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Butterfly diversity of Gangulpara, Balaghat, Madhya Pradesh

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Abstract

Butterflies are important bio indicators of the ecosystem. To document the relative abundance, local status, and seasonal occurrence of butterflies, the present work was carried out in the Gangulpara, Balaghat. In the present study, a total of 37 species of butterflies belonging to 5 families have been recorded during the study period. Out of 37 species, 8.1% of species include rare and 21.62% of species that include uncommon are important species and required conservation at Gangulpara. The family dominated over the other recorded family is Nymphalidae with the highest percentage (57%).

Keywords: Butterfly diversity, balaghat, bio indicator, Gangulpara

Introduction

Butterflies are beautiful and fascinating creatures of nature. Along with moths, they belong to the order Lepidoptera of the class Insect. Worldwide, there are more than 28,000 species of butterflies, with about 80 percent in tropical regions. The Indian subcontinent bearing a diverse terrain climate and vegetation hosts about 1,504 species of butterflies (Tiple, 2011) [15]. The butterfly plays an important role in ecosystems, acting as a pollinator, a food source, and a bio indicator of the ecosystem (Ghazanfar *et al.*, 2016) [5]. As a bio indicator of the ecosystem, butterflies can sense the slightest alteration in an ecosystem. They are highly sensitive to changes in temperature, microclimate, humidity, and luminosity level of their habitat (Ehrlich *et al.*, 1964; Kremen, 1993) [3, 7]. There is a co-evolutionary relationship between butterflies and plants (Ehrlich and Raven, 1964) [3]. These insects tell us everything about the healthier ecosystem. They have different requirements for different habitat types for mating, breeding, and nectarine and are, thus, in sync with the diversity and quality of their habitats (Harsh, 2014) [6]. They show extreme susceptibility towards habitat deterioration like changes in vegetation structure, microclimate, and co-occurrence of vegetation types at a local scale.

In the central region of India, the Balaghat district of M.P. is known for its maximum forest density, ecological values and biological diversity. More than 75% of the area of district is covered with forest. It is dominated by typical deciduous forests which include Ain, Kino, Mahua, Sal, Sagwan, Tendu, and good-quality bamboo. This area is broadly covered by three types of soils (black cotton soils, sandy loam & lateritic soil). The faunal diversity of Balaghat forest includes many species of *Amphibia*, reptiles, mammals, birds, insects, butterflies, dragonflies as well as spiders. There is no published checklist of butterflies from the Balaghat district, the present study was conducted at Gangulpara of Balaghat district which is known for its natural beauty.

Materials and Methods**Study area**

Surveys of butterflies were conducted within a 3 km radius of the Gangulpara waterfall. It is located in Balaghat tehsil of Balaghat district in Madhya Pradesh, India. It is located 16 km towards the East of District headquarters Balaghat. Geographically, the area lies between 21°54'09N, and 80°16'01E. In the present study area, major types of vegetation included grasslands, wetlands, open scrub forests, dry deciduous forests, and bamboo groves. The present study was conducted in 10 transects (200 to 600 m long) covering an area of 2.60 square kilometres. For the present study, transects were divided into four habitats according to general landscape attributes and vegetation present there.

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Survey and identification of butterflies

The survey of butterflies was done throughout four major seasons (summer, monsoon, autumn, and winter). Pollard Walk Protocols were used for butterfly samplings (Pollard and Yates, 1995) [11]. The survey was done from 7:30 am to 12:30 pm in order to spot maximum butterflies. Ten transects were covered mostly during cloudless and sunny weather. Collecting live specimens was avoided during the study. Colour patterns, sizes, and shapes, as well as their designs, were considered in the identification of the species of butterfly. The identification of butterflies was done using field guides; Butterflies of India by Isaac Kehimkar. Butterfly Identifies Mobile Application; Biodiversity Atlas India was also used for the identification and preparation of a checklist of Butterflies. Nikon 5700D, Lens 70-300 mm, was used for photography of butterflies. Drone camera DJI Mavic 3 was used for mapping and monitoring of the study site. The host plants, nectar plants, food resources, and other factors affecting butterfly diversity were also recorded during the study period.

Data analysis

In the present study of butterflies, their taxonomic classification was done by following the standard method of Isaac Kehimkar (2016). During the study period, the calculation of the relative abundance (RA) of each butterfly species was done. Obtained relative abundance (RA) values were examined under four categories (Rare; $RA \leq 0.5$, Uncommon; $RA > 0.5$ to 1.5 , Common; $RA > 1.5$ to 3.5 and Very Common; $RA > 3.5$). Rank abundance plot was obtained from the log-transformed value of the total individual counts of each species of butterfly. For the comparison of butterfly species variation seasonal index was calculated by using the following formula: Seasonal index (SI) = No. of Species identified in season/ Total No. of species. Measures of diversity; Simpson's dominance index (D), Mechanic's Index (D_{mn}), and Margoles's richness index (D_{mg}), were computed for analysis of the diversity of butterflies for the present study area.



Fig 1: The geographical location of the study area (Image: Google earth) (Catchment area indicated in yellow dotted lines)



Fig 2: Drone view of Study Area

Results

In the present study sites, habitat heterogeneity and rich vegetation cover encourage the abundance of butterflies. In the present study, 37 species of butterflies belonging to 5 families have been recorded. In total, 759 individual butterflies have been observed in Gagulpara. A checklist of butterflies with their families, their relative abundance, Seasonal Occurrence, and their local status are given in Table 2. Plate 1 and Plate 2 show photographs of the reported butterflies from the study area. Out of 5 families, Family Nymphalidae consisted the highest number of species (57%), followed by Pieridae (16%), Papilionidae (13%), Lycaenidae (11%), and Hesperidae (3%). The Fig. 3 pie chart shows the percentage no. of species recorded in 5 different families. Obtained Rank abundance plot (Fig.4) represented in a gentle

curve showing even distribution pattern of butterflies in the present study area. Out of 37 species, 3 species were recorded as rare, 8 species were uncommon, 22 as common, and 4 species are very common. Butterfly species namely *Junonia Lemonade vaisya*, *Danaus chrysippus*, *Eurema hecabe*, and *Phalanta* recorded as very common. On the other side, rare butterflies namely *Pachliopta aristolochiae*, *Papilio polymnestor*, and *Arhopala curiosa* constituted 9.09% of the total individuals. The Fig. 5 graph shows the seasonal index which indicates the temporal changes in the butterfly diversity of different species in the present study area. Table 1 shows the value of different diversity Indexes calculated for butterflies' diversity for the present study area.

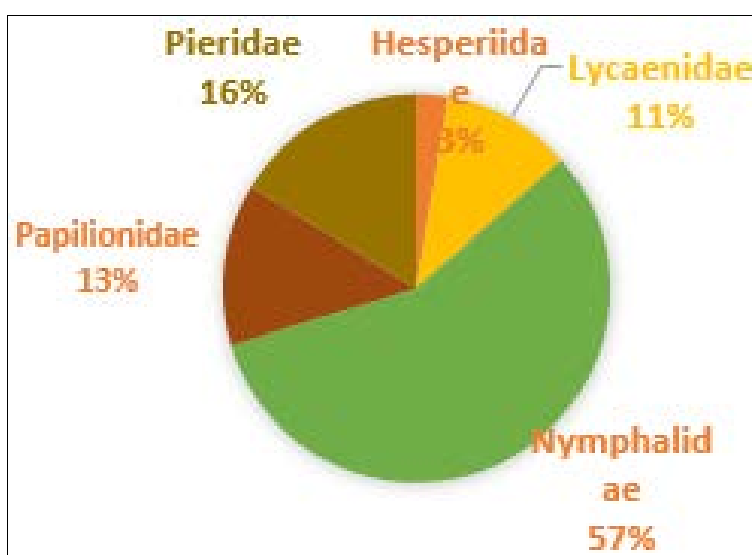


Fig 3: Abundance of butterfly's family -

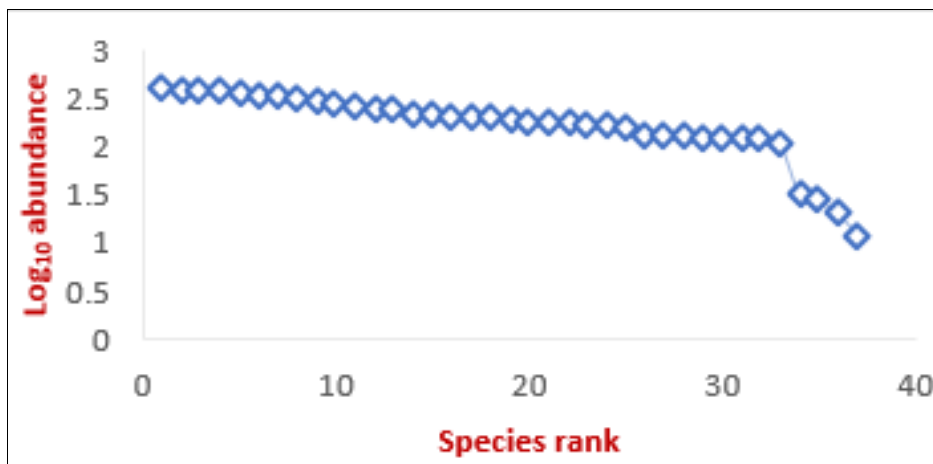


Fig 4: Rank abundance plot

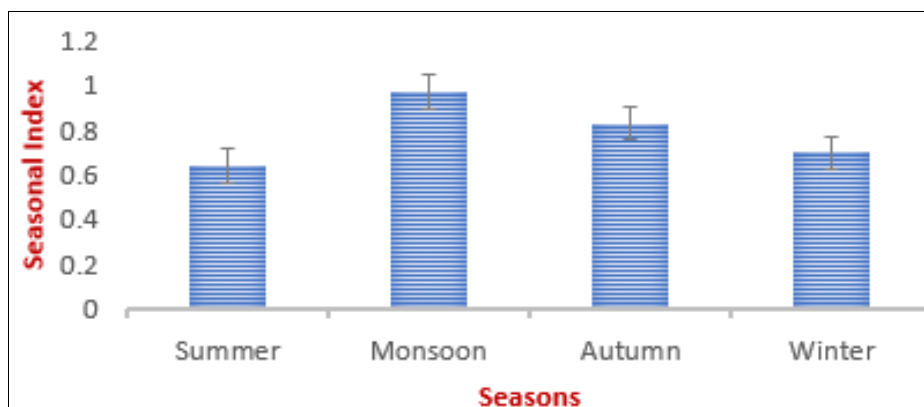


Fig 5: Seasonal Index

Table 1: Diversity measures

Diversity measures	Index
Simpson's dominance index (D)	0.331
Margoles's richness index (D _{mg})	7.34
Mechanic's Index (D _{mn})	1.3

Table 2: List of butterfly species with their conservation status, relative abundance, and Seasonal Occurrence

S.N.	Common Name	Scientific Name	Family	Local Status	Relative abundance	Seasonal Occurrence
1	Lemon Pansy	<i>Junonia Lemonade vaisya</i>	<i>Nymphalidae</i>	VC	3.9	S, M, A, W
2	Baronet	<i>Euthalia nais</i>	<i>Nymphalidae</i>	C	1.3	S, M, A, W
3	Grey Pansy	<i>Junonia atlites</i>	<i>Nymphalidae</i>	C	2.1	S, M, A, W
4	Common Sailer	<i>Neptis hylas astola</i>	<i>Nymphalidae</i>	C	2.2	S, M, A, W
5	Tawny Coster	<i>Acraea terpsicore</i>	<i>Nymphalidae</i>	C	2.8	S, M, A, W
6	Plain Tiger	<i>Danaus chrysippus</i>	<i>Nymphalidae</i>	VC	3.8	S, M, A, W
7	Chocolate Pansy	<i>Junonia iphita</i>	<i>Nymphalidae</i>	UC	1.2	S, M, A, W
8	Common vagrant	<i>Catopsilia florella</i>	<i>Pieridae</i>	UC	0.29	M
9	Common grass yellow	<i>Eurema hecabe</i>	<i>Pieridae</i>	VC	4.23	S, M, A, W
10	Mottled Emigrant	<i>Catopsilia pyranthe</i>	<i>Pieridae</i>	C	1.66	S, M, A
11	Spot Swordtail	<i>Graphium nomius</i>	<i>Papilionidae</i>	C	1.8	S, M, A
12	Common Indian Crow	<i>Euploea core</i>	<i>Nymphalidae</i>	C	2.6	S, M, A, W
13	Lime Butterfly	<i>Papilio demoleus</i>	<i>Papilionidae</i>	C	1.89	S, M, A
14	Short Banded Sailer	<i>Neptis columella</i>	<i>Nymphalidae</i>	C	2.1	S, M, A
15	Danaid Eggfly	<i>Hypolimnas misippus</i>	<i>Nymphalidae</i>	C	3.1	S, M, A, W
16	Common Rose	<i>Pachliopta aristolochiae</i>	<i>Papilionidae</i>	R	0.12	S,A
17	Common Emigrant	<i>Catopsilia</i>	<i>Pieridae</i>	C	3.26	S, M, A, W
18	Blue Tiger	<i>Trimula limniace</i>	<i>Nymphalidae</i>	C	3.7	S, M, A, W
19	Common Leopard	<i>Phalanta</i>	<i>Nymphalidae</i>	VC	3.9	S, M, A, W
20	Common Jezebel	<i>Delias eucharis</i>	<i>Pieridae</i>	C	1.6	S, M, A, W
21	Tailed Jay	<i>Graphium agammenon</i>	<i>Papilionidae</i>	UC	1.1	S, M, A, W
22	Great Eggfly	<i>Hypolimnas bolina</i>	<i>Nymphalidae</i>	C	1.7	S, M, A, W
23	Blue Pansy	<i>Junonia orithya</i>	<i>Nymphalidae</i>	C	1.2	S, M, A

24	Commander	<i>Moduza procris</i>	<i>Nymphalidae</i>	C	2.2	S, M, A, W
25	Common tree brown	<i>Lethe rohria</i>	<i>Nymphalidae</i>	UC	1.8	S, M, A
26	Bamboo tree brown	<i>Lethe europa</i>	<i>Nymphalidae</i>	C	2.3	S, M, A, W
27	Spotless Grass Yellow	<i>Eurema laeta</i>	<i>Pieridae</i>	UC	1.3	M,W,A
28	Indian Skipper	<i>Spialia galba</i>	<i>Hesperiidae</i>	UC	1.2	M,W
29	Long-brand Bush brown	<i>Mycalesis visala</i>	<i>Nymphalidae</i>	C	2.9	S,M,W
30	Common Evening Brown	<i>Melanitis leda</i>	<i>Nymphalidae</i>	C	3.4	S, M, A, W
31	Blue Mormon	<i>Papilio polymnestor</i>	<i>Papilionidae</i>	R	0.2	S, M, A, W
32	Angled Sunbeam	<i>Curetis acuta</i>	<i>Lycaenidae</i>	UC	1.2	S, M
33	Bhutan Oak blue	<i>Arhopala curiosa</i>	<i>Lycaenidae</i>	R	0.3	M
34	Common Baron	<i>Euthalia aconthea</i>	<i>Nymphalidae</i>	C	2.1	S, M, A, W
35	Tiny grass blue	<i>Zizula hylax</i>	<i>Lycaenidae</i>	C	2.3	S, M, A, W
36	Dingy bush brown	<i>Mycalesis perseus</i>	<i>Nymphalidae</i>	C	1.8	S, M, A, W
37	Indian Purple Leaf Blue	<i>Amblypodia anita dina</i>	<i>Lycaenidae</i>	UN	1.3	M



Plate 1: (1. a Lemon pansy, 1.b Baronet, 1.c Grey pansy, 1.d Common sailer, 1.e Plain tiger, 1.f Tawan coster, 1.g Chocolate pansy, 1.h Spot Swordtail, 1.i Common Indian crow, 1.j Lime butterfly, 1.k Short banded sailer, 1.l Great eggfly)



Plate 2 (2. a Danid eggfly, 2.b Common jezebel, 2.c Common leopard, 2.d Great eggfly, 2.e Blue pansy, 2.f Tailed jay, 2.g Common grass yellow, 2.h Spotless grass yellow, 2.i Common Emigrant, 2.j Commander, 2.k Common rose, 2.l Long brand Bush brown)

Discussion

This is the first investigation that gives preliminary data on butterfly diversity of Gagulpara, Balaghat. Gagulpara is one of the most important ecotourism sites in the Balaghat district, but it received the least attention from conservation planners and managers. The present study emphasizes the significance of the mosaic and variegated vegetation of Gagulpara in sustaining a rich diversity of butterflies. The area under study is dominated by different host plant species of butterflies which includes *Lantana camara* (Tick –berry), *Cassia tora* (Charota), *Alstonia scholaris* (Devil tree), *Lessingianthus elegans* (*Vernonia elegans*), West Indian Jasmine (*Ixora sp*), Curry tree (*Murraya koenigii*), White sky flower (*Duranta repens*).

About 8.1% of species that include rare and 21.62% of species that include uncommon are important species and required conservation at Gagulpara. In the present butterfly survey, Nymphalidae Family acquires of the highest number of species (57%), which is dominant over other families. In the support of the present study, many researchers in central India (Barsagade *et al.*, 2019; Patil *et al.*, 2014; Tiple *et al.*, 2011) also documented the dominance of Nymphalidae over other families. Over the total recorded family's occurrence of the highest percentage, Nymphalidae might be due to the presence of large wing span rendering them powerful and active flights flies and also their polyphagous nature significantly help them to survive easily (Majumder *et al.*, 2012; Subedi *et al.*, 2021) [9, 13].

The present investigation revealed the highest seasonal index in monsoon followed by summer it may be because of less availability of host plants as well as an increase in humidity and temperature. In India, the abundance of foliage cover and vegetation density is being promoted by the monsoon which profoundly influences the seasonal occurrence of variation of butterflies (Wynter-Blyth, 1957) [17]. The high rainfalls stimulate the growth of young tender leaves does provide a better quality of food in ample amounts for butterfly larvae resulting in a peak abundance of butterflies during monsoon (Kunte, 1997; Sengupta *et al.*, 2014) [8, 12]. As compared to records published by the forest department Balaghat the species richness of butterflies of Gagulpara Balaghat is also very high. The study area has lower species richness in comparison to known records of 63 species recorded in Balaghat, studies on butterflies in central India were conducted by Chandra *et al.* (2007) [2], where the authors published a checklist of butterflies of Madhya Pradesh and Chhattisgarh based on first-hand records and literature. Over 174 species were recorded in the two-state by the author, of which 63 were recorded in Balaghat and 65 in Mandla (Chandra *et al.*, 2007) [2].

Conclusion

The present study provides initial data about the butterfly diversity of Gagulpara, Balaghat. Out of 37 recorded butterfly species, the Nymphalidae family shows maximum and the Hesperidae family shows minimum diversity. However, the

present study is the first investigation on the butterfly diversity in Gagulpara and future monitoring and research is required to observe for any change in the species composition of butterfly diversity. This work will be helpful for further details research on butterfly fauna, and their seasonal distribution. The present study will also help to recognize the potential threats to butterfly diversity. Thus the present work concluded that Gagulpara is rich in butterfly diversity, and holds the potential for butterfly eco-tourism.

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