lepidopterans were discovered over the course of two months, with 27 of them recognised and collected for diversity. 13 of the 27 species discovered were butterflies, and 14 were moths. Despite the fact that several butterflies were only mentioned once, according to the study materials, the Nymphalidae was the most specious family with 5 species, followed by Papilionidae with 3 species, Pieridae with 2 species, Lycaenidae with 2 species, and Hesperridae with 1 species. The moths were mostly cited inside homes at night, and approximately 14 species of moths from various families were identified, with the Erebidae family having the most species (8 species), followed by Crambidae (2 species), Geometridae

(2 species), Sphingidae (1 species), and Hyblaeidae (1 species). To support a butterfly or moth species, an environment must meet all of its needs throughout its life cycle (egg, larva, pupa and adult). Butterflies and moths live and reproduce in a variety of environments, such as salt marshes, mangroves, sand dunes, lowland woodland, wetlands, grasslands, and mountain zones. Rock surfaces and bare ground are crucial because they are home to the lichen that the larvae consume. Most ecosystems are teeming with butterflies and moths. The specific species mix is determined by the season, time of day, and other plants and animals at the location. The summer heat attracts the most moths, while some are only active in late fall or early winter. The distribution of butterflies is predicted to mirror the distribution of their host plants at all scales, and the type of vegetation may reflect differences in the composition of butterfly species among habitats at the generic and family level. The majority of the butterflies observed were among wildflowers, gardens, and agricultural fields (Anbalagan et al., 2022).

In the brief time that the study was conducted, the number of butterflies was significantly reduced due to habitat degradation. As the wildflowers and other grasses were chopped down as part of the cleaning procedure, the normally visible butterflies, both known and unnamed, were not seen at all. Even though the butterflies were citied singly on alternate days, the smaller butterflies were not seen once the habitat was destroyed. In terms of citing in gardens, only homes with a lot more blooming plants have some butterflies. In terms of citation, the butterflies have only been cited between the hours of 6 and 10 a.m., however smaller butterflies have been noticed in agrifields and also in parks. The majority of the reported moths were nocturnal, and the majority of them were cited at a residence near a marsh. The moths saw in the mornings were in the grassland and were all pretty similar. Some were also observed in residences near agrifields (Mathew et al., 2018). Butterfly and moth populations may be quite dynamic, with some years being abundant and others being rare. They can also be significantly more responsive to good changes in land management than birds, plants, or animals. This is one of the reasons they are good 'indicator' species. In general, the more diversified an environment, the more butterflies and moths it can sustain. This is frequently best achieved by adequate animal grazing. Seasonal grazing, particularly by cattle, can help to maintain and promote floristic diversity by feeding a diverse range of larval foodplants and adult nectar plants. Butterfly and moth populations may be highly dynamic, with bountiful years and unusual years. They can also be far more receptive to excellent land management improvements than birds, plants, or animals. One of the reasons they are good

'indicator' species is because of this. The more diverse an ecosystem, the more butterflies and moths it can support. This is typically best accomplished with proper animal grazing. By feeding a varied range of larval foodplants and adult nectar plants, seasonal grazing, particularly by cattle, can assist to preserve and enhance floristic diversity.

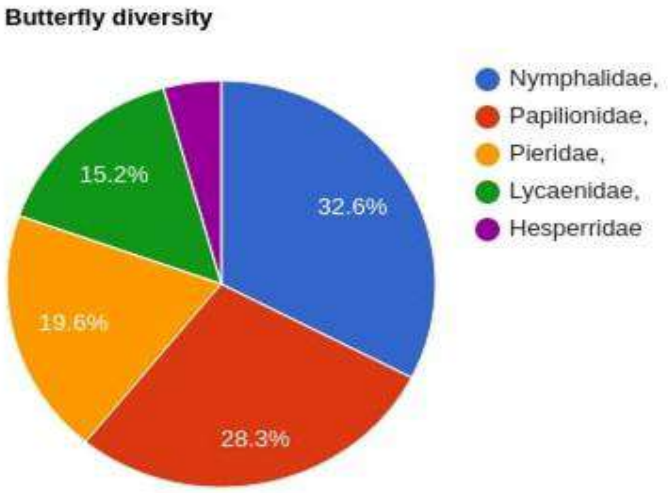


Fig. 2. Pie digram showing the diversity of Butterflies

As the pie diagram so the locality has an specious amount of Nymphalidae followed by Papilionidae, Pieridae,Lycaenidae and Hesperridae.

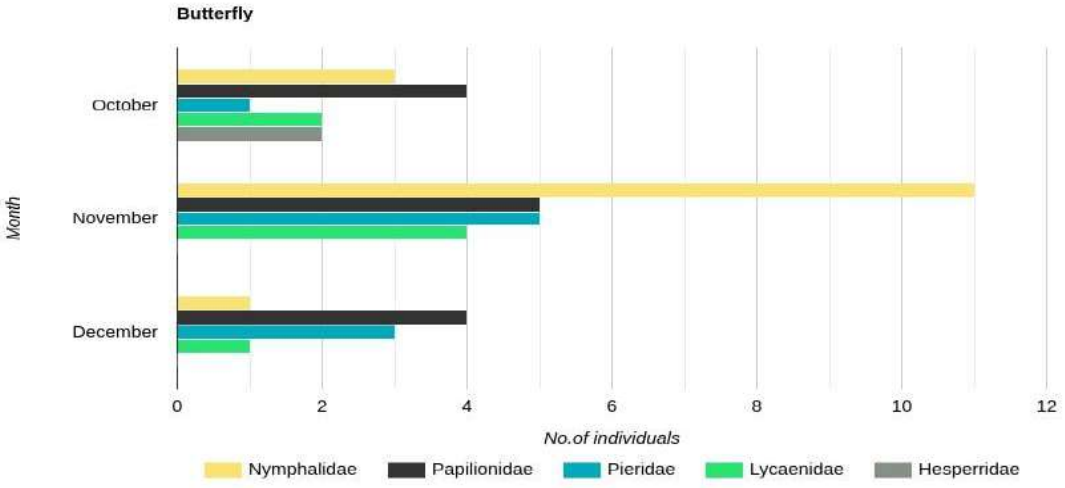
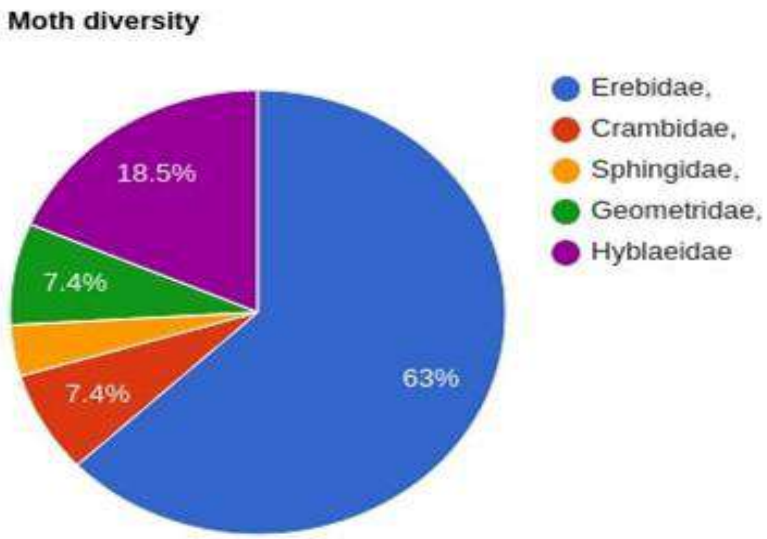


Fig. 3 . Bar diagram showing the monthly observation of Butterflies .

From the bar diagram it is clear that, it is during the month of november the most citings were done. According to the studies by Tipal AD (2007) it is said that there is a peak in the abundance of butterflies during the months November-January and a drop in the abundance in February in tropical regions.



.Fig. 4. Pie digram showing the diversity of Moths

5. Conclusion

The study gives a baseline of Lepidopteran variety in the Asokapuram area for around 3km. Both butterflies and moths were mentioned separately. The butterflies were occasionally mentioned in pairs. A large number of butterflies, including some that were not recognised, were spotted around wildflowers, agrifields, marshes, and grasslands. And the butterflies that were recognised belonged to the family Nymphalidae, according to the short-term research. The species diversity so calculated is 0.93, indicating a diverse variety. According to recent studies undertaken by numerous researchers, including Tipal (2007), November is the peak season for butterflies in tropical locations. Following the research, habitat degradation in nearby areas resulted in a substantial fall in the number of butterflies seen fluttering around, even the smaller ones. And urabanization in communities is still destroying many places that may support a range of species of not only butterflies but also other life. The number of moths spotted in the region was modest in comparison to the number of butterflies reported, despite the fact that the species number is significantly higher.

Because of their love to lights, they were primarily spotted in dwellings. Because it is not the peak season (May-October) for moths, who prefer warmer climates over colder climes. The ones spotted were near agrifields, meadows, and so forth. And, while a few were sighted alone in November and December, there weren't many other citations. And, according to the short-term research, the majority of the identified moths belonged to the Erebidae family, and the species of this family were visible throughout October and November, as opposed to other families. The resulting species diversity is 0.94.

It may be inferred that the area has a suitable number of butterflies and moths, or lepidopterans in general. Because butterflies have a peak season, they were seen a lot before habitat degradation, and moths, while not having a peak season, were seen in sufficient numbers. When seen, both lepidopterans are influenced by environmental conditions. The butterflies, for example, were spotted in the early mornings and late evenings. They were also observed around locations with an abundance of wild flowers, flowers, and agrifield. The majority of the moths were nocturnal, and two of them were pests. Morning moths were typically spotted in meadows (Swafvan & Joshi, 2004). Butterflies are very sensitive biota that are strongly impacted by environmental changes and changes in forest structure. Birds, reptiles, amphibians, spiders, and predatory insects all feed on them. They also respond to disturbances and changes in habitat quality, making them an excellent indicator species for assessing habitat and landscape structural changes (Thayyullathil et al., 2020).

Because the field research only covers a small region, the variety may be more than that revealed by this study. A further in-depth investigation of the region might provide a complete picture of the lepidopteran variety. Habitat destruction and sustainable urbanisation aid in the survival of lepidopterans.

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Competing Interests

Authors have declared that no competing interests exist.

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