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Research paper

Diversity & Species richness of Family Geometridae (Lepidoptera: Insecta) in Veerangana Durgavati Wildlife Sanctuary, Damoh, Madhya-Pradesh.

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Abstract: The present study was conducted at Veerangana Durgawati Wildlife Sanctuary (VDWLS) Damoh (M.P.) to evaluate the diversity of Moths (Lepidoptera). During field study, a total of 69 Geometer moth specimens were collected from various localities during different seasons which yielded 8 species and 7 genera under three subfamilies viz., Ennominae, Larentiinae and Sterrhinae. The subfamily Ennominae represented as most diversed group as the Larentiinae and Sterrhinae. The biological diversity was also calculated by using Biodiversity calculator software. Richness (S) is 8, Shannon's diversity (H') is 1.624, Berger-Parker dominance (BP) is 0.435 & Simpson's diversity (D_2) is 0.257.

Keywords: Geometridae, Lepidoptera, Diversity, Moths, Veerangana Durgavati Wildlife Sanctuary, Damoh, Madhya Pradesh.

INTRODUCTION

The family Geometridae is the second most diverse family in the order Lepidoptera. Family Geometridae have been chosen as an important group in a number of environmental studies in tropical regions (Holloway *et al*. 1992, Intachat *et al*., 1997, 1999; Kitching *et al*. 2000, Schulze 2000, Beck *et al*. 2002), but also in Africa (Axmacher *et al*., 2004), and in South America (Brehm, 2002). In spite of this Zheng *et al.* (2018) studied the complete mitochondrial genome of *Biston marginata* (Geometridae), molecular phylogeny of geometridae by L. Murillo-Ramos *et al.* (2019). Globally, the family Geometridae represents 23,002 species and 2002 genera (Van Nieukerken *et al*., 2011) whereas in India, a total of nearly 2041 species under 7 subfamilies were recorded (Kirti *et al*., 2019). This family is the second largest family to the maximum recorded species after family Noctuidae of Lepidoptera (Scoble, 1999). On subfamily Larentiinae J. D. Holloway (1997) published a volume named as 'Moths of Borneo'. In this volume, Holloway described 199 species under 56 genera in which figures and details of their male and female genitalic attributes also published, out of which 37 species & 26 genera were reported from Indian Subcontinent. While

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studying and reviewing the moths fauna of Madhya Pradesh and Chhattisgarh by Chandra and Nema (2007), listed 313 species of moths, which included 34 species of family Geometridae. Moth fauna of Veerangana Durgawati Wildlife Sanctuary was also studied by Chandra and Sambath (2016), who studied 8 species of moths of family Geometridae.

The adult moths of family Geometridae are usually have slender bodies and relatively small to medium-sized with slender bodies and delicate wings (Minet and Scoble, 1999). The fore wings generally broad, often crossed by thin wavy lines. Proboscis usually present or rarely absent and the antennae are thread-like, serrate or bipectinate. Fore wing with vein 1a forming a fork with 1b, 1c absent; vein 5 from or from above middle of the discocellulars, 7 rising from 8, 9. Hind wing with the frenulum usually present, but absent in a few genera; vein 1a very short, apparently absent in some forms; vein 1b running to anal angle; 1c absent; 8 with a well developed precostal spur.

The diversity indices, sometimes referred to as heterogeneity measures, distil the information contained in a species abundance distribution into a single statistic. Heterogeneity measures like nonparametric measures, for example Simpson index, Shannon index, Berger-Parker index, are very useful in measuring biodiversity. (Magurran, 1988). The present study deals with the species diversity at VDWLS by collecting, identifying and measuring the richness (S), Shannon's diversity (H'), Berger-Parker dominance (BP), Simpson's diversity (D_2), and Simpson's evenness (E).

MATERIALS AND METHODS

Study Area: - The study was undertaken in the Veerangana Durgavati Wildlife Sanctuary, Damoh M.P. The wildlife sanctuary is named after, 'Rani Durgavati' ,the famous queen of Gond dynasty, the area now coming under the sanctuary fell under her regime. The sanctuary was created in the year 1996 vide Government of Madhya Pradesh Notification no. F- 14-33-94-(X)-2, dated 6-1-1997. It comes under tehsil Jabera of district Damoh in the forest area of Sangrampur, presents a mosaic of all kinds of habitat. The total area of the sanctuary is 24 Sq.Kms. The sanctuary lies between 23°30'9" and 24°35'N latitudes and between 79°51'0" & 79°51'13"E longitudes (Tiwari, 2003). The topography of Veerangana Durgavati Wildlife Sanctuary is hilly. In VDWLS there are various localities viz. Giridarshan, Sajtalya, Bhaisaghat, Danital, Tilgua, Sangrampur, Chota Chakkar, NidanKund, Kola-Nala etc. (Fig.1)

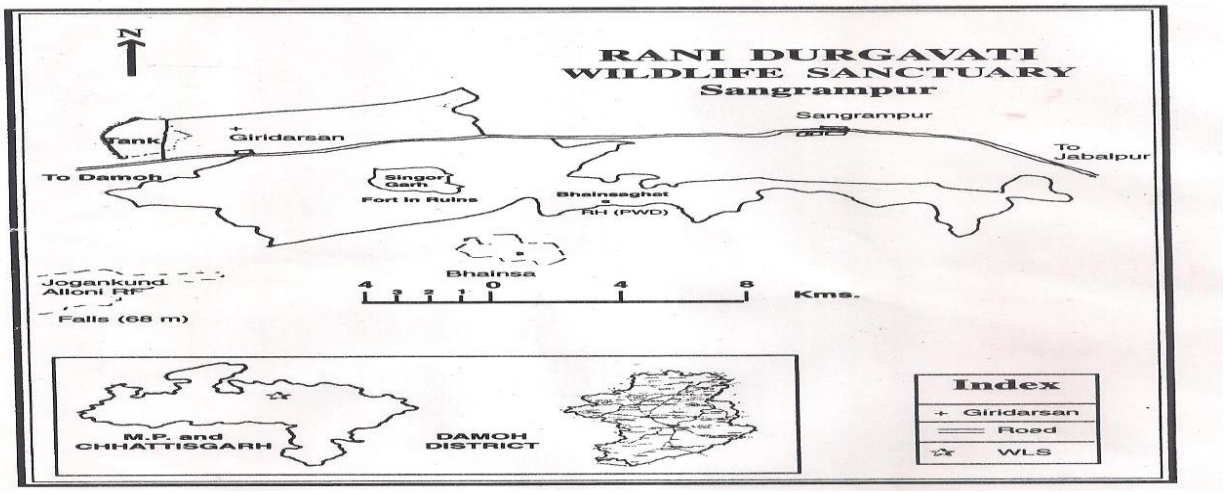

Figure 1. Veerangana Durgavati Wildlife Sanctuary, Damoh: Location.

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Methodology: Majority of moths, being nocturnal, are attracted to light, so that the adults of moths were collected by using the sheet trap, this trap consists of a light source and a big white sheet. The sheet is hung between two trees, with the light (160-watt mercury bulb) placed in front of it. Insects attracted to the lamp will settle on the sheet while others will settle nearby. Make sure the sheet is also spread on the ground to catch insects that fall.

Larger specimens can be taken in a killing jar in small numbers; smaller moths should be collected individually in small glass tubes. After collecting the moths from the field are killed in the killing bottle, which is filled with Benzene vapors as a killing agent. For temporary storage in the field they were kept in the insect envelops with labels and envelops are kept in the ordinary cardboard boxes (Alfred, 2004). Photographs were taken by Nikon coolpicks L120. Male genitalia were also be dissect out and kept in 10% KOH solution for 12 hrs, rinsed in distilled water for several times and then preserved in 70% alcohol (Robinson, 1976).

The identification of moths was made with the help of available traditional taxonomic characters for the group & available literature (Hampson 1895, Common 1990), also by comparing with the reference collection available at Central Zone Regional Centre, Zoological Survey of India (Jabalpur). The current nomenclature used for species identification is based on LEPINDEX (Beccaloni *et al*. 2003).

Statistical Analyses: We calculated richness (S), Shannon's diversity (Shannon and Wiener, 1949), Berger-Parker dominance (Berger and Parker, 1970) & Simpson's diversity (Simpson, 1949) for each group. Abundance was quantified as number of individuals. Shannon–Wiener & Simpson indices are the mathematical equations for the calculation of alpha diversity. Shannon – Wiener index measures the species diversity within the community of an ecosystem. It will be zero if the sample in consideration has only one species and would be maximal when all species of the sample in consideration have even abundances (Sagar and Singh, 1999). Opposite to this, Simpson index measures the strength of dominance and diversity, the value of this index ranges from 0-1; zero represents no dominance or diversity and 1 for maximum dominance and diversity (Simpson, 1949). The diversity indices were also calculated with the help of Biodiversity calculator software.

RESULT & DISCUSSION

The present paper deals with an account of family Geometridae of VDWLS, Damoh. During field surveys there are 69 specimens of family Geometridae were collected and identified. Which belongs to three subfamilies. 6 species to 5 genera of subfamily Ennominae, 1 species to 1 genus each of subfamilies Larentinae and Sterrhinae. Altogether 69 specimens belonging to 8 species under 7 genera and 3 subfamilies were studied and recorded from the Sanctuary. (Table 1)

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Table: 1 Checklist of Geometrid moth species of VDWLS.

S. No.	Superfamily	Family	Subfamily	Name of the Species
1	Geometroidea Leach, 1815	Geometridae Leach, 1815	Ennominae Duponchel, 1845	*Ascotis selenaria* [Denis & Schiffer-muller], 1775
2				*Biston suppressaria* Guen'ee, [1858]
3				*Hyposidra talaca* Walker, F., 1860
4				*Petelia delostigma* Prout, 1932
5				*Petelia medardaria* Herrich-Schaffer, [1856]
6				*Chiasmia eleonora* Cramer, [1780]
7			Larentiinae Duponchel, 1845	*Hydrelia ornata* Moore, 1868
8			Sterrhinae Meyrick, 1892	*Antitrygodes cunceilinea* Walker, (1863)

The maximum number of species is recorded in the subfamily Ennominae (75%) followed by Sterrhinae (13%) Larentiinae (12%). (Fig.2)

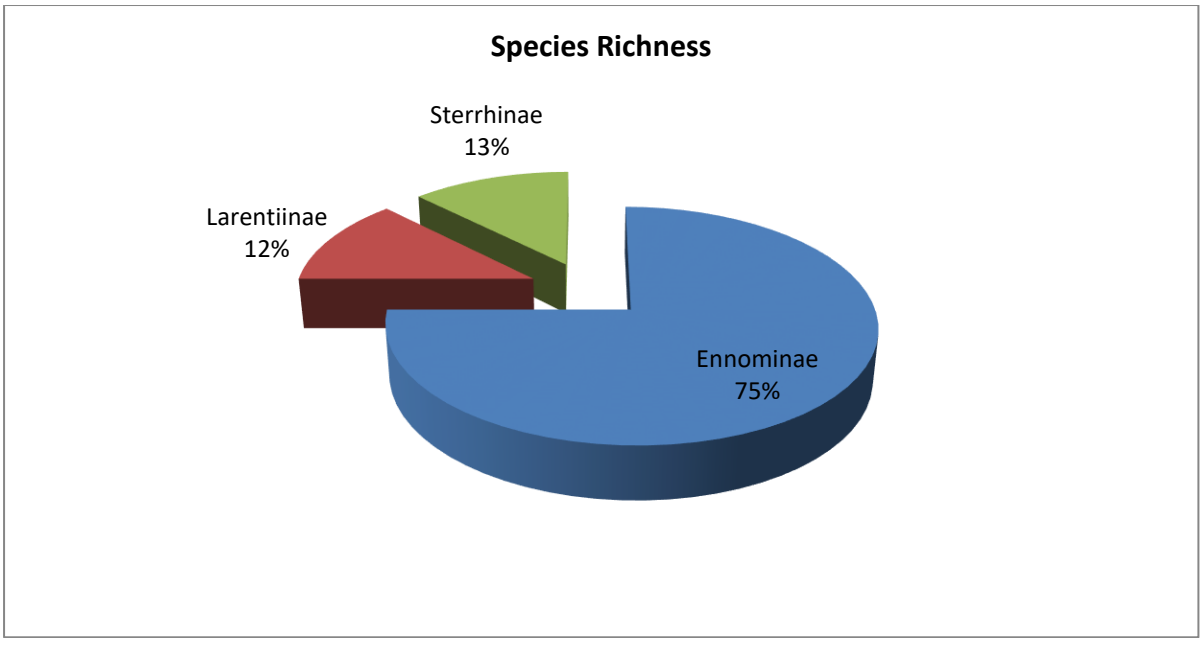

Figure 2. Species Richness among different subfamilies of Geometridae in VDWS

Diversity index enables the researcher to describe the moth fauna mathematically and to compare their diversity between different habitats. Species diversity, in essence, has always been defined by the indices to measure it (Peet, 1974).
Richness (S) is 8, Shannon's diversity (H') is 1.624, Berger-Parker dominance (BP) is

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0.435 & Simpson's diversity (D_2) is 0.257, which shows a very good diversity in VDWLS. (Fig.3).

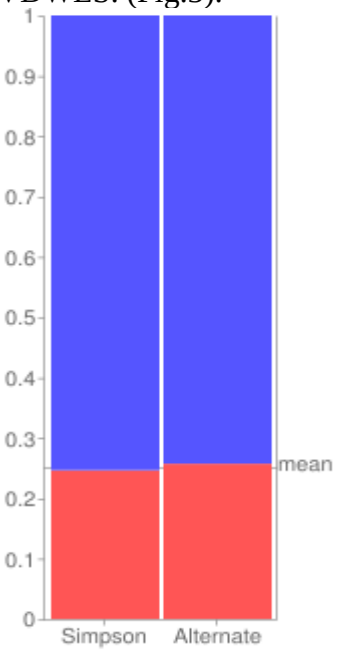

Figure 3. Simpson's diversity of VDWLS of family Geometridae

Simpson index (1-D) ranges between 0 to 1 denotes that the greater the value, the greater the moth diversity. So, according to the Simpson index value (0.257) the Sanctuary show very good diversity. Shannon diversity index was used for calculating the diversity of sampling sites of the sanctuary taking into account the number of individuals as well as number of taxa. Shannon diversity index varies from 0 for communities with only a single taxon to high values for communities with many taxa; Shannon values vary between 1.3 and 3.5 and may exceeds 4.0. Thus the sanctuary exhibit 1.624 Shannon's diversity (H') value which shows the great diversity of family geometridae. Berger-Parker index calculate the proportional importance of the most abundant type. Its equals the maximum pi value in the dataset of sample. This corresponds to the weighted generalized mean of the pi values when q approaches infinity and hence equals the inverse of true diversity of order infinity. So the Berger-Parker dominance (BP) index is 0.435, the reciprocal of the index, 1/d, is generally used, thus an increase in the value of the index accompanies an increase in species diversity and a reduction in dominance. It shows the high dominance in the sanctuary. The *Antitrygodes cunceilinea* (Walker) is a very abundant species throughout the sanctuay. (Fig.4)

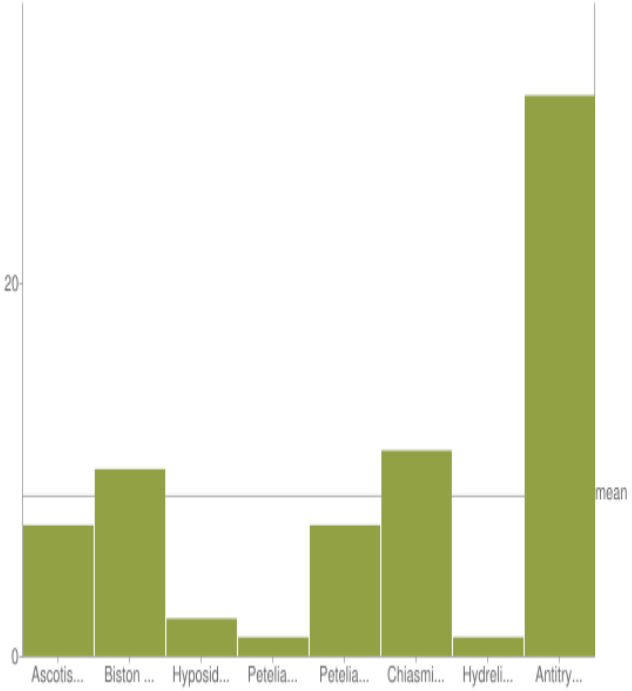

Figure 4. Species Diversity of Family Geometridae in VDWLS

Moths are closely associated to plants in the form of pollinators & herbivores; hence the rich flora of VDWLS is a reason of richness of Moth species. The study area represents the mosaic of different habitats which help in supporting high diversity of flora so as moth fauna. In Veerangana Durgavati Wild life Sanctuary there are mixed jungle with teak as the dominant tree, this may another reason for its huge diversity. The rich biodiversity of moth fauna of family geometridae of Veerangana Durgavati Wild life sanctuary is mainly due to rich vegetation and play a greater role for the existence of moth fauna of family geometridae in a particular community as it provides main source of

food and shelter for their survivorship. Overall, the moth fauna of family geometridae of VDWLS is highly diverse but some species are only uncommonly encountered. The results from this study can be used to make decisions on the conservation of natural resources management especially for Moth diversity of family Geometridae.

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