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Preliminary study on butterfly diversity in Jamdoba village of Chhatna block, Bankura district and its adjoining areas in Purulia district, West Bengal

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Abstract
Butterflies are ecological indicators that provide multiple ecosystem services. The current study was conducted to assess the diversity and abundance of butterfly community of Jamdoba village of Chhatna Block, Bankura district and four other adjoining selected study sites situated in Purulia district, West Bengal. A total of 56 butterfly species belonging to five different families were recorded from the study site. Percentage composition revealed that the number of butterflies belong to Nymphalidae family were found maximum (45.18%) followed by the family Lycaenidae (41.96%), Papilionidae (7.14%), Pieridae (4.46%), Hesperiidae (1.25%). Based on the sightings of butterflies at the study site, it was found that 76.96% of the total counted butterflies belonged to very common category, followed by 14.46% to common category, 6.43% to fairly common category and 2.14% to uncommon category. Among the documented butterfly species, six were found to be protected under various schedules of Wildlife Protection Act, 1972. Values of diversity indices such as Shannon diversity index (H'=3.50) signified the high species richness, Pielou's evenness index (j=0.87) illustrated the evenly distributed nature of the butterfly community while, Simpson's index of diversity (D=0.96) depicted the persistence of high species abundance in the sampled butterfly community. Among the five recorded families, the values of H' and D was found higher in the family Nymphalidae which illustrates this family dominates the study area. High species richness and abundance of the butterfly community in the study sites might be due to presence of different varieties herbs, shrubs and trees. Further studies are needed in the nearby regions of badland terrain. The present preliminary survey-based information will be beneficial for future studies which ultimately provide an insight for adopting necessary conservation strategies to restore this laterite terrain habitat.

Keywords: Butterfly community, diversity indices, Jamdoba, Nymphalidae, species richness

Introduction

Butterflies are fascinating creatures belonging to the order Lepidoptera. Thes beautiful insects provide a variety of ecosystem services which facilitate the smooth functioning of an ecosystem. Butterfly species are dependent on a variety of host plants therefore any place with abundant butterflies is a result of the ample floral diversity (Mukherjee *et al*., 2023) [16]. They signify the overall health status of an ecosystem and are therefore considered as one of the most efficient bioindicators (Pollard, 1991) [22]. Hence, studies on butterfly diversity and abundance have been considered as a crucial aspect of ecology and conservation studies (Watt and Boggs, 2003; Ehrlich and Hanski, 2004) [30, 10]. They are especially sensitive to any changes in climatic conditions like changes in temperature, moisture or light levels and are promptly affected by any slight disturbances or alteration in habitat health (Anu *et al*., 2009; Tiple *et al*., 2011) [1, 28]. Thus, studies on butterfly diversity and abundance are quite essential, as it gives us an idea of the ecosystem status and thereby enables us to adopt strategies, if necessary, in order to promote ecological restoration.

Approximately 18,000 butterflies have been reported worldwide and around 1500 have been reported from India (Singh, 2011) [26]. However, during last few decades, habitat structure and function has been greatly modified by anthropogenic activities and sudden changes in climatic conditions which also had a negative impact on the butterfly community (Clark *et al*., 2007; Di Mauro *et al*., 2007) [5, 8]. Therefore, studies focused on butterfly diversity and abundance provides us a better understanding regarding the detrimental effects of urbanization on butterfly community as well as on the various components of ecosystem. Prior documentation on butterfly community has been conducted in several regions of West Bengal which include studies on butterfly diversity and abundance in Howrah district by Dwari and Mondal (2015) [9], in Nadia district by Dey and Ghosh (2016) [6], in Bolpur Shantiniketan urban area by Kamar (2022) [13], in Midnapore urban area by Biswas *et al*. (2019) [3], in heterogeneous habitat of Bankura by Mukherjee and Mondal (2020) [17], in Ajodhya Hills of Purulia by Mukherjee *et al*. (2023) [16] etc.

Purulia and Bankura districts lie on the westernmost part of West Bengal. Over the years, deforestation and urbanization has led to the creation of barren lands in both the districts. In order to restore the functionality of the land and implement indigenous agricultural practices, many organic farms were established in Jamdoba village. These farms were situated on the westernmost fringes of the rarh region of West Bengal, in the Purulia-Bankura border. Previously covered by dense forests and inhabited by tribal communities, this region is an arid expanse composed of red soil and weathered bedrock etched by Chota Nagpur plateau. Indigenous tree species such as palash (*Butea monosperma*), mahua (*Madhuca longifolia*) are abundant along with teak, sal, neem, banyan and peepal which are scattered across the area. Several fruit trees including mango, java plum and jackfruit are also found in this area.

The current study was conducted to assess the diversity and abundance of butterfly community in Jamdoba village of Chhatna Block, Bankura district and four other adjoining selected study sites which includes Darakeswar, Barsighat,

Banerjee bandh and mica mines, situated in Purulia district, West Bengal. As no prior studies have been conducted at the selected study sites, the data obtained from this preliminary survey-based study will prove to be beneficial for all future studies and will also be useful in adopting conservation strategies for habitat restoration, if necessary.

Materials and Methods

Study Area

The study was conducted in selected study sites in Jamdoba village (23.3757°N, 86.83686°E) of Chhatna Block, Bankura district and its adjoining areas which includes Darakewar, Barsighat, Banerjee Bandh and Mica Mines, situated in Purulia district, West Bengal, India. The study area experiences tropical savanna climate. Temperature reaches more than 40°C in summer and around 10°C in winter. The south-west monsoon winds act as the principal source of rainfall and the annual rainfall varies between 1100 mm to 1500 mm.

Survey technique

For the collection of data surveys were carried out in the month of March, 2025, on sunny days (08:00 h to 12:00 h and 16:00 h to 17:30 h), in the designated study areas. Pollard Walk method was implemented (Pollard *et al*., 1975; Pollard 1977) [20, 21]. Observations were primarily made through naked eyes or with the help of photographs and binocular. The line transect method was implemented for the purpose of butterfly sampling (Hossain and Aditya, 2016) [12]. The observed butterflies were recorded along with their number during the sampling period. Maximum butterfly species were identified via direct observation in the field or in few cases, photographs were clicked for the same purpose. Identification was carried out by following the keys of Kunte *et al*. (2014) [15], Kehimkar (2016) [14] and Dey *et al*. (2017) [7]. During the survey period, the butterflies were neither collected nor captured. The common English names and scientific names followed in the study are in compliance with Varshney and Smetacek (2015) [29].

Statistical data Analysis

To understand the community structure of the butterfly species in the sampled site, all the recorded data were used to estimate the diversity indices with the help of Microsoft Excel 2019 software. Species richness, abundance and evenness were determined through Shannon index (Shannon and Weaver, 1963) [23], Simpson index (Simpson, 1964) [25] and Pielou's index (Mulder *et al*., 2004) [18] respectively. To explain species richness and evenness a rank abundance curve was prepared (Whittaker, 1965) [31].

Shannon diversity index (H') = $- \Sigma$ pi ln pi

Shannon $H_{max} = Log_1 (N)$

Dominance index (D_{BP})= ni/N (Berger and Parker, 1970) [2]

Simpson's diversity index (Ds)= Σ^{S}_{i-1}[ni (ni-1)/N(N-1)]

Simpson's index of diversity (D)= $1-\Sigma^{S}_{i-1}$[ni (ni-1)/N(N-1)]

Simpson's reciprocal index (Dr)= $1/ \Sigma^{S}_{i}$ pi^2

Pielou's evenness index (J') = H'/ln N

Here, pi is the proportion of the i^{th} species in the butterfly community. N is the number of species present in a butterfly fauna. ni is the number of individuals of i^{th} species

Results

The map of India, West Bengal, Bankura and Purulia districts showing the study sites are all represented in figure 1. A checklist of butterfly species that were recorded during the survey period have been illustrated in table 1, along with their scientific name, their family, relative abundance and WPA Schedules (Wildlife Protection Act, 1972). A total number of 56 butterfly species belonging to 38 genera and 5 different families were documented from the study site. Among the 56-butterfly species, 9 of them belonged to family Papilionidae, 24 belonged to family Nymphalidae, 13 belonged to family Lycaenidae, 7 belonged to family Pieridae whereas only 3 species belonged to family Hesperiidae. While considering the relative abundance of the various butterfly species, observed at the study site, it was found that Common five-ring (*Ypthima baldus*; RA=10.18) was the most abundant butterfly, followed by Forget-me-not (*Catochrysops strabo*; RA=8.04), Tawny Coster (*Acraea terpsicore*; RA=7.50). Relative abundance of 26 butterfly species ranged from 4 to 1 and the remaining butterfly species had relative abundance less than 1.

Figure 2 illustrates the percentage composition of five butterfly families that were observed at the study site. Analysis of percentage composition revealed that family Nymphalidae had the maximum value constituting 45.18% of the total counted butterflies, followed by family Lycaenidae (41.96%), Papilionidae (7.14%), Pieridae (4.46%), Hesperiidae (1.25%).

Analysis of genus proportion composition of the studied butterfly community revealed that maximum number of genera were recorded from the family Nymphalidae (39.47%), followed by Lycaenidae (31.58%), Pieridae (13.16%), whereas families Papilionidae and Hesperiidae were both comprised of 7.89% of the total recorded genus. Results of species proportion analysis illustrated that maximum number of butterfly species belonged to the family Nymphalidae (42.86%), followed by Lycaenidae (23.21%), Papilionidae (16.07%), Pieridae (12.50%) and lastly Hesperiidae (5.36%) (figure 3).

The butterflies recorded from the selected study sites were categorized into four categories based on their prevalence, namely very common (VC), common (C), fairly common (FC) and uncommon (UC). The study revealed that 76.96% of the total counted butterflies belonged to VC category, followed by 14.46% which belonged to C category, 6.43% belonged to FC category whereas 2.14% belonged to UC category (figure 4).

Figure 5 depicts the species richness of various butterfly genera that were recorded from the study site. It was found that genus *Papilio* of the Papilionidae family was the dominant genera, comprised of 6 species namely, *Papilio polytes*, *Papilio clytia*, *Papilio helenus*, *Papilio nephelus*, *Papilio xuthus* and *Papilio polymnestor*. Under Nymphalidae family, genera *Junonia* and *Ypthima* were comprised of three species each namely, *Junonia atlites*, *Junonia lemonias* and *Junonia iphita*under *Junonia*, *Ypthima asterope*, *Ypthima huebneri* and *Ypthima baldus*under *Ypthima*. Genus *Graphium* under the family Papilionidae, genera *Euploea*, *Ariadne*, *Danaus*, *Melanitis*, *Acraea* under the Nymphaidae family, genus *Zizina* under Lycaenidae family and genera *Catopsilia* and *Appias* under Pieridae family were all comprised of 2 species. The remaining 26 genera were found to have only 1 species each. Species genus ratio was 1.47 in the current study.

The butterfly species sampled at the study areas were mostly 'common' and 'generalist' species and none of them were universally threatened according to IUCN Red List (Ver.

3.1). Only six butterfly species observed at the study site, were found to be protected under various schedules of Wildlife Protection Act, 1972. Among these butterfly species, Common Mime (*Papilio clytia*) and Mottled Argus (*Callerebia narasingha*) are protected under Schedule I, Pea Blue (*Lampides boeticus*) and Common Albatross (*Appias albino*) are protected under Schedule II whereas Blue Crow (*Euploea mulciber*) and Striped Albatross (*Appias libythea*) are protected under Schedule IV.

Table 2 depicts the species diversity and evenness of the butterfly community of the study sites which were expressed by means of diversity indices like Shannon diversity index (H'), Pielou's evenness index (j), Simpson's diversity index (Ds) and Simpson's index of diversity (D). The Shannon diversity index (H') value (3.50) signified that the species richness and diversity of the butterfly fauna at the sampled sites were very high. The abundance of the butterfly community was evaluated by means of Simpson's index (Ds) whose value was found to be more inclined towards 0 thus, indicating the prevalence of high species abundance within the butterfly community. While, the value of Simpson's index of diversity (D=0.96) illustrated that the surveyed butterfly community had high abundance. The value of Pielou's evenness index (j=0.87) was close to 1 which depicted the existence of more evenness among the butterfly species of the studied butterfly community. All these values therefore expressed the butterfly community was highly diverse along with high abundance and high evenness, thus implying the community was in the direction of an ideal natural community.

Table 3 illustrates the family-wise values of various biodiversity indices, such as Shannon diversity index (H'), Shannon H_{max}, Pielou's evenness index (j), Simpson's index (Ds), Simpson's index of diversity (D) and Simpson's reciprocal index (Dr). Shannon diversity index (H') value of the recorded five butterfly families ranged from 2.58 to 1.0. In this case, the family Nymphalidae (2.58) was noted with the highest value as the maximum number of species were recorded from this family, followed by Lycaenidae (2.42), Papilionidae (1.77), Pieridae (1.62) whereas, the least value was observed from the Hesperiidae family. Moreover, the highest value of Shannon H_{max} was obtained from the family Nymphalidae (2.40), followed by Lycaenidae (2.37), Papilionidae (1.60), Pieridae (1.40), Hesperiidae (0.85). The values of Pielou's evenness index (j) determine whether the species in a community are evenly distributed or not. This value was found to be highest in case of Lycaenidae (0.94), followed by Hesperiidae (0.91), Pieridae (0.83), Nymphalidae (0.81) and lastly Papilionidae (0.80). Simpson's index of diversity (D) revealed the abundance of species in a community. Its value was recorded higher for the family Lycaenidae (0.90), Nymphalidae (0.89), Papilionidae (0.80), Pieridae (0.79). Again, the value of Simpson's reciprocal index (Dr) indicated a higher diversity of butterfly from the family Lycaenidae (9.90).

Figure 6 illustrated the Whittaker plot i.e., species-wise rank abundance curve that explains the species abundance with evenness and the family-wise rank abundance curve that illustrates the species abundance and evenness among the five families. The Whittaker plot's curve depicted a steep inclination up to the first nine butterfly species that were recorded in the surveyed areas. This nine-butterfly species occurred in high abundance and with less evenness in comparison to the remaining species. Species rank eleven onwards the abundance of the observed butterfly species were found to decrease accordingly with increased evenness among the sampled species of the study areas.

While considering the family-wise rank abundance curve, it was clearly observed that more evenness was in family Lycaenidae, followed by the family Hesperiidae, Pieridae, Nymphalidae, whereas, the families Papilionidae showed relatively less evenness (figure 7).

Table 1: Checklist of butterfly species along with their family, relative abundance, status and WPA Schedule recorded in study site.

Sl. No.	Family	Common Name	Scientific name	Relative Abundance (RA)	Status	WPA Schedule
1	Papilionidae	Common Mormon	*Papilio polytes*	1.61	C	
2		Common Mime	*Papilio clytia*	0.54	FC	Schedule I
3		Red Helen	*Papilio helenus*	0.18	UC	
4		Yellow Helen	*Papilio nephelus*	0.18	UC	
5		Asian Swallowtail	*Papilio xuthus*	0.18	UC	
6		Blue Mormon	*Papilio polymnestor*	0.54	FC	
7		Common Rose	*Pachliopta aristolochiae*	2.50	VC	
8		Common Jay	*Graphium doson*	0.18	UC	
9		Tailed Jay	*Graphium agamemnon*	1.25	C	
10	Nymphalidae	Common Crow	*Euploea core*	2.32	VC	
11		Blue Crow	*Euploea mulciber*	0.36	FC	Schedule IV
12		Common Castor	*Ariadne merione*	4.46	VC	
13		Angled Castor	*Ariadne ariadne*	1.79	VC	
14		Great Eggfly	*Hypolimnas bolina*	1.96	VC	
15		Plain Tiger	*Danaus chrysippus*	0.36	FC	
16		Striped Tiger	*Danaus genutia*	0.18	UC	
17		Common Evening Brown	*Melanitis leda*	1.79	VC	
18		Dark Evening Brown	*Melanitis phedima*	0.54	FC	
19		Commander	*Moduza procris*	0.18	UC	
20		Common Bush Brown	*Mycalesis perseus*	1.25	C	
21		Common Baron	*Euthalia aconthea*	0.36	FC	
22		Common Sailer	*Neptis hylas*	0.18	UC	
23		Common three-ring	*Ypthima asterope*	2.32	VC	
24		Common four-ring	*Ypthima huebneri*	3.93	VC	
25		Common five-ring	*Ypthima baldus*	10.18	VC	
26		Mottled Argus	*Callerebia narasingha*	1.61	C	Schedule I

27		Grey Pansy	*Junonia atlites*	0.54	FC	
28		Lemon Pansy	*Junonia lemonias*	0.54	FC	
29		Chocolate Pansy	*Junonia iphita*	0.89	C	
30		Common Leopard	*Phalanta phalantha*	1.25	C	
31		Tawny Coster	*Acraea terpsicore*	7.50	VC	
32		Yellow Coster	*Acraea issoria*	0.54	FC	
33		Baronet	*Symphaedra nais*	0.18	UC	
34	Lycaenidae	Forget-me-not	*Catochrysops Strabo*	8.04	VC	
35		Common Pierrot	*Castalius rosimon*	0.89	C	
36		Zebra Blue	*Leptotes plinius*	1.25	C	
37		Common Cerulean	*Jamides celeno*	3.21	VC	
38		Plains Cupid	*Chilades pandava*	2.68	VC	
39		Common Grass Blue	*Zizina labradus*	2.86	VC	
40		Indian Lesser Grass Blue	*Zizina otis indica*	4.82	VC	
41		Dark Grass Blue	*Zizeeria karsandra*	2.50	VC	
42		Pea Blue	*Lampides boeticus*	2.50	VC	Schedule II
43		Pale Grass Blue	*Pseudozizeeria maha*	4.46	VC	
44		Hedge Blue	*Acytolepis puspa*	1.61	C	
45		Common Ciliate Blue	*Anthene emolus*	2.68	VC	
46		Tiny Grass Blue	*Zizula hylax*	4.46	VC	
47	Pieridae	Common Emigrant	*Catopsilia Pomona*	1.25	C	
48		Mottled Emigrant	*Catopsilia pyranthe*	0.54	FC	
49		Common Albatross	*Appias albino*	0.18	UC	Schedule II
50		Striped Albatross	*Appias libythea*	0.18	UC	Schedule IV
51		Common Grass Yellow	*Eurema hecabe*	1.61	C	
52		Common Wanderer	*Pareronia valeria*	0.18	UC	
53		Psyche	*Leptosia nina*	0.54	FC	
54	Hesperiidae	Dark Palm Dart	*Telicota bambusae*	0.54	FC	
55		Indian Palm Bob	*Suastus gremius*	0.54	FC	
56		Grass Demon	*Udaspes folus*	0.18	UC	

UC (uncommon=1 individual recorded; minimum abundance), FC (fairly common=2-3), C (common=4-9) and VC (very common=10-96) to indicate the rarest to the most common butterfly species (Sing, 2017) [27]. WPA- Species enlisted in Indian Wildlife Protection Act, 1972.

Table 2: Values of different biodiversity indices of butterfly population of the study area

Shannon diversity index (H')	Pielou's evenness index (j)	Simpson's index (Ds)	Simpson's index of diversity (D)
3.50	0.87	0.04	0.96

Table 3: Values of different biodiversity indices of five butterfly families of the study area

Family	Shannon diversity index (H')	Shannon H_{max}	Pielou's evenness index (j)	Simpson's index (Ds)	Simpson's index of diversity (D)	Simpson's reciprocal index (Dr)
Papilionidae	1.77	1.60	0.80	0.20	0.80	4.60
Nymphalidae	2.58	2.40	0.81	0.11	0.89	9.10
Lycaenidae	2.42	2.37	0.94	0.10	0.90	9.90
Pieridae	1.62	1.40	0.83	0.21	0.79	4.14
Hesperiidae	1.00	0.85	0.91	0.29	0.71	2.58

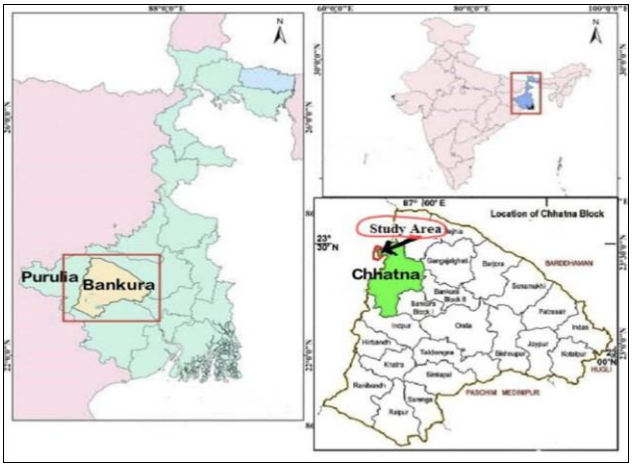

Fig 1: Map of West Bengal (left one), India (right upper one), Bankura (right down one) showing the study area.

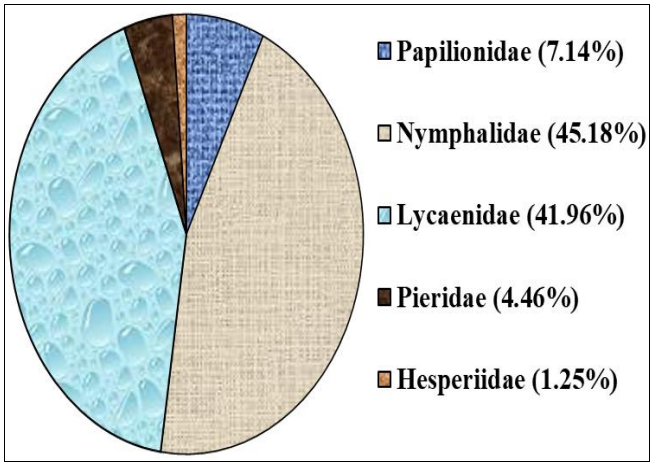

Fig 2: Percentage composition of five families of butterflies in the study area

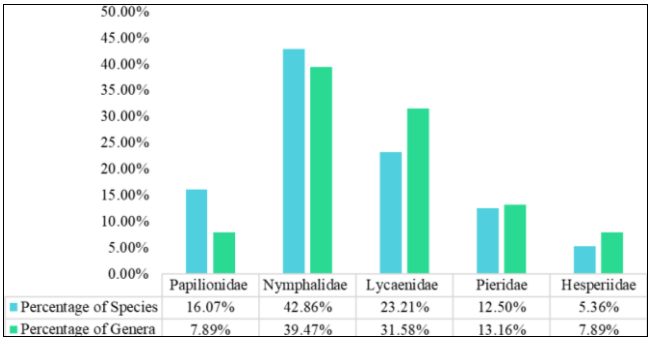

Fig 3: Genus to species proportion of butterflies of five families.

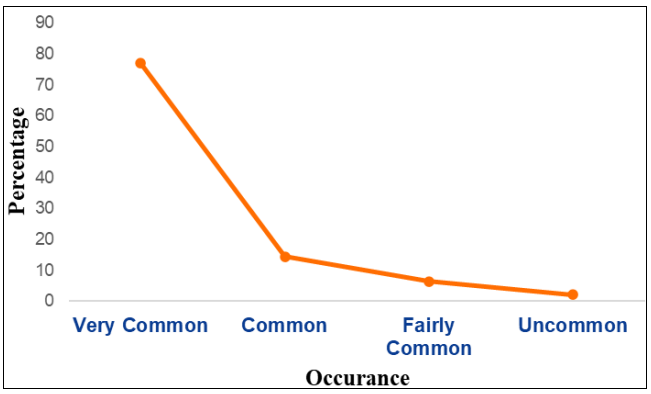

Fig 4: Occurrence of different butterfly species in the study area

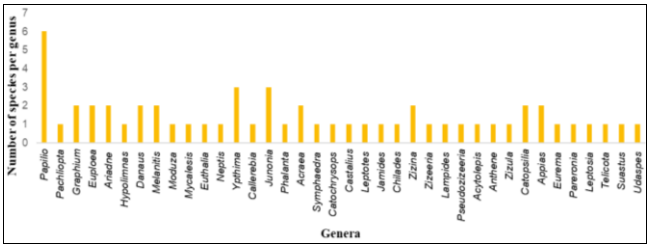

Fig 5: Species richness of the recorded butterfly genera of the study site.

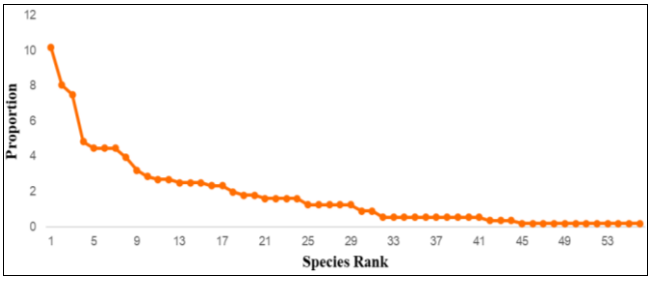

Fig 6: Rank abundance curve of 56 species of butterfly in the study area

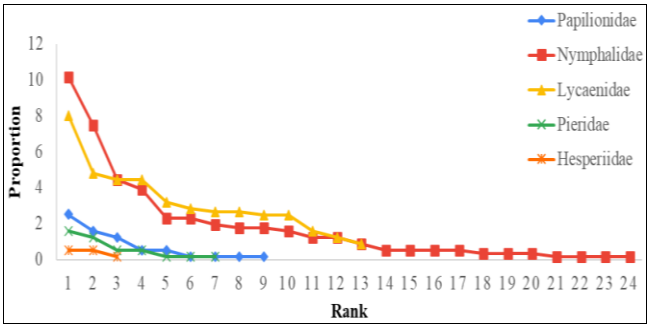

Fig 7: Rank abundance curve of five families of butterfly in the study area.

Fig 8: Photographs of different butterfly species recorded in the study area 1) *Junonia lemonias*, 2) *Euploea core*, 3) *Mycalesis perseus*, 4) *Ypthima huebneri*, 5) *Jamides celeno*, 6) *Castalius rosimon*.

Fig 9: Photographs of different butterfly species recorded in the study area 7) *Catochrysops Strabo*, 8) *Acraea terpsicore*, 9)

Papilio polytes, 10) *Hypolimnas bolina*, 11) *Lampides boeticus*, 12) *Ariadne merione.*

Discussion

Butterflies constitute the group of insects which occupy a vital position in the food chain and also play an important role in pollination (Watt and Boggs, 2003) [30]. They comprise the taxonomically widely inspected group of insects which have earned recognition among entomologists worldwide (Ghazoul, 2002) [11]. Butterflies are also quite well-reflective of the human inflicted consequences that eventually lead to habitat degradation (Kamar, 2022) [13]. These brightly coloured winged hexapods are therefore considered as the most efficient taxa for biodiversity assessment which is necessary for both biological conservation as well as for determining environmental conditions (Simonson *et al*., 2001) [24].

A total number of 56 butterfly species belonging to five different families have been recorded from the study site. Among the five different families that were observed at the study site, family Nymphalidae was found to be the dominant family in terms of percentage composition which is similar to the results obtained from various studies that were conducted at various parts of West Bengal such as Bankura town (Nayak, 2020) [19], Ajodhya Hills, Purulia (Mukherjee *et al*., 2023) [16] and Joychandi Hill, Purulia (Chowdhury and Chowdhury, 2020) [4]. In this study, Lycaenidae family was found to be second most dominant family while considering percentage composition values, which is similar to the results of the studies conducted at Joychandi Hill, Purulia (Chowdhury and Chowdhury, 2020) [4], and Bankura town (Nayak, 2020) [19]. Family Hesperiidae was recorded with only three species from the study site, whereas Chowdhury and Chowdhury (2020) [4], recorded the presence of two species under Hesperiidae family from Joychandi Hill of Purulia district and Nayak (2020) [19] recorded the presence of 6 butterfly species belonging to Hesperiidae family from Bankura Town.

Common five-ring was found to be the most abundant butterfly at the study site, whereas a study conducted at Bankura town by Nayak (2020) [19] reported Common Castor as the most abundant species and a study conducted throughout Midnapore urban area by Biswas *et al*. (2019) [3] reported Plain Tiger as the most abundant species. Species genus ratio of the present study was found to be 1.47, which is quite similar to the findings of Mukherjee *et al*. (2023) [16] at Ajodhya Hills, Purulia where species genus ratio was reported to be 1.50.

Butterfly diversity of an area is directly influenced by the plant diversity of that respective area. In the study site, many farms are found, those were initiated to support the nutritionally malnourished local rural people. Here, various types herbs and shrubs having economic importance are grown by organic farming. Moreover, it has been observed that butterflies belonging to family Nymphalidae and Hesperiidae were found in areas those were mostly comprised of herbaceous plants, while butterflies belonging to families Papilionidae, Pieridae and Lycaenidae preferred areas enriched with trees and shrubs (Mukherjee and Mondal, 2020) [17]. Apart from herbaceous plants, Palash trees were abundant at the selected study sites which served as a larval host plant for butterfly species like Forget-me-not, Plains Cupid, Common Cerulean, Pea Blue and Common Emigrant.

The high species abundance and diversity of butterfly community at the study site was influenced by several factors such as presence of vast agricultural fields, minimized human interference and rural landscape. Agricultural fields comprised of food crops and large herbaceous trees provided a suitable habitat for the conglomeration of butterfly community and minimized human interference allowed these winged hexapods to thrive freely without any hindrance. Majority of the rural population were engaged in agricultural activities. Tourism also plays a crucial role as a source of income for the district. However, excessive tourists might have a negative impact on the butterfly community residing in the region. Therefore, systematic surveys must be conducted from time to time in order to assess the butterfly fauna and thus the overall health of the ecosystem.

Conclusion

The current study documented the presence of a diverse butterfly community at the selected study sites in Jamdoba village of Bankura district and its surrounding areas in Purulia district. The rural landscape, along with the vast agricultural fields and the vegetation of different farms has provided a suitable habitat for the assemblage of butterfly community. The present study is one of the first survey-based studies that has been conducted in this region. As butterflies are susceptible to any minor fluctuations of habitat conditions, if any deviation in diversity indices is recorded, utmost care has to be taken in land utilization pattern so as to conserve the habitat as well as the butterfly fauna residing in the region. Thus, the data recorded in this study will prove to be beneficial as a source of reference for future systematic survey-based studies.

Reference

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