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Preliminary studies on butterfly fauna of Sarahan Bird Sanctuary, Shimla, Himachal Pradesh, India

Dr. Mousumi Das[1*], Avishikta Ghosh[2], Somdutta Basu Thakur[2]
[1] Assistant Professor, Department of Zoology, Vidyasagar College, Kolkata, West Bengal, India
[2] Department of Zoology, Vidyasagar College, Kolkata, West Bengal, India

Abstract
A preliminary study was conducted in the month of April, 2025, to assess the butterfly fauna at Sarahan Bird Sanctuary situated in Shimla district of Himachal Pradesh, India. A total number of 43 butterfly species belonging to 33 genera and 5 different families were documented from the study site. Results of percentage composition of the recorded butterflies revealed that highest percentage belonged to the family Pieridae (50.18%), followed by family Nymphalidae (31.08%), Lycaenidae (17.20%), Papilionidae (0.95%), Hesperiidae (0.59%). Based on the sightings of butterflies at the study site it was found that 35.82% belonged to the not rare category, 30.96% to the common category, 18.62% to the rare category, 14.00% to the very common category and only 0.59% to the very rare category. Among the recorded butterfly species, seven of them were found to be protected under Schedule II of Wildlife Protection Act, 1972. Value of Shannon diversity index (H'=3.27) revealed the high species richness of the butterfly community in the study site. Pielou's evenness index (j=0.87) depicted the evenly distributed nature of the butterflies in the studied butterfly community and Simpson's index of diversity (D=0.95) stated the persistence of high abundance of the recorded butterfly species in the sampled butterfly community. When considering species richness, family Nymphalidae was the dominant one (2.43), followed Lycaenidae (2.38), Pieridae (2.01). While, abundance of butterfly was taken under consideration, family Lycaenidae was the dominant family (0.90), followed by the Nymphalidae (0.88), Pieridae (0.84). The maximum value of Pielou's evenness index was obtained from family Lycaenidae (0.93), followed by the Nymphalidae (0.88), Pieridae (0.87). Therefore, the information from this preliminary survey will prove to be beneficial for the further future long term studies as well as for the implementation of necessary conservation strategies required for the persistence of butterfly fauna in this mountainous terrain.

Keywords: Butterfly community, lycaenidae, nymphalidae, Sarahan Bird Sanctuary, Simpson's index of diversity, species richness

Introduction

Insects are the most diverse, dynamic and largest group among living organism on the globe (Schowalter, 2016) [38]. Butterflies, member of the order Lepidoptera, are scale winged, colorful, charismatic creatures which are taxonomically and ecologically most studied group among insects in the world (Ghazoul, 2002; Mihoci *et al*., 2011; Tiple and Khurad, 2009) [12, 30, 47]. Butterflies not only have a cultural and aesthetic value (Kumar *et al*., 2016) [20] but also play a pivotal role in the terrestrial ecosystem, being effective pollinators of forest trees and agriculture crops (Merlin and Liedvogel, 2019) [29]. More than 35% of global food crops depend on insect pollination, predominantly helped by butterflies (Klein *et al*., 2007) [19].They are known for their various ecosystem services for human well-being such as seed dispersal, mineral recycling (N, P, K) and decomposition (Majumder *et al*., 2012) [26], energy transformation up to succeeding trophic level into the forest food chain (Prajapat *et al*., 2024) [34], predation or parasitism, biological pest control (Ghazanfar etc al., 2016) [11], good source of food, pollution indicators of terrestrial ecosystem (Alarape *et al*., 2015) [1].

Butterflies are considered as an indispensable biological indicator offering critical insights into vegetative structure, habitat quality (Castro and Espinosa, 2015) [6], ecosystem health and degradation (Ghazanfar, 2016) [11], overall environmental integrity (Sawchik *et al*., 2005) [37], climate change, and the impact of anthropogenic disturbances on habitat as well as ecosystem (Kunte, 2008) [24]. As butterflies are highly sensitive to minor change in their habitat and climatic condition, hence functioning as sentinel species for monitoring environmental disturbances such as pollution, resource exhaustion, and habitat degradation, fragmentation or encroachment particularly due to rapid urbanization (Khairunnisa *et al*., 2015) [17].

Over 28,000 species of butterflies are recorded worldwide (Tiple, 2011) [45] and approximately 1504 species are identified from the Indian subcontinent which forms 65% of the total Indian fauna (Tiple, 2011; Sidhu, 2023) [45, 42], and is nearly 8.74% of the total global butterfly species (Sidhu, 2023; Karmakar *et al*., 2018) [42, 15], and is the one-fifth of the world's living organisms (Karmakar *et al*., 2018) [15].

However, over the past decades, many reports stated the decrease in population of the butterfly species due to unexpected anthropogenic disturbances like climate change, deforestation, habitat fragmentation, destruction or loss, urbanization, artificial lightening, plant invasion, agricultural intensification and pesticides and herbicides, pollution and lack of better conservation policies (Hallmann, 2020; Sawchik *et al*., 2005) [13, 37]. Moreover, these hazards sometimes cause migration or local extinction of butterflies (Bates *et al*., 2014) [3]. About 35% of butterfly abundance declined worldwide in last 40 years (Dirzo *et al*., 2014) [9] and many species (about 40%) are in the verge of extinction (Sanchez-Bayo and Wyckhuys, 2019) [36]. Studies on the diversity and abundance of butterfly fauna in any area provide a complete portrait about the status of an ecosystem (Meeta, *et al*., 2017) [27]. Hence, monitoring

efforts are essential to estimate the butterfly diversity in different habitats that will help to assess their ecological roles and responses to climate change. The surveillance of species diversity depicts the impacts of climatic variability upon the habitat.

Systematic survey-based studies related to butterfly diversity within various forest reserves are prerequisite to prevent extinction and further decline in their population (Panicker, 2016) [33]. Furthermore, such systematic studies act as pivotal tools for managing human-induced impacts in urbanized, protected, industrial area (Wilson, 1997) [50] and for effective and proper conservation of butterflies (Sharma *et al*., 2020) [40].

A literature survey reveals that the butterfly fauna was explored in the different parts of the Himalayan region by Mehta (2002) [28], Arora *et al*. (2005) [2], Kumar (2009) [21], Khan *et al*. (2011) [18], Thakur (2011) [44] etc.

Sarahan Bird Sanctuary also known as Sarahan Pheasantry is located in Sarahan, Shimla district of the Himachal Pradesh, India. The sanctuary is at an elevation of 2313 metres from sea level and is situated at a considerable distance from human settlements. The park is surrounded by majestic snow-clad mountain ranges, dense forests, green valleys. It is a lush-green forest with numerous treks and is filled with variety of flora, avian species and other wildlife. It is renowned for the breeding and protecting of the endangered Western Tragopan, the state bird of Himachal Pradesh. This forest land covers an area of almost 12 hectares.

Despite the considerable biodiversity of the area, no previous study has been carried out on the butterflies' diversity and abundance at Sarahan Bird Sanctuary, Sarahan, Shimla district, Himachal Pradesh, India. Hence, the current study was the first preliminary attempt to document the diversity and abundance of butterfly species. The result of the survey will delineate the health of ecosystem and provide the baseline information for adopting conservation strategies to protect the habitat as well as the biodiversity of butterflies.

Materials and Methods Study Area

The survey was carried out at the Sarahan Bird Sanctuary which lies at 31°30'25.53"N, 77°47'46.95"E in Shimla district of Himachal Pradesh. The study area covered a distance of approximately 2000 m. The region experiences a pleasant and temperate climate particularly during summer and monsoon season. Temperature ranges between 10°C to 28°C during the summer months and can range from 7°C to -11°C during the winter months. The region receives moderate rainfall between the months of August to October.

Survey Technique

The procedure of data collection was carried out in the month of April, 2025 when the climatic conditions were temperate and pleasant. Observations were primarily made via 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) [14]. The entire survey path of 2000 m was divided into 5 transects each comprised of 400 m, were surveyed every day. During the sampling process, for each and every sampling the same transect path was followed in order to minimize the number of variables (Pyle, 1992) [35]. All the butterfly species that were observed during the sampling period were recorded along with their number. Identification of maximum butterfly species were done 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) [25], Kehimkar (2016) [16] and Dey *et al*. (2017) [8]. During the survey period, neither of the butterflies were collected nor captured. The common English names and scientific names followed in the study are in correspondence with Varshney and Smetacek (2015) [48].

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) [39], Simpson index (Simpson, 1964) [43] and Pielou's index (Mulder *et al*., 2004) [31] respectively. To explain species richness and evenness a rank abundance curve was prepared (Whittaker, 1965) [49].

Shannon diversity index (H') = - Σ pi ln pi

Shannon H_{max}= Log_1 (N)

Dominance index (D_{BP})= ni/N (Berger and Parker, 1970) [4]

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

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

Simpson's reciprocal index (Dr)= 1/ Σ^{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 Himachal Pradesh, Sarahan, satellite image of study site and vegetation are showed in figure 1.Table 1 illustrates the entire list of butterfly species that were recorded at the study site along with their scientific name, their family, relative abundance and WPA Schedule (Wildlife Protection Act, 1972). The study documented the presence of 43 butterfly species belonging to 33 genera and 5 different families namely Nymphalidae, Papilionidae, Pieridae, Lycaenidae and Hesperiidae. Family Nymphalidae was found to be the dominant one comprised of 16 species belonging to 11 genera, followed by family Lycaenidae comprised of 13 species belonging to 10 genera, Pieridae comprised of 10 species belonging to 6 genera, Papilionidae and Hesperiidae were both comprised of 2 species with 2 different. Few butterfly species were highly abundant at the study site which includes Large Cabbage White (*Pieris brassicae*; RA- 14.00), Dark Clouded Yellow (*Colias fieldii*; RA-8.07), Indian Tortoiseshell (*Aglais caschmirensis*; RA-7.95), Himalayan Cabbage White (*Pieris canidia*; RA-7.95) and Himalayan Bath White (*Pontia daplidice*; RA-7.00). Relative abundance of 19 butterfly species at the study site ranged from 4.51 to 1.07. The remaining butterfly species was found with relative abundance less than 1.

Among the butterfly species that were recorded under family Nymphalidae, Indian Tortoiseshell (*Aglais caschmirensis*) was counted with maximum number followed by Indian Red Admiral (*Vanessa indica*) whereas Great Satyr (*Aulocera padma*) was counted with least number. Large Cabbage White (*Pieris brassicae*) belonging to family Papilionidae was the most abundant species followed by Dark Clouded Yellow (*Colias fieldii*) whereas

Common Wanderer (*Pareronia valeria*) was counted with least number. While considering family Lycaenidae Common Copper (*Lycaena phlaeas*) was found to be the most abundant species whereas White-Bordered Copper (*Lycaena panava*) was observed with the least number. Only 2 butterfly species were recorded from the families Papilionidae and Hesperiidae each.

Most of the butterfly species sampled at the study site were 'common' and 'generalist species' and none of them were universally threatened according to IUCN Red List (Ver. 3.1). Only 7 butterfly species observed at the study site, were found to be protected under Schedule II of the Wildlife Protection Act, 1972 which includes Common Argus (*Callerebia nirmala*), Indian Tortoiseshell (*Aglais caschmirensis*), Dark Clouded Yellow (*Colias fieldii*), Pea Blue (*Lampides boeticus*), Brown Argus (*Callerebia hyagriva*), White-Bordered Copper (*Lycaena panava*) and Sorrel Sapphire (*Heliophorus sena*).

Analysis of the percentage composition of the five recorded families was presented in figure 2(i) that revealed maximum percentage of the total number of butterflies belong to the family Pieridae (50.18%), followed by family Nymphalidae (31.08), Lycaenidae (17.20%), Papilionidae (0.95%), Hesperiidae (0.59%).

The result of the genus proportion analysis was showed in figure 2(ii) that depicted the highest number of genera was observed under family Nymphalidae which comprised of 36.36% of the total recorded genera, followed by the family Lycaenidae with 33.33%, Pieridae with 18.18% and the family Papilionidae and Hesperiidae were both with 6.06%. While evaluating the species proportion, it was revealed that the maximum number of species belonged to the family Nymphalidae (37.21%), followed by Lycaenidae (30.23%), Pieridae (23.26%) and the family Papilionidae and Hesperiidae both comprised of 4.65% of the total number of the recorded species.

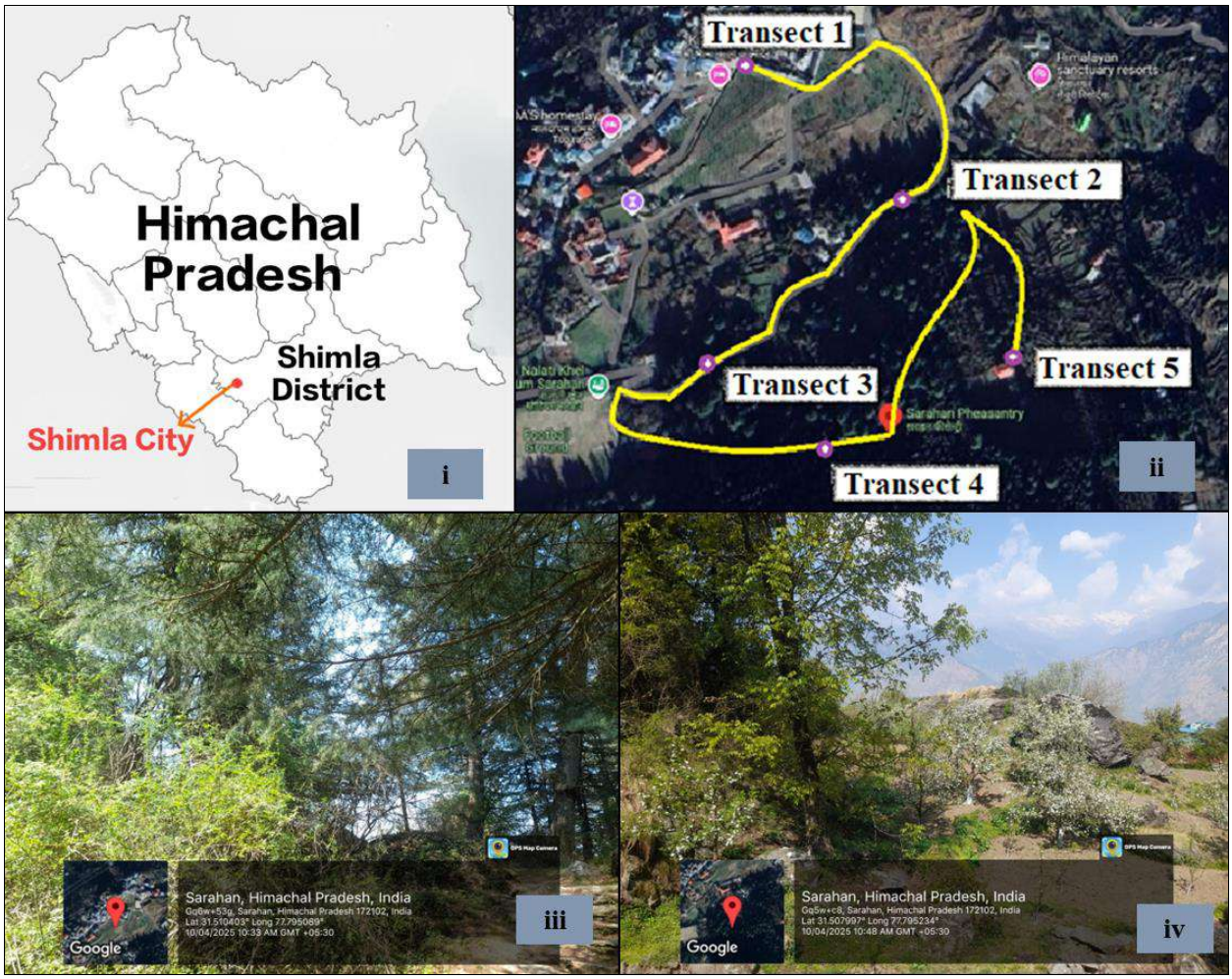

Fig 1: Map of Himachal Predesh (i) and satellite image (ii) and vegetation of study area (iii & iv).

Species richness of the recorded 33 butterfly genera has been illustrated in figure 2 (iii). Genus *Junonia*, under family Nymphalidae, genus *Pieris*, under family Pieridae and genus *Celastrina* under family Lycaenidae were the dominant genera observed at the study site as all of them were comprised of 3 species namely, *Junonia orithya*, *Junonia lemonias*, *Junonia iphita*, under genus *Junonia*, *Pieris brassicae*, *Pieris canidia*, *Pieris melete* under genus *Pieris* and *Celastrina argiolus*, *Celastrina gigas*, *Celastrina lavendularis* under genus *Celastrina*. a total number of 4 genera were comprised of 2 species which includes genus *Vanessa* having *Vanessa cardui* and *Vanessa indica*, genus *Aulocera* having *Aulocera padma* and *Aulocera swaha*, genus, *Gonepteryx* having *Gonepteryx rhamni* and *Gonepteryx nepalensis* and genus *Colias* having *Colias fieldii* and *Colias hyale*. All the remaining 26 genera were comprised of 1 species each. Species genus ratio was found to be 1.30.

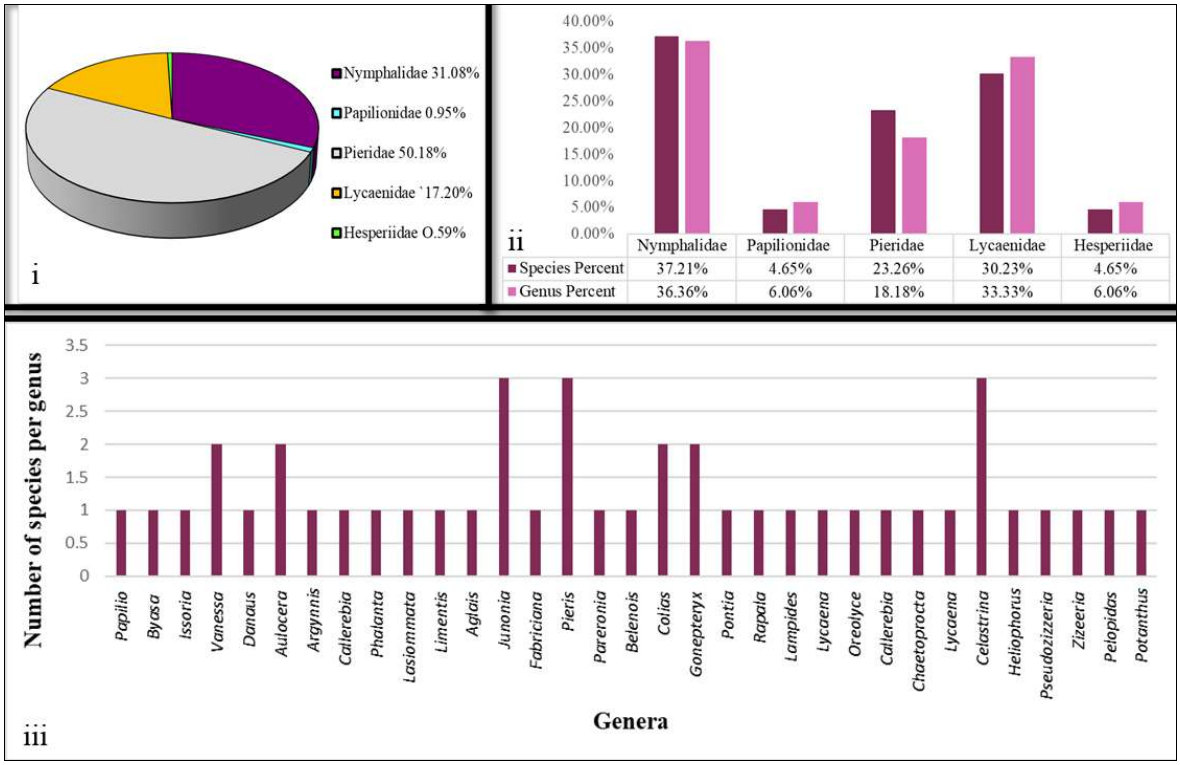

Fig 2: Percentage composition (i), genus to species proportion of butterflies of five families (ii), and genus wise species richness of the recorded butterfly genera (iii) of the study site.

The butterflies that were recorded from the study site were categorized into five different classes based on their prevalence, namely very common (VC), common (C), not rare (NR), rare (R) and very rare (VR). The results showed that 14.00% of the total number of butterflies belonged to the VC category, followed by 30.96% to the C category, 35.82% to the NR category, 8.62% to the R category and 0.59% to the VR category.

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

Sl. No.	Family	Common Name	Scientific name	Relative Abundance	Status	WPA schedule
1	Papilionidae	Common Yellow Swallowtail	*Papilio machaon*	0.71	R	
2		Common Windmill	*Byasa polyeuctes*	0.24	VR	
3	Nymphalidae	Queen of Spain Fritillary	*Issoria issaea*	2.25	NR	
4		Indian Red Admiral	*Vanessa indica*	4.51	NR	
5		Plain Tiger	*Danaus chrysippus*	0.95	R	
6		Common Satyr	*Aulocera swaha*	2.14	NR	
7		High Brown Silverspot	*Argynnis jainadeva*	1.90	NR	
8		Common Argus	*Callerebia nirmala*	0.71	R	Schedule II
9		Painted Lady	*Vanessa cardui*	2.49	NR	
10		Common Leopard	*Phalanta phalantha*	2.02	NR	
11		Common Wall	*Lasiommata schakra*	0.71	R	
12		Indian White Admiral	*Limenitis trivena*	0.59	R	
13		Indian Tortoiseshell	*Aglais caschmirensis*	7.95	C	Schedule II
14		Pale Blue Pansy	*Junonia orithya*	1.30	R	
15		Lemon Pansy	*Junonia lemonias*	1.07	R	
16		Chocolate Pansy	*Junonia iphita*	0.59	R	
17		Common Silverstripe	*Argynnis kamala*	1.66	R	
18		Great Satyr	*Aulocera padma*	0.24	VR	
19	Pieridae	Large Cabbage White	*Pieris brassicae*	14.00	VC	
20		Himalayan Cabbage White	*Pieris canidia*	7.95	C	
21		Common Wanderer	*Pareronia valeria*	0.83	R	
22		Pioneer White	*Belenois aurota*	1.54	R	
23		Dark Clouded Yellow	*Colias fieldii*	8.07	C	Schedule II
24		Pale Clouded Yellow	*Colias hyale*	2.61	NR	
25		Green-Veined White	*Pieris melete*	1.90	NR	
26		Common Brimstone	*Gonepteryx rhamni*	4.15	NR	
27		Himalayan Brimstone	*Gonepteryx nepalensis*	2.14	NR	
28		Himalayan Bath White	*Pontia daplidice*	7.00	C	
29	Lycaenidae	Indian Red Flash	*Rapala airbus*	0.59	R	
30		Pea Blue	*Lampides boeticus*	2.14	NR	Schedule II
31		Common Copper	*Lycaena phlaeas*	3.44	NR	

32		Dusky Hedge Blue	*Oreolyce vardhana*	1.07	R	
33		Brown Argus	*Callerebia hyagriva*	1.90	NR	Schedule II
34		Walnut Blue	*Chaetoprocta odata*	0.71	R	
35		White-Bordered Copper	*Lycaena panava*	0.47	R	Schedule II
36		Plain Hedge Blue	*Celastrina lavendularis*	0.71	R	
37		Silvery Hedge Blue	*Celastrina gigas*	0.95	R	
38		Hill Hedge Blue	*Celastrina argiolus*	2.25	NR	
39		Sorrel Sapphire	*Heliophorus sena*	1.42	R	Schedule II
40		Pale Grass Blue	*Pseudozizzeria maha*	0.59	R	
41		Dark Glass Blue	*Zizeeria karsandra*	0.95	R	
42	Hesperiidae	Small Branded Swift	*Pelopidas mathias*	0.12	VR	
43		Himalayan Dart	*Potanthus dara*	0.47	R	

VC -very common (>100 sightings), C – common (51 to 100sightings), NR – nor rare (16 to 50 sightings), R – rare (3 to 15 sightings), VR – very rare (1 to 2) to indicate the rarest to the most common butterfly species (Tiple *et al*., 2006) [46].

WPA- Species enlisted in Indian Wildlife Protection Act, 1972.

Table 2 stated the species diversity, abundance and species evenness of the butterfly community of the study site which were illustrated by the diversity indices such as 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 (3.27) signified that the species richness and diversity of the butterfly fauna at the study site was very high. The abundance of the butterfly community was evaluated by the Simpson's diversity index (Ds) whose value was more inclined towards 0 indicating the prevalence of high species abundance within the butterfly community. Again, the value of Simpson's index of diversity (D=0.95) supported the presence of high abundance of butterfly. The value of Pielou's evenness index (j=0.87) was inclined towards 1 which depicted the persistence of more evenness among the butterfly species of the studied butterfly community. All these values proclaimed the butterfly community was highly diverse with high abundance and high evenness, thus inferring the community was in the direction of an ideal natural community.

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 diversity index (Ds)	Simpson's index of diversity(D)
3.27	0.87	0.05	0.95

Table 3 represents the family-wise values of various biodiversity indices, such as Shannon diversity index (H'), Shannon H_{max}, Pielou's evenness index (j), Simpson's diversity index (Ds), Simpson's index of diversity (D) and Simpson's reciprocal index (Dr). The Shannon diversity index (H') value of the recorded five butterfly families ranged from 0.50 to 2.43. In this case, the family Nymphalidae was noted with the highest value as the maximum number of species were recorded from this family, followed by Lycaenidae, Pieridae, Papilionidae whereas, the least value was observed from the Hesperiidae family. Moreover, the highest value of Shannon H_{max} was obtained from the family Pieridae (2.63), followed by Nymphalidae (2.42), Lycaenidae (2.16), Papilionidae (0.90) and Hesperiidae (0.70). The value of Simpson's index of diversity (D) ranged from 0.40 to 0.90, where the highest value was noted from the family Lycaenidae, followed by the family Nymphalidae, Pieridae, Papilionidae, Hesperiidae that illustrates the family Lycaenidae had the highest species abundance and lowest in the family Hesperiidae. Values of Pielou's evenness index (j) determine whether a community is evenly distributed or not. This value was highest in case of Lycaenidae (0.93), followed by Nymphalidae (0.88), Pieridae (0.87), Papilionidae (0.81) whereas the least value was observed from the family Hesperiidae (0.72). In the present study, the value of Simpson's reciprocal index (Dr) indicated that the highest abundance of butterfly was observed in the family Lycaenidae (9.25).

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 diversity index (Ds)	Simpson's index of diversity (D)	Simpson's reciprocal index (Dr)
Nymphalidae	2.43	2.42	0.88	0.12	0.88	8.38
Papilionidae	0.56	0.90	0.81	0.57	0.43	1.60
Pieridae	2.01	2.63	0.87	0.16	0.84	6.16
Lycaenidae	2.38	2.16	0.93	0.1	0.90	9.25
Hesperiidae	0.50	0.70	0.72	0.60	0.40	1.47

Figure 3(i) demonstrated the Whittaker plot i.e., species-wise rank abundance curve that explains the species abundance along with evenness and family-wise rank abundance curve (figure 3.ii) that illustrated the species abundance and evenness among the five different families. The Whittaker plot's curve showed a steep inclination up to the first five butterfly species that were documented from the study site, five butterfly species occurred in high abundance with less evenness in comparison to the remaining species. Species rank nine onwards the abundances of the observed butterfly species were reduced accordingly with increased evenness among the recorded species in the butterfly community.

While considering the family-wise rank abundance curve, it was clearly observed that more evenness was in the family Lycaenidae, followed by family Nymphalidae, Pieridae Papilionidae, Hesperiidae (figure 3.ii).

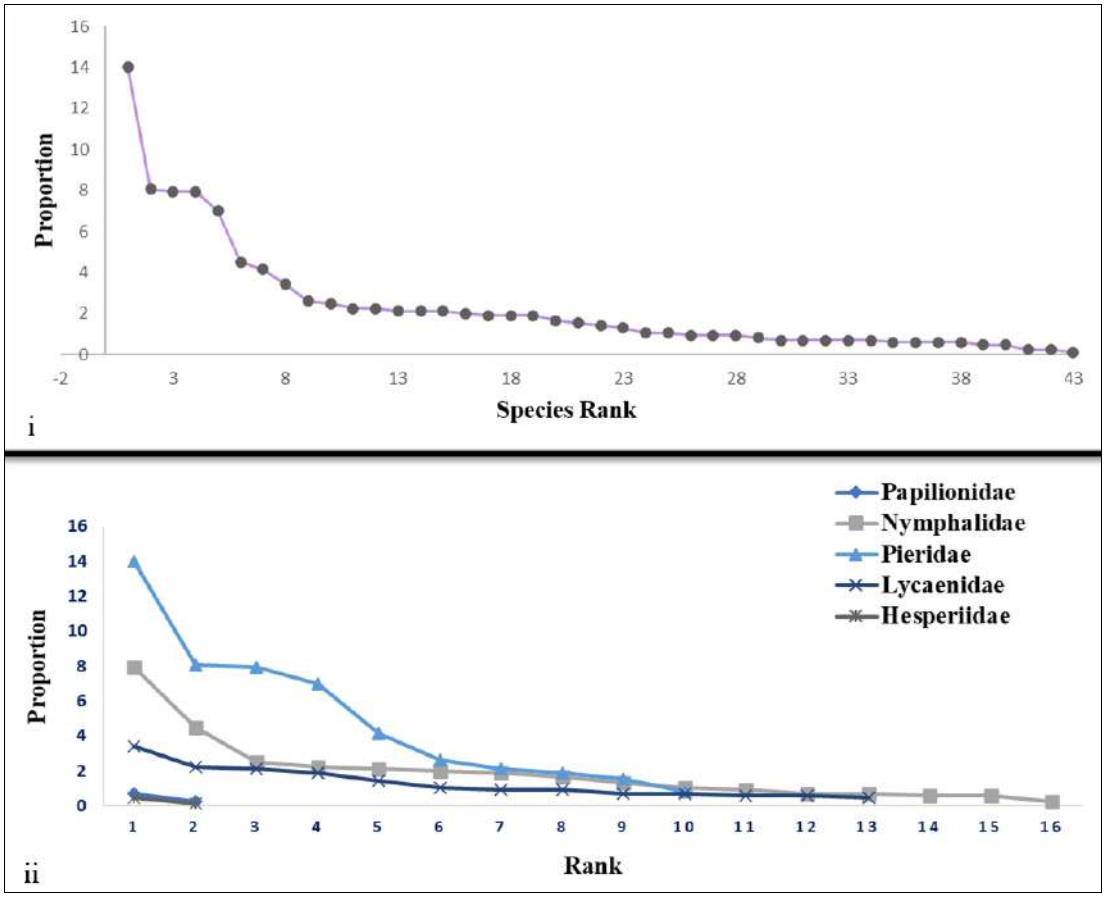

Fig 3: Rank abundance curve of 43 species of butterfly (i) and rank abundance curve of five families of butterfly community (ii) in the study area.

Discussion

Butterflies are considered as the potential umbrella taxa for the purpose of biodiversity conservation (Dayananda, 2014) [7]. They play a pivotal role in conserving the biodiversity in natural ecosystem via their complex and crucial connections in the food web (Bonebrake *et al*., 2010) [5]. As they are sensitive to habitat degradation and any kind of climatic alterations, they play a major role as a valuable bioindicators thus assessing environmental changes (Kunte, 2000) [23]. Butterflies also maintain environmental equilibrium by providing various ecosystem services.

The Sarahan Bird Sanctuary is located in the range of mountains covered with dense forests and rich in flora and fauna. A total of 43 different butterfly species were recorded from the study site. Nymphalidae was found to be the dominant family comprised of 16 species, which is quite similar to the findings of Kumari *et al*., (2020) [22] from Deot-Sidh hills and Gangotia and Kumar (2018) [10] from Chail Wildlife Sanctuary, Shimla, of Himachal Pradesh. In both the studied area Nymphalidae family was recorded as a dominant one comprised of 14 species and 23 species respectively. Family Lycaenidae was comprised of 13 species and the second most dominant family after Nymphalidae at the study site which contradicts the findings of most of the previous studies conducted in Himachal Pradesh (Gangotia and Kumar, 2018; Sharma and Kumar, 2015; Kumari *et al*., 2020) [10, 41, 22]. The dominance of family Lycaenidae over Pieridae could be due to the presence of widespread grass cover in the entire study site. A total number of 10 species belonging to family Pieridae were recorded from the study site which is quite similar with the other prior investigation report of Chail Wildlife Sanctuary and Renuka Lake, Himachal Pradesh (Gangotia and Kumar, 2018; Sharma and Kumar, 2015) [10, 41] where the number of butterfly species belongs to the family Pieridae was 12 and 11 respectively. Only 2 species of butterfly were recorded from the family Papilionidae which follows the findings of Kumari *et al*. (2020) [22] from the Deot-Sidh Hills of Himachal Pradesh where 3 species were recorded under this family. Hesperiidae family was also comprised of 2 species of butterfly which is similar to the findings of Gangotia and Kumar (2018) [10] studied at the Chail Wildlife Sanctuary.

Butterfly diversity and abundance of any particular region often exhibit seasonal fluctuation and are influenced by various ecological and climatic conditions such as temperature, rainfall, photoperiod, humidity etc (Narmadha *et al*., 2023) [32]. The study site is predominantly a mountainous region with green valleys surrounded by snow-capped mountains and is covered with dense temperate forests that harbours diverse flora and fauna. The apple orchards were situated at close vicinity where various butterflies such as Common Yellow Swallowtail (*Papilio machaon*), Large Cabbage White (*Pieris brassicae*), Himalayan Cabbage White (*Pieris canidia*), Dark Clouded Yellow (*Colias fieldii*) were seen hovering. Butterflies like Painted Lady (*Vanessa cardui*), Sorrel Sapphire (*Heliophorus sena*) and Pea Blue (*Lampides boeticus*) were found nectar feeding on Tridax Daisy plant (*Tridax procumbens*). Thus, the diverse vegetation pattern of the study site provides a suitable habitat for the assemblage of large number of butterflies. Human intervention is considerably less in and around the Sarahan Pheasantry thus enabling the natural habitat to retain its original form and provide an enormous space for the conglomeration of diverse flora and fauna.

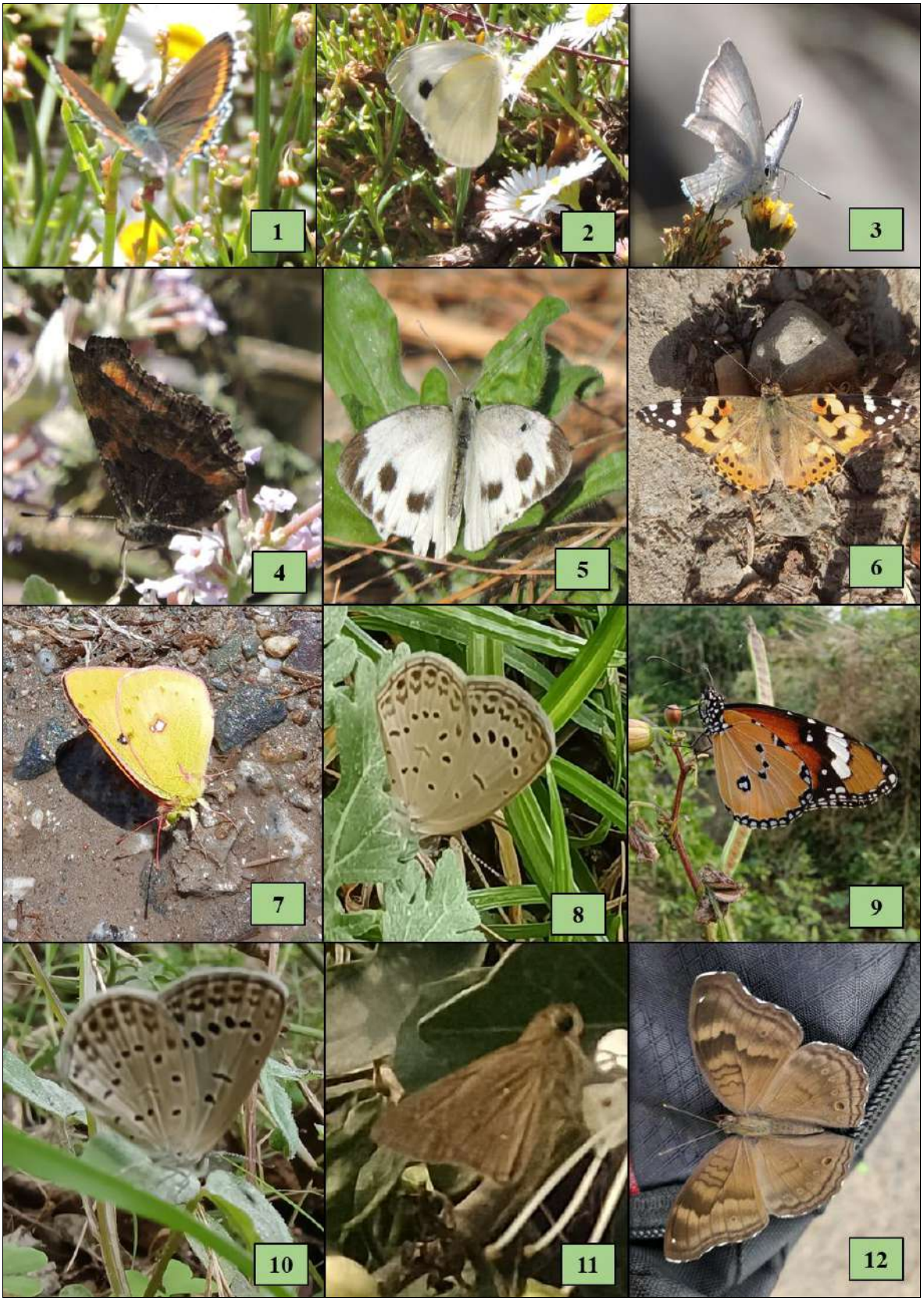

Fig 5: Photographs of different butterfly species recorded in the study area, 1) *Heliophorus sena*, 2) *Pieris brassicae*, 3) *Celastrina argiolus*, 4) *Aglais caschmirensis*, 5) *Pieris canidia*, 6) *Vanessa cardui*, 7) *Colias fieldii*, 8) *Pseudozizzeria maha*, 9) *Danaus chrysippus*, 10) *Pseudozizzeria maha*, 11) *Pelopidas mathias*, 12) *Junonia iphita.*

Conclusion

The Sarahan Bird Sanctuary is aimed at conserving endangered and vulnerable bird species and also acts as a conservation breeding centre for Western Tragopan, the state bird of Himachal Pradesh. It is covered with dense green forests along with grasslands, which provides a suitable habitat for the dwelling of large number of butterflies which were eventually recorded in the present study. The data recorded from this preliminary study will prove to be beneficial as a source of reference for upcoming survey-based studies.

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