



A Study on Moth Diversity in Three Different Habitats of Maruthamalai Hill, Western Ghats, South India

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ABSTRACT

Lepidopteron (Butterflies and moths) functioning as a dynamics of agricultural and forested ecosystems by serving as decomposers, prey and hosts to carnivores and pollinators. There are two important measures of biodiversity are species richness and abundance of individuals. However, values for these measures require an ecosystem context for insightful interpretation of ecological function. In the current investigation we focused on moth diversity assessment in three habitats of Maruthamalai hill. We examined twelve sites in examined area and nearest Grassland habitat. In the experimental plots Moths specimen were collected by using light trap by using white screen (40 W - UV Lamp) during the study period July 2013 to December 2013. The total abundance and richness of moth species were higher in forest edges (Site-B, 43 species, 2481 individuals) follow by decidus forests (Site-A, 34 species 1783 individuals), and grassland (Site-C, 28 species 1495 individuals) among the sites. Therefore, the species value of diversity indicates a good biodiversity of moth and interaction with their host plants in various ecological conditions and indicating the Maruthamalai hill as a good habitat for moth biodiversity.

KEYWORDS : Maruthamalai Hill, Western Ghats, Biodiversity, Lepidoptera, Moths

INTRODUCTION

The order Lepidoptera comprises with Butterflies and Moths, which are the most common insects of the forest ecosystems and agricultural fields and are often termed as the biological indicators of the ecosystem. Lepidoptera is the second largest and the most diverse order of the class Insecta (Benton, 1995) and a key component of the herbivore assemblage, and the larval stage insect's act as prey for other predators and the lepidopteron species feed primarily on plants and mainly act as pollinators in the ecosystem. Most of the biological researchers have used Lepidoptera as a model organism to assess the impact of human and pollution disturbance and management practices of the forest ecosystems (Willott *et al.*, 2000; Lewis, 2001). In recently scientists estimated to comprise of 1, 74, 250 species, in 126 families and 46 super families in worldwide. In India it is estimated that approximately 12,000 species of moths belongs to 41 families are recorded (Chandra, 2007). Lepidoptera (moths and butterflies) highly depending up on the local vegetation pattern. Climate factor like temperature, humidity, rainfall, wind speed, wind direction al so a very important to survival of the species, and also food requirement. It has been predicted that climatic warming over the course of the next century will cause an increase in global average temperature of between 1.4°C and 5.8°C (IPCC 2007). India, being a vast country with wide contrasts in physical features, climate and vegetation, possesses one of the richest and most varied flora and fauna in the world. The Western Ghats is an area of exceptional biological diversity and conservation interest and are "one of the major tropical evergreen forest regions in India" Lepidoptera are the most diverse order of insects associated primarily with angiosperm plants and with some 160,000 named species, are one of the largest insect orders. Powell (2003) estimated that

the world fauna is certain to exceed 350,000 species. Past thirty years human population was very past development and in many reactions (industries, Co2 releases, CFC releases, pesticides usages urbanization and etc.) flora and fauna populations are threatened by human activities. In these reasons to urgent need of conservation of moth diversity and forest ecosystems. Terrestrial invertebrates are a diverse group of organism they play a key role in the function of many ecosystems. In the present investigation we are concentrated on the lepidopteron- Moth species assemblage's in the Maruthamalai hill, Western Ghats, South India.

MATERIALS AND METHODS

Study Area

Species richness and abundance of the moths were compared among the three experimental sites. The selected sites were located in a Maruthamalai hill, Coimbatore district. The each experimental site was divided in to four locations (East, West, North, South) in three habitats namely Experimental Site-A Decidus forest, Experimental Site-B, Forest Edges, Experimental Site-C, Grassland. The Nilgiri Biosphere Reserve (NBR) is the first biosphere reserve in India Tamil Nadu (2537.6 km²), Kerala (1455.4 km²) and Karnataka (1527.4 km²). The total area of the Nilgiri Biosphere Reserve is 5,520 sq. km. The Western Ghats older than Himalayas is one of the 34 – global hot spots of biodiversity and various endemic flora, fauna was presented in study areas. The Maruthamalai hill, part of southern Western Ghats it is situated at Coimbatore district of Tamil Nadu and the elevation between 76°55' E and 11°0' and 11°5' N. The forest type of this region is dry deciduous forest and shrub forest. Annual rainfall is around 450 mm and temperature in the 17° C to 38° C. The hills occupy the altitudinal range between to 450 to 973 M above MSL. The soil is generally shallow with sandy loam texture.

Study Areas maps



Fig 1. Locations of the study area in Maruthamalai Hill, Western Ghats. Deciduous forest (Site-A), Forest Edges (Site-B) and Grassland, (Site-C)

Method of Sample collection

In the experimental plots Moths specimen were collected by using light trap by using white screen (40 W - UV Lamp) during the study period July 2013 to December 2013. The samples were collected in evening 6 PM to morning 6 AM and the light trap was set as stable automatic mode that is on and off in the time interval system and the samples were collected from morning time. After collection the experimental samples were killed by using insect killing bottle and the samples without damage transported in to the laboratory for the purpose of taxonomical identification. Specimens were identified with the help of fauna of British India hand book and some more species were identified with the help of the entomological scientist. Specimens were pinned and were mounted on the insect setting boards. All the collected experimental specimens were deposited in to the Zoology department museum.

MEASUREMENT OF DIVERSITY

For analysis of between sample diversity it is necessary to use an index. The experimental Sample were analysis Species richness (the total number of species), abundance (total number of individuals), were calculated for sample sites. The statistically analysis was done by Shannon winner index (Shannon's diversity index (H'), this index was commonly used in to analyse the diversity, evenness ($e^{H'/S}$) index, Menhinick, Margalef were calculated by using PAST software package.

RESULT AND DISCUSSION

Among insects, the moths (Lepidoptera) species are economically important primary herbivores in the forest ecosystem and other habitats. They are dissimilar in their habits and adapted to variety of ecological conditions. In the current observation was conducted on moth species of Lepidoptera in the Maruthamalai Hill, Western Ghats. In this study, totally 5759 individuals are belonging to 9 families (Noctuidae, Geometridae, Pyraloidae, Notodontidae, Bombycoidea, Gelechiidae, Epipleniidae, Sphingidae, Saturniidae) Noctuidae, Geometridae, Arctiidae and Notodontidae) and 105 species were observed in three habitats of deciduous forest (Site - A), forest edges (Site - B) and grassland, (Site - C) were shown (Table1; Map 1). The total numbers of moth species were observed and estimated, and the abundance rates were statistically different between the three sites (Fig1 and Table 2).

Table 1. Number of species in three different habitats site-A, site-B and site- C in nine different families

Family	Number of species	Site-A	Site-B	Site-C
Noctuidae	42	16	17	9
Geometridae	28	8	11	9
Pyraloidae	16	7	5	4
Notodontidae	5	1	4	0
Bombycoidea	1	0	0	1
Gelechiidae	1	0	1	0

Table 2. Number of species, individuals and Shannon H index values in three different habitats (Site-A, Site-B and site- C).

	Site-A	Lower	Upper	Site-B	Lower	Upper	Site-C	Lower	Upper
Taxa_S	6	9	9	7	9	9	7	8	9
Individuals	1783	1783	1783	2481	2481	2481	1495	1495	1495
Dominance_D	0.2551	0.2318	0.2515	0.2257	0.2328	0.2491	0.2772	0.2308	0.2525
Shannon_H	1.496	1.587	1.659	1.63	1.593	1.655	1.482	1.585	1.665
Simpson_1-D	0.7449	0.7484	0.7682	0.7743	0.7509	0.7672	0.7228	0.7472	0.7691
Evenness_e ^{H/S}	0.7439	0.5436	0.5884	0.7289	0.5475	0.5823	0.6289	0.5424	0.6217
Menhinick	0.1421	0.2131	0.2131	0.1405	0.1807	0.1807	0.181	0.2069	0.2328
Margalef	0.6679	1.069	1.069	0.7676	1.023	1.023	0.8208	0.9576	1.094

Epipleniidae	3	0	2	1
Sphingidae	6	1	3	2
Saturniidae	3	1	0	2
Total Number of species	105	34	43	28

Site-A, deciduous forest; Site-B, forest edges; Site- C Grassland

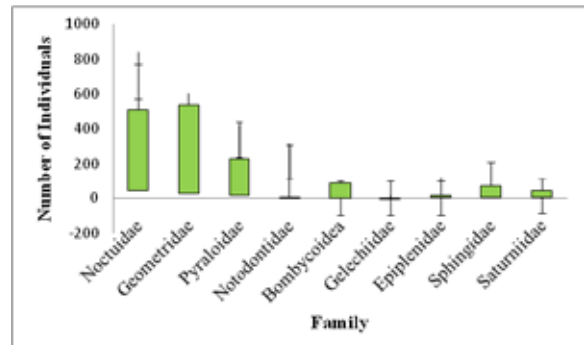


Fig 2. Number of individuals from the three (site-A, site-B and site- C) different study areas during the study period

Site-A, deciduous forest; Site-B, forest edges; Site- C Grassland

The result shows the highest number of moth species (17) belonging to Noctuidae family. Further, the Fisher's alpha diversity index value is higher in grassland (0.951) followed by forest edges (0.8812) and deciduous forest (0.775). Previous research findings revealed that Noctuidae was the predominant family and maximum number of species (Samways 2005). Scriber *et al.* (2014) reported that hybrids of *Papilio canadensis* and *Papilio glaucus* upstate New York emerged 2–4 weeks later than either of their parent species at the same location and skipper populations in Manitoba may have adapted to undergo less in these habitats. The Maruthamalai hills showed the moth species richness value is 10.5 and also calculated Bootstrap value is 9.7034. Also, species evenness values were calculated in the study areas and the site - A showed maximum (0.7439) followed by site-B (0.7289) and site-C (0.6289) at Maruthamalai Hill (Table 2).

Shannon diversity indices also were resulted and reveals the site B comprises with more individual species (1.63) followed by the site A - value (1.496) and least population in site - C (1.482). However, A and C sites almost similar compare to site B. According to Simpson index the moderate population were seen in site B (0.7743) and site A (0.7449) showed lowest value in C (0.7228) and also calculated the dominance_D, Menhinick values Margalef values were found to be increased in site C and Berger parker value was found to be higher in site A when compared to other sites.

Equitability_J	0.8349	0.7226	0.7586	0.8375	0.7258	0.7539	0.7617	0.7216	0.7714
Fisher_alpha	0.775	1.237	1.237	0.8812	1.176	1.176	0.951	1.11	1.273
Berger-Parker	0.3769	0.3303	0.3746	0.3386	0.3333	0.3692	0.3612	0.3251	0.3746

Site-A, deciduous forest; Site-B, forest edges; Site- C Grassland

In the present investigation indicates that, the moths species are useful for ecological and conservation research since most of them are nocturnal fauna and are allowing relatively efficient estimation of geographic patterns of diversity and abundance. In addition, many researchers reported that moths play a vital role in ecological indicators of plant diversity as well as local lands and forests management due to their host-specific (Usher and Keiller 1998; Kitching *et al.*, 2000; Ricketts *et al.*, 2001; Summerville *et al.*, 2004) and they reported that moth indicates the quality of habitat in temperate of agricultural and forests. In this experimental findings concluded that the moth diversity index was found to be higher in site-B. Usher and Keiller (1998) reported that there was no difference among moth communities of coniferous, deciduous, mixed canopy woodlands and forest edges, because moth species feeding on herbaceous plants and not affected forest ecosystems. Moths that favour disturbed sites are often feeding on herbaceous and weedy food plants and they favour undisturbed sites to feed on woody plants, trees or vines. It is difficult to test the relationship between moths and favourable habitats based on host plant due to limited information on larval host plants. In this findings showed the moth assemblages in forests and tropical forests agricultural lands, grasslands could be a good ecological indicator set for addressing habitat quality. According to Stork *et al.* (2003) lepidopteron moth taxonomy from different ecological niches can exhibit variable responses to anthropogenic habitat alteration to the similar abundance patterns. In this current situation habitat fragmentation in some forest landscapes due to human domination. The loss of forest patches in agricultural landscapes in Maruthamali Hill, Western Ghats by forest succession or removal might endanger the species that depends on these type of forest and grassland ecosystems.

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