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INVENTORY OF MOTH FAUNA (LEPIDOPTERA: HETEROCERA) OF MALABAR REGION OF KERALA

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ABSTRACT

This paper presents an inventory of 267 species of moths (212 identified to species, 55 identified to genus) from 22 families belonging to 10superfamilies.The study was carried out in eight different sites of Malabar Region (Wayand and Kannur) of Kerala between June 2015 to May 2017. Of the species recorded, with reference to their published distribution ranges, majority of species appear to be new records to Malabar and seven species (Six-Sphingidae and One Erebidae) are new records to Kerala part of Western Ghats. The dominant families were Erebidae, Geometridae, Sphingidae, Noctuidea and Crambidae. The highest numbers of moths were recorded from Varayal (Wayanad part) and second highest was from Kozhummal (Kannur part) of Malabar region of Kerala. The highest species diversity was recorded from Varayal. The species richessness was higher in Varayal following Talapuzha and Kozhummal. The Wayanad part of Malabar region need further detailed sampling, as these areas have been largely unexplored for moths. Extensive sampling in Malabar region resulted in many variety of species; this indicates that if sampling is intensified additional records may also be generated at the other sites of Malabar region. It was concluded that the moth diversity is very high in Malabar region. Further systematic and intensive surveys will yield more data.

KEYWORDS: Moths, Kerala, Diversity Indices, Malabar, Species Richness, Species Diversity.

The moths are coming under the order Lepidoptera same order of butterflies are lacking attention compare to the butterflies. Universally we do not consider moths needing conservation, because some of them are notorious pests for vegetation. But in fact most moths are harmless; instead we can get plentiful benefits-pollination, a balanced environment, or monitoring environmental quality using the population fluctuation of indicator species. A number of research works have been done in butterflies, but moth's study is in its initial. The status of this specimen requires immediate attention. Many of the species may be endangered or may be on the verge of extinction. Studying the diversity of moths will help to conserve them. By conserving the moths we can also conserve their habitats, host plant and the entire ecosystem. No comprehensive studies have been carried out on the diversity of moths of Malabar region of Kerala. In this study the diversity of moths of Wayanad and Kannur part of Kerala have been studied. No compressive studies have been carried out in the diversity of moths of Malabar region of Kerala. This work was an attempt to describe some aspects of biodiversity of moth fauna of Malabar region of Kerala . Further work is necessary for getting a detailed periodic estimate of the faunal diversity of moths.

MATERIALS AND METHODS

Collection of Sphingidae was carried out from different areas of the Malabar region. The collection Sampling of Sphingidae was carried out at each of the collection sites using battery operated light traps specially fitted with switching device to facilitate automatic operation at specified hours (Mathew and Rahamathulla, 1995). The light trap consisted of 12 watts UV tube. An electronic timer was used to switch the UV tube on and off so that trapping carried out at desired hours. The timer was set such that the UV tube in the traps was switched on at 6.30 pm and off at 10.30 pm, ensuring that the trap was operated for a constant period of 4 hours thereby facilitating uniform sampling, each time the trap was operated. In addition to that collection of Sphingidae was carried out during the night time with the help of portable light traps. The insects trapped in the collection chamber of the light-trap were collected on next morning. Besides this, some specimens were collected at night to an illuminated vertical white sheet. (Shamsudeen *et al*, 2005).The sheet method was used, which allows collection of all the specimens individually without any damage. A white cloth sheet (70cm ×55cm) was hung between two vertical poles in such a way that it touched the surface and extended forward over the ground slightly away from direct source of light placed at such a point that the whole sheet from edge to edge brightly reflected the light. A 160 watt mercury vapour lamp was used as a light source through the night. Moths started collecting on the sheet just after sunset between 6.30pm to 10.30pm, after that the abundance of moths slowly declined. The collected moths were killed by using ethyl acetate, pinned, stretched and preserved in airtight insect box, having naphthalene balls as fumigant. The methodology discussed by workers such as Mikkola(1986) as well as by Landry and Landry (1994) was followed for the pinning, stretching and preservation

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of specimens. The standard techniques given by Robinson et *al*. (1994) and Zimmerman (1978) were followed for wings and genitalia respectively. Each specimen was provided with a label indicating the scientific name, locality and date of collection. The specimens were then identified up to species level with the help of identified specimens and available literature by T.R.D Bell and F.B.Scott (1937), and other published literatures. Indices of diversity, species richness and evenness, dominance of moth species were assessed for each month and calculated by using Shanon-Wiener diversity index(1949), Margalef's index (1958) and evenness index (Pielou, 1966) (Magurran,1988) and confirmed with the help a software, PAST (version 3.14; November 2016).

RESULTS

The study was carried out in eight different sites of Malabar Region (Wayand and Kannur) of Kerala between June 2015 to May 2017. In this present study inventory of 267 species of moths (212 identified to species, 55 identified to genus) from 27different families belonging to 10superfamilies have been done. Of these seven species (Six belonging to family Sphingidae and one belonging to family Erebidae are new records to Kerala part of Western Ghats. *Macroglossum assimilis* Swainson 1821,*Macroglossum neotroglodytus* Kitching & Cadiou 2000, *Macroglossum troglodytes* Boisduval 1875, *Rhagastis acuta* Walker 1856, *Theretra silhetensis silhetensis* Walker 1856, *Theretra latreillii lucasii* W.S. MacLeay1827of the family sphingidae and *Asota canaraica, Moore 1878.*of the family Erebidae are the new records. Diversity indices of the 27 different families and diversity indices of the eight study areas were calculated.

Dominance index of eight different sites were calculated and it was seen to be high in Varayal (0.291) followed by Muyyam (0.881) and Kozhummal (0.2398) (fig 1). The dominance indexes of the different families of moths were also calculated. Dominance index was 1 for six moth families and both Pyrasutidae and Bombycidae have the dominance index of 0.5556.For the family Erebidae the dominance index obtained was 0.04(Table 1).Species richness index for eight different sites were calculated using Menhinick and Margalef formula, are given in Table1. Varayal had highest species richness index (4.275). The second highest species richness was seen in Talapuzha (4.087) (fig 1).The Family Erebidae shared the highest species richness (Menhinic – 9.91 Margalef- 24.62) followed by the families Geometridae (5.01, 11.64), Crambidae (4.036, 10.22), and Noctuidae (4.186, 7.233). The least species richness was seen in six families and the species richness was calculated by Menhinic and the value was 1. (Table1)

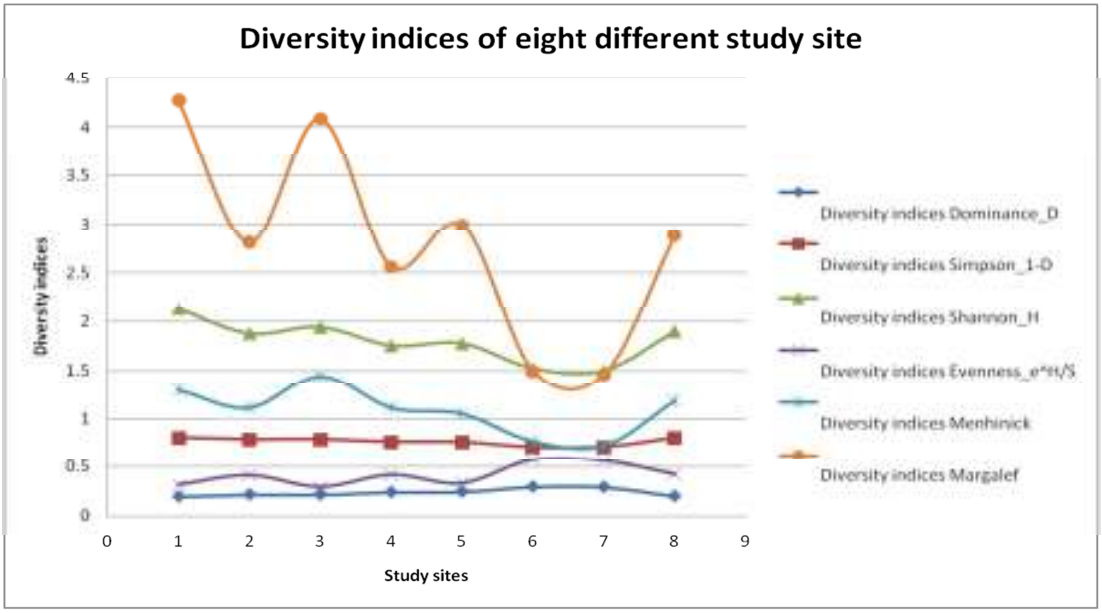

Figure 1: Showing different diversity indices of the eight different study sites.
(Study sites: 1-Varayal, 2-Manandavady campus, 3- Talapuzha, 4- Madaipara, 5- Kozhummal, 6- Morazha, 7- Muyyam, 8- . Sir Syed campus)

Table 1: Diversity indices of all the family represented in this study

Family	Taxa_S	Individuals	Dominance	Simpson_1-D	Shannon	Evenness_e^H/S	Brillouin	Menhinick	Margalef	Equitability J	Fisher alpha	Berger-Parker	Chao - 1
I	5	7	0.2245	0.7755	1.55	0.9421	1.02	1.89	2.056	0.963	7.824	0.2857	6
II	2	2	0.5	0.5	0.6931	1	0.3466	1.414	1.443	1	0	0.5	3
III	2	2	0.5	0.5	0.6931	1	0.3466	1.414	1.443	1	0	0.5	3
IV	1	1	1	0	0	1	0	1	-	-	0	1	1
V	4	7	0.2653	0.7347	1.352	.9661	0.9208	1.512	1.542	0.9751	3.878	0.2857	4
VI	3	6	0.5	0.5	0.8676	0.7937	0.5669	1.225	1.116	0.7897	2.388	0.6667	4
VII	2	2	0.5	0.5	0.6931	1	0.3466	1.414	1.443	1	0	0.5	3
VIII	1	1	1	0	0	1	0	1	-	-	0	1	1
IX	7	11	0.157	0.843	1.894	0.9492	1.339	2.111	2.502	0.9732	8.286	0.1818	7.6
X	2	6	0.5556	0.4444	0.6365	0.9449	0.4513	0.8165	0.5581	0.9183	1.051	0.6667	2
XI	54	179	0.02406	0.9759	3.839	0.861	3.416	4.036	10.22	0.9625	26.26	0.04469	58.5
XII	4	8	0.3438	0.6563	1.213	0.8409	0.8417	1.414	1.443	0.875	3.184	0.5	4.5
XIIII	5	19	0.2244	0.7756	1.548	0.9409	1.259	1.147	1.358	0.9621	2.212	0.3158	5
XIV	2	3	0.5556	0.4444	0.6365	0.9449	0.3662	1.155	0.9102	0.9183	2.633	0.6667	2
XV	4	12	0.4167	0.5833	1.075	0.7326	0.8059	1.155	1.207	0.7755	2.101	0.5833	5
XVI	24	85	0.071	0.929	2.895	0.7535	2.522	2.603	5.177	0.9109	11.13	0.1412	24.6
XVII	3	6	0.5	0.5	0.8676	0.7937	0.5669	1.225	1.116	0.7897	2.388	0.6667	4
XVIII	58	134	0.03141	0.9686	3.788	0.7615	3.262	5.01	11.64	0.9329	38.86	0.1045	71.8
XIX	7	23	0.1871	0.8129	1.797	0.8618	1.459	1.46	1.914	0.9236	3.427	0.3043	7
XX	1	1	1	0	0	1	0	1	-	-	0	1	1
XXI	5	5	0.2	0.8	1.609	1	0.9575	2.236	2.485	1	0	0.2	15
XXII	128.0	330	0.04	1.96	7.98	1.72	6.97	9.91	24.62	1.93	77.25	0.09	147.56
XXIII	29	48	0.06337	0.9366	3.12	0.7807	2.488	4.186	7.233	0.9265	31	0.1875	50.38
XXIV	1	1	1	0	0	1	0	1	-	-	0	1	1
XXV	1	1	1	0	0	1	0	1	-	-	0	1	1
XXVI	1	1	1	0	0	1	0	1	-	-	0	1	1
XXVII	1	1	1	0	0	1	0	1	-	-	0	1	1

(I:Psychidae, II:Tinidae, III: Tortricidae, IV: Cossidae, V : limacodidae, VI :Zyganidae, VII: Thyrididae, VIII: Hybalidae, IX:pyralidae, X:Pyrasutidae, XI:Crambidae, XII:Lasiocampidae, XIII: Eupterotidae, XIV:Bombycidae, XV:Saturnidae, XVI:Sphingidae, XVII:Uranidae, XVIII: Geometridae, XIX: Notodontidae, XX:Eutellidae, XXI:Nolidae, XXII: Erebidae, XXIII: Noctuidae, XXIV:Cosmopterigidae, XXV: Oecophoridae, XXVI: Gelechiidae, XXVII: Pterophoridae.)

Shannon's and Simpson's index of species diversity calculated for eight different sites are given in Fig 1. The diversity was maximum at Varayal (H= 2.13, 1-D=0.807) and minimum at Morazha (H=1.525, 1-D=0.709) and Muyyam (H=1.501, 1-D=0.7119). The second largest diversity was seen in Talapuzha and Sir Syed campus Taliparamba. Simpson and Shannon species diversity of each moth families were also calculated. And both the values were high in the family Erebidae(1.96, 7.98) followed by the families Crambidae (0.9759,3.839), Geometridae (0.9686,3.788), Noctuidae (0.9366,3.12) and Sphingidae (0.929,2.895) and the species diversity was zero for the families Cossidae, Eutellidae, Cosmopterigidae, Oecophoridae ,Gelechiidae and Pterophoridae.(Table 1).

The evenness index for all the families were found to be above 0.80 (Table 1). For 11 families the evenness is 1.This value is higher in family Erebidae (1.72). (Table 1). The evenness of eight different sites was also calculated. It was high at Morazha (0.5732) and Muyyam (0.5609) and the evenness value was least at Talapuzha (0.2905) (Fig 1).

DISCUSSION

All the study sites Erebidae was the dominant family, the species richness and species diversity were high in Erebidae family. This is because the Erebidae is the biggest family of Lepidoptera with 1,760 genera and 24,569 described species (Nieukerken *et al.* 2011) .The members of this family are diversed. The Family Erebidae is currently divided into 18 subfamilies. Majority of the Erebid moths are Polyphagous in nature. This may another reason for its huge diversity. This work was an attempt to describe some aspects of biodiversity of moth fauna of Malabar region of Kerala. Further work is necessary for getting a detailed periodic estimate of the faunal diversity of moths. Most of the species of moths are now in a state of Decline. We should protect them and save them from the verge of extinction.

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