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A preliminary study on the diversity of butterflies in Rongo Forest, West Bengal, India

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Abstract
A preliminary survey was conducted on the butterfly diversity in Rongo Forest, West Bengal, India from 17th –20th, April, 2024. A total of 31 species belonging to 27 genera under 5 family was recorded. Out of these 31 species, the butterflies belonging to the family Nymphalidae were the most dominant (51.61%) followed by Papilionidae (19.35%), Pieridae (12.90%), Lycaenidae (9.67%) and Hesperiidae (6.45%). It was also observed that 26 butterfly species prefer woodland and forest habitat, 23 Shrubby and grassland habitat,15 prefer riverine and forest habitat. The present study also records 5 butterflies that were classed as threatened, 3 as vulnerable, 1 endangered and the remaining 22 are classed as least concerned or not evaluated. The butterfly *Pieris canidia* was found to be the most common species observed in all the three selected habitats with R.A. of 37.68%, 30.61% and 24.49% in the riverine and forest area, Shrubby and grassland area & woodland and forest area respectively. The butterfly diversity recorded during the present study is being reported here for the first time from Rongo Forest area.

Keywords: Butterfly species diversity, Rongo forest, West Bengal, India

Introduction
Butterflies belong to the order Lepidoptera (derived from the Greek word lepido means scales and ptera means wings). The butterfly diversity is uneven throughout the world. Butterflies are one of the major components of biodiversity since they act as good pollinators, indicators of environmental changes as they are sensitive to slightest changes in the climate or even temperature and also they act as source of food [18, 23, 25]. Till date there are approximately about 20,000 known species of butterflies [15, 19]. The Indian subcontinent has about 1504 species where West Bengal represents 452 species [5, 7, 24]. Some parts of West Bengal are still unexplored in terms of butterfly diversity, especially the northern parts. Rongo is a village at the foothill of eastern Himalaya beside Jaldhaka river at the elevation of 450 ft. and is situated at India-Bhutan border in the Kalimpong district of West Bengal, India [3]. Rongo is mainly a rural area with 77.67% of the population living in rural areas and the remaining 22.23% living in urban areas [6]. The forest of Rongo has a number of hills and many small streams with large number of exotic and native ornamental and medicinal plants [3] which helps in enhancing floral diversity and also is beneficial to the native butterflies. Earlier no literatures have been found documenting butterfly diversity from Rongo Forest. Hence, to fulfil this lacuna a study was conducted about the butterfly diversity of Rongo Forest.
The present study is the first report from the Rongo Forest region documenting not only the butterfly diversity but also provides some knowledge on the distribution, diversity, and status of butterflies in this region.

Material and methods
1. Study area and sampling site
The present study was conducted in three selected places of Rongo forest (27.0435°N 88.8335°E) situated in the Gorubathan CD block in the Kalimpong Sadar subdivision of the Kalimpong district in the state of West Bengal, India (Fig 1). The forest of Rongo village is extended to the south-eastern flank of the Neora Valley national park on the valley of river Jaldhaka and is composed of high level of floral and faunal biodiversity [3]. The study was conducted in the month of April and the climate was moderately cold with occasional rainfall in the daytime. Average daytime temperature was around 16-20°C and the night-time temperature was as low as 10-14°C. The month of April was appropriate for visit since the temperature did not fluctuate much and there were occasionally showers of rain, and the availability of butterflies was much more after rainfall. The study area was a hilly region with several bushy trees, numerous shrubs and a waterfall which turns the region into a dense forest. Three sampling sites were chosen for the documentation of butterflies (Fig1-4). The three chosen places are: Site A-riverine and forest area (Jal Dhaka river and surrounding area with GPS Coordinates 27.0423625, 88.8350469 2RRP+W2V), Site B: woodland and forest area (forest area of the Rongo forest and waterfall with 27.0423625, 88.8350469 2RRQ+Q7M), and Site C: shrubby and grassland (plain grassland area of Rongo forest and waterfall with 27.0423625, 88.8350469 2RRP+H6R).

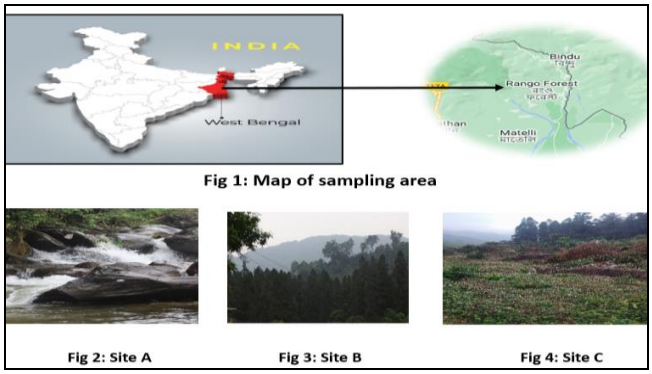

Fig 1: Map of sampling area

Fig 2: Site A

Fig 3: Site B

Fig 4: Site C

2. Survey method
The present survey was conducted in for 4 days from 17th April to 20th April between 7 to 10 am and again between 2-

4 pm. The butterflies were observed using different sampling techniques such as Pollard walk method, Direct searching method and Time Constrained method at the above mentioned sampling sites [14, 21, 22].

3. Identification and documentation

The images of butterflies were photographed using Canon EOS 700D DSLR camera. The wing size, colour, pattern were the parameters of identification of butterfly species were identified using the following standard literatures [8, 10, 11, 20] and also consulting the website of Butterflies of India [12].

4. Statistical data analysis

During the present study the community structure of the butterfly species were analyzed in terms of relative abundance (R.A.) and different other diversity indices *viz*. Shannon diversity index, Simpson's dominance index, Evenness index using the Microsoft Word version 2010. All these biodiversity indices were analyzed by using formula adopted by Ashok ,2017 [1], Karan *et al*. 2023 [9] and Kumar *et al*. 2016 [10].

Result

A total number of 31 species of butterflies under 27 genera belonging to 5 families were recorded and identified from three different selected sites of the Rongo hill range with a total population count of 659 (Table 1&2; Figures 5). Of these 31 butterfly species, 2 butterfly species belonged to the family Hesperiidae, 3 belonged to Lycaenidae, 16 to Nymphalidae, 6 to Papilionidae, and 4 to Pieridae. Out of 659 total count of butterflies species recorded during the present study, 199(R.A. = 30.19%) were found in site-1, 266 (R.A. = 40.36%) in site-2 and 196(R.A. = 29.74%) in site-3. *Pieris canidia* was the most common species found in these three sites with a total number of 200(R.A. = 30.34%) as shown in Table. 2 & 3. Population size of species like *Appias lalage Lalage*, *Danaus genutia*, *Hypolimnas Bolinas* were moderate in number 90 (R.A. = 13.65%), 76(R.A. = 11.53%),47(R.A. = 7.13%) respectively in three sites (Table. 2). While total number count of *Graphium macareus*, *Lethe confusa aurelius* and *Anthene emolus* were each 7(R.A. = 1.06%) accounting least in number respectively in the three sites (Table. 2). During the present study the butterfly species *Neptis hylas*, *Stibochiona nicea* and *Ypthima baldus* was recorded only from the Woodland forest while the species *Heliophorus epicles*, *Byasa latreillei*, *Acraea issoria* was recorded from the Shrubby & grassland area (Table. 2). Most of the species (26 species) were recorded at site 2. The Simpsons diversity index (D´), Shannon diversity index (H´), evenness of the site were 0.88, 2.48 and 0.76 respectively (Table. 3). The maximum value of D´ was recorded from woodland forest (0.88), followed by shrubby grassland (0.84) and riverine area (0.8) as shown in (Table. 3). The present study also documented the checklist of these butterflies with their diversity and distribution along with their Status as show in Table 1.

Table 1: Checklist of butterfly species with their distribution and status at 3 sampling sites of Rongo Forest, Kalingpong.

Sl. No.	Family	Scientific name	Distribution in India	Status
1	Hesperiidae	*Telicota bambusae* (Moore, 1878)	Assam and peninsular india	Not evaluated
		Celaenorrhinus dhanada (Moore, [1866])	Kakaijana pt1 assam, Jammu region of J&K	Near threatened
2	Lycaenidae	*Anthene emolus* (Godart, [1824])	Northwestern Himalayas, Sikkim, assam, Bengal, orissa, bihar, Uttarakhand.	Threatened
		Heliophorus brahma (Moore, [1858])	Many states in India	Lacking status and distribution
		Heliophorus epicles (Godart, [1824])	Sikkim, Assam, Andaman	Vulnerable
3	Nymphalidae	*Ypthima baldus* (Fabricius, 1775)	Dooars region and gorumara national park	Endangered
		Stibochiona nicea (Gray, 1846)	East Kashmir, Himachal, Uttarakhand, Nepal, Sikkim, the northern part of west Bengal.	Vulnerable and near threatened
		Melanitis leda (Linnaeus, 1758)	Throughout India except the extreme northwest region	Least concern
		Junonia iphita (Cramer, 1779)	Tamil Nadu, Kerala, Andhra Pradesh, West Bengal	Not evaluated
		Aglais caschmirensis aesis (Fruhstorfer, 1912)	Himalayas, Shimla east to Arunachal pradesh	Threatened species
		Lethe confuse Aurivillius, 1897	Andaman and Nicobar islands, Andhra Pradesh, Arunachal Pradesh, assam, bihar, etc.	Threatened
		Lethe verma (Kollar, [1844])	Northern indiaupto assam, and in the pains	Least concern
		Acraea Issoria (Hübner, [1819])	Himalayan foothills	Not evaluated
		Phaedyma columella (Cramer, [1780])	Southern West Bengal, Jharkhand, Chhattisgarh, Madhya Pradesh, southeast Gujrat, northern Tamil Nadu, Kerala	Not evaluated
		Danaus chrysippus (Linnaeus, 1758)	Almost everywhere	Least concern
		Danaus genutia (Cramer, [1779])	Himachal Pradesh, Jammu and Kashmir UT, Jharkhand, Karnataka	Least concern
		Hypolimnas bolina (Linnaeus, 1758)	Throughout India	Near threatened
		Euploea core (Cramer, [1780])	All over India	Least concern
		Neorina hilda Westwood, 1850	Sikkim and assam	Vulnerable, rare and extremely local
		Neptis hylas (Linnaeus, 1758)	Throughout continental India	Under creation/ not evaluated
		Ariadne ariadne (Linnaeus, 1763)	Some parts of india	Not evaluated
4	Papilionidae	*Graphium Agamemnon* (Linnaeus, 1758)	Southern India to Saurashtra, northern India (Kumaon to Assam)	Not threatened

		Papilio helenus Linnaeus, 1758	Western ghats, north and northeast India	Slightly threatened
		Papilio polytes Linnaeus, 1758	Almost everywhere	Least Concern
		Byasa polyeuctes (Doubleday, 1842)	Tamil nadu, maharastra, Gujrat, Andhra Pradesh, Madhya Pradesh, and karnataka	Near threatened
		Graphium macareus (Godart, 1819)	Assam, Sikkim, Arunachal Pradesh	Not threatened
		Byasa latreillei (Donovan, 1826)	Uttarakhand, Sikkim, Assam, Meghalaya, Nagaland, Manipur	Least concern
5	Pieridae	*Pieris canidia* (Linnaeus, 1768)	Sub-Himalayan India, assam and upper Myanmar.	Not evaluated
		Appias lalage Lalage (Doubleday, 1842)	Assam, Arunachal Pradesh, Meghalaya, Nagaland, Sikkim, West Bengal, Maharashtra, goa etc.	Threatened
		Eurema sp. Hübner, [1819]	Northwestern part of India.	……..
		Ixias Marianne s(Cramer, [1779])	Plains and lowlands of peninsular India.	Least concern

Table 2: Species diversity, richness, evenness and abundance recorded for butterfly fauna of the three selected sites of Rongo forest, Kalimpong.

Sl. no.	Sites	Simpsons diversity index (D´)	Shannon Weiner diversity index (H´)	Evenness (E)	Species Richness	Total no of individuals	Average population size
1	Riverine area	0.8	2.0	0.74	15	199	13.3
2	Woodland forest	0.88	2.48	0.76	26	266	10.2
3	Shrubby grassland	0.84	2.27	0.71	24	196	8.17

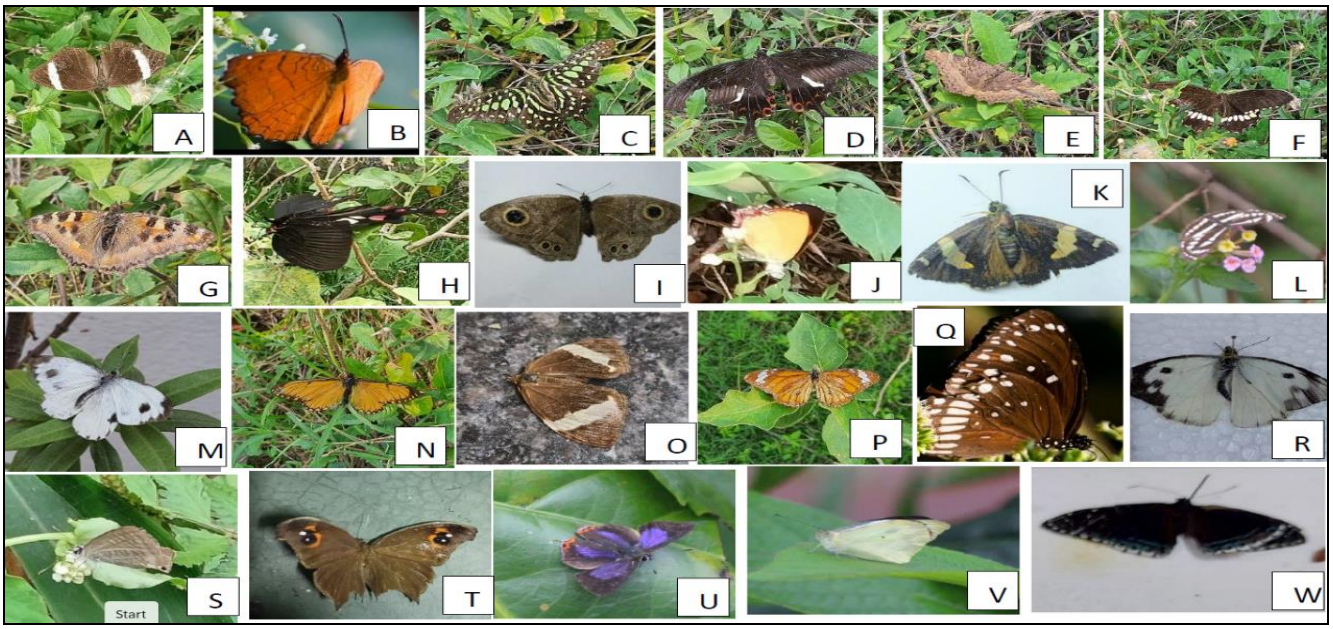

Fig 5: Pictures of some butterflies observed in Rongo forest, Kalimpong A. *Lethe confusa* , B. *Ariadne arisdne* , C. *Graphiumagamemnon* , D. *Papilio helenus* , E. *Junoniaiphita* , F. *Papilio polytes* , G. *Aglaiscaschmirensisaesis* , H. *Byasapolyeuctes*, I. *Ypthimabaldus* , J. *Heliophorusepicles* , K. *Celaenorrhinus Dhanada* , L. *Phaedyma columella* , M. *Pieris canidia* , N. *Acraea issoria* , O. *Lethe verma* , P. *Danaus genutia* , Q. *Euploea core*, R. *Appiaslalage Lalage*, S. *Anthenedefinta*, T. *Melanitisleda* , U. *Antheneemolus*, V. *Eurema sp.* W. *Stibochionanicea*

Table 3: Distribution of Butterfly fauna recorded from the three selected sites of Rongo Forest, Kaling pong

Sl.no.	Species	Riverine and forest area		Woodland and forest area		Shrubby and grassland area	
		Total no. of individual	Relative abundance (%)	Total no. of individual	Relative abundance (%)	Total no. of individual	Relative abundance (%)
1	*Acraea issoria* (Hübner, [1819])	0	-	0	-	4	2.04
2	*Aglais caschmirensis aesis* (Fruhstorfer, 1912)	1	0.51	2	0.75	0	-
3	*Anthene emolus*(Godart, [1824])	2	1.01	1	0.38	4	2.04
4	*Appias lalage lalage*(Doubleday, 1842)	35	17.58	20	7.51	35	17.86
5	*Ariadne ariadne* (Linnaeus, 1763)	0	-	1	0.38	1	0.51
6	*Byasa latreillei*(Donovan, 1826)	0	-	0	-	2	1.02
7	*Byasa polyeuctes*(Doubleday, 1842)	0	-	3	1.12	1	0.51
8	*Celaenorrhinus dhanada*(Moore, [1866])	0	-	3	1.12	2	1.02
9	*Danaus chrysippus*(Linnaeus, 1758)	13	6.52	6	2.25	2	1.02
10	*Danaus genutia*(Cramer, [1779])	0	-	40	15.04	36	18.38
11	*Euploea core*(Cramer, [1780])	12	6.03	4	1.50	2	1.02
12	*Eurema sp.* Hübner, [1819]	18	9.05	17	6.39	0	-

13	*Graphium agamemnon*(Linnaeus, 1758)	0	-	12	4.51	8	4.08
14	*Graphium macareus* (Godart, 1819)	2	1.01	4	1.5	1	0.51
15	*Heliophorus brahma* (Moore, [1858])	0	-	1	0.38	1	0.51
16	*Heliophorus epicles*(Godart, [1824])	0	-	0	-	6	3.06
17	*Hypolimnas bolina* (Linnaeus, 1758)	0	-	45	16.92	2	1.02
18	*Ixias marianne*(Cramer, [1779])	3	1.51	1	0.38	0	-
19	*Junonia iphita*(Cramer, 1779)	0	-	3	1.12	7	3.57
20	*Lethe confuse* Aurivillius, 1897	2	1.00	4	1.50	1	0.51
21	*Lethe verma* (Kollar, [1844])	4	2.01	4	1.50	1	0.51
22	*Melanitis leda*(Linnaeus, 1758)	20	10.05	1	0.38	0	-
23	*Neorina hilda* Westwood, 1850	0	-	1	0.38	1	0.51
24	*Neptis hylas* (Linnaeus, 1758)	0	-	6	2.25	0	-
25	*Papilio helenus* Linnaeus, 1758	7	3.52	11	4.13	0	-
26	*Papilio polytes* Linnaeus, 1758	2	1.01	0	-	4	2.04
27	*Phaedyma columella*(Cramer, [1780])	0	-	7	2.63	5	2.55
28	*Pieris canidia* (Linnaeus, 1768)	75	37.68	65	24.49	60	30.61
29	*Stibochiona nicea*(Gray, 1846)	0	-	3	1.12	0	-
30	*Telicota bambusae*(Moore, 1878)	3	1.51	0	-	8	4.08
31	*Ypthima baldus*(Fabricius, 1775)	0	-	1	0.38	0	-

Discussion

A total of 31 species under 27 genera of butterflies belonging to 5 families were documented during the present study from the three different selected sites of Rongo hill range. The checklist of butterfly species, their distribution in India, Status as well as other details are provided in the table 1.

The present study provides a preliminary outline about the butterfly fauna of Rongo forest (Table 1&2; Fig.5). It was also observed that the butterflies belonging to the family Nymphalidae (n=16, 51.61%) is the most abundant followed by the family Papilionidae (n=6,19.35%) Pieridae (n=4, 12.90%) and Lycaenidae (n=3,9.67%) taking the place in between and Hesperiidae (n=2, 6.45%) being the less rich family observed.

Thus the family Nymphalidae found to be the most the dominant one during the present study and this result is also supported by the reports of earlier workers from different parts of West Bengal as well as India [2 ,4, 10, 13, 16, 17].

The present study on butterfly diversity from three different selected sites of Rongo Forest could provide helpful literature to the future researchers on the detailed study of biology, ecology and conservation of butterflies in the said region.

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