Research Article

A study on butterfly diversity in Prayagraj district of Uttar Pradesh, India

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Abstract

A study on butterfly diversity was carried out in Prayagraj district of Uttar Pradesh, India. Fallowing selected three sites in the study area for the surveyed of butterflies namely Company bagh, Shuats campus and Kushrobagh, a total of 316 individuals and 21 species of butterfly belong to 4 families were recorded during the study period. Nymphalidae was the richest family that comprised (9 and 43%) of the total species of butterfly recorded in the study area followed by Pieridae (6 and 29%), Papilionidae and Lycaenidae families were the lowest (3 and 14%) each respectively. Maximum number of butterflies were observed in Company bagh (114) followed by Shuats campus (107) and minimum in Kushrobagh (95) respectively. Among the species of butterfly observed in the study area, 4 of them were abundantly and 2 species were common while 8 numbers of the species of butterfly were less common. In addition 7 numbers of the species of butterfly were occasionally. The Simpson Index of Diversity was found highest in Company bagh (0.8) followed by Shuats campus (0.7) and Kushrobagh (0.6). The study area is rich in butterfly diversity and further research could be conducted to obtain more details and documentation on butterfly diversity for the conservation and butterfly park.

Keywords: Butterfly, Diversity, Prayagraj district, Conservation

Introduction

Butterflies make up a large group of insects known as the order Lepidoptera in phylum Arthropod. The name from the Greek lepido "scale" and ptera "wings" which refers to a prominent features of adult butterflies (the tiny scales that cover the wings). Butterflies are wonderfully diverse in shape, size and colour. They are found everywhere around the world except near the Poles. There are about 200.000 known species of Lepidoptera, of which about 10% are butterflies. Based on Wikipedia their anatomy, they are classified into six families: the Pieridae, commonly known as whites and sulphurs; the Papilionidae, or swallowtails; the Nymphalidae, including the morphos, the owl butterfly and the long wings; the Hesperidae, or skippers; the Libytheidae, or snout butterflies; and the small Lycaenidae. Butterflies are

good indicators of climatic conditions, seasonal and ecological changes, they can also serve in formulating strategies for conservation. However, they have largely been ignored by conservation biologists and policy makers as well. Hence butterflies play a vital role in ecosystem and co-evolutionary relationship between them and plants as well as their lives are interlinked (Ghazanfar *et al.,* 2016).

Kunte *et al.* (2012) indicated that India harbored total 1504 of butterfly species which accounted 8.74% of the world's butterfly and 285 species found in southern India. The peninsular India and Western Ghats have 351 and 334 species respectively. The order represents a mega diverse radiation of almost exclusively phytophagous insects probably correlated with the great diversification of flowering plants since the Cretaceous (Menken *et al.,* 2012). Butterflies they provide many vital economically important services within terrestrial ecosystems (such as nutrients recycling, soil formation, food resources and pollination). Pahari *et al.* (2018) revealed on the study of butterfly diversity in Haldia industrial zone that shows few numbers of butterfly species, less diversity and evenness indices when compared with the adjacent rural belt. And also recommend that industrialized areas are harmful places to the butterflies. Leon-Cortes *et al.* (2019) reported that the most diverse species of butterfly in the study area were belonging to Nymphalidae family with (31) species followed by Hesperidae (12), Pieridae (19) and Lycaenidae (16) respectively. One of the groups of animals with diverse species richness is insects which represent over 50% of terrestrial biodiversity. Butterflies, unlike most of other groups of insects, are popular, well documented, and easy to recognize. Butterflies they are well adapted to the landscape and react quickly to any alteration in their habitat as a result of human-induced activities such as farmland intensification and intensive logging (Mora *et al*., 2011). Climatic change affects the diversity of species and is expected to exacerbate the ecosystems (Scott and Lemieux, 2005). The changes in parameters of temperature, rainfall patterns, and extreme weather conditions such as heat waves, prolonged drought or excessive rainfall, have to be taken into consideration. Depletion of nectar and desiccation of host plants cause direct mortality and induce migratory behavior. Butterflies, being exothermal, are highly sensitive to climatic variation and a short generation time which makes them an appropriate model organism to study. Vu (2009) described that forest edges have greater diversity of butterflies and more exposure to the open

forest. Stream in the forest area play a vital role for the conservation of butterfly diversity, unlike bamboo forest that have less diverse of the butterfly species (Vu and Vu, 2011).

There is a need for the documentation of butterfly species from Prayagraj district, under the issues of environmental change from the seasonal variations. Hence, the present study was undertaken to provide baseline information on the checklist of butterflies and their diversity in the study area.

Materials and Methods

Study area and Sampling site

The present study was carried out in Prayagraj district of Uttar Pradesh, India. The study area is situated between the North latitude 25° 15 N and at the longitude 82° 58 E with an altitude of 98m (322ft.) and it is located in the southern part of Uttar Pradesh state. The climate of the study area is characterized by hot summers with the maximum temperature of 47°C during May to June with an average of 14°C in January. It has subtropical to tropical climate with extremes of summer and winter. On an average, the area receives an annual rainfall of 850 to 1000 mm. Three sampling sites were selected in the study area, which include: Company Bagh, Shuats Campus and Khusro Bagh.

Survey Method

The field surveys on butterflies were carried out in the study area three times a week for the period of four months from February to May, 2019. Butterflies were accessed in the study area from 9am to 11am in the morning by random observations during walking through the three selected sites based on habitats present in the study area. In the field, photographs of the butterflies were taken with the aid of camera for the identification purpose based on (Dey *et al.,* 2017).

Identification of the species of butterfly

The photographs of butterflies were used for the identification of the species of butterfly. Colour patterns, sizes and shapes as well as their designs were considered in identification of the species of butterfly with the help of entomologist expert and relevant available literature as well as photographs described by (Sunil *et al.,* 2016) and (Kumar *et al.,* 2016).

Statistical Analysis of Data

Identified species of butterfly observed in the study area were analysed by using Simpson index of diversity formula adopted by (Sunil *et al.,* 2016) and (Ashok, 2017).

The Simpson index of diversity mathematical formula is giving as follows:

$$\text{Where: } (D) = 1 - \frac{\sum n(n-1)}{N(N-1)}$$

1- D = Simpson Index of Diversity
  = sum of (Total)
 n = the number of individuals of each different species
N = the total number of individuals of all the species

Results

Checklist of the species of butterfly in the study area

The checklist of the species of butterfly observed in the study area is presented in (Table 1 & 2). The results showed that a total of 316 individuals and 21 species of butterfly belong to 4 families were recorded in the study area. Nymphalidae was the richest family in the study area that comprised (9 and 43%) species of butterfly followed by Pieridae with (6 and 29%) species, Papilionidae and Lycaenidae families were the lowest with (3 and 14%) species each as indicated in (Fig.1& 2).

Table 1: Checklist of the species of butterfly recorded in the study area

S\N	Family	Scientific Name	Common Name	Individual Number of Butterflies
1.	Nymphalidae	*Danaus chrysippus*	Plain Tiger	145
2.		*Danaus genutia*	Common Tiger	48
3.		*Euploea core*	Common Crow	9
4.		*Phalanta phalantha*	Common Leopard	5
5.		*Neptis hylas*	Common Sailer	3
6.		*Vanessa cynthia*	Painted Lady	3
7.		*Acraea violae*	Tawny Coster	11
8.		*Hypolimnas misippus*	Danaid Egg fly	4
9.		*Tirumala limniace*	Blue Tiger	9
10.	Pieridae	*Eurema hecabe*	Common Grass Yellow	6
11.		*Eurema andersoni*	One Spot Grass Yellow	9
12.		*Catopsilia pomona*	Common Emigrant	20
13.		*Anaphaeis aurota*	Pioneer	3
14.		*Delias eucharis*	Common Jezebel	8
15.		*Appias albino*	Common Albatross	8
16.	Papilionidae	*Graphium doson*	Common Blue Jay	5
17.		*Papilio polytes*	Common Mormon	2
18.		*Papilio demoleus*	Lime Butterfly	10
19.	Lycaenidae	*Chilades pandava*	Plains Cupid	4
20.		*Zizeeria karsandra*	Dark Grass Blue	3
21.		*Pseudozizeeria maha*	Pale Grass Blue	1

Table 2: Photographs of the species of butterfly observed in the study area

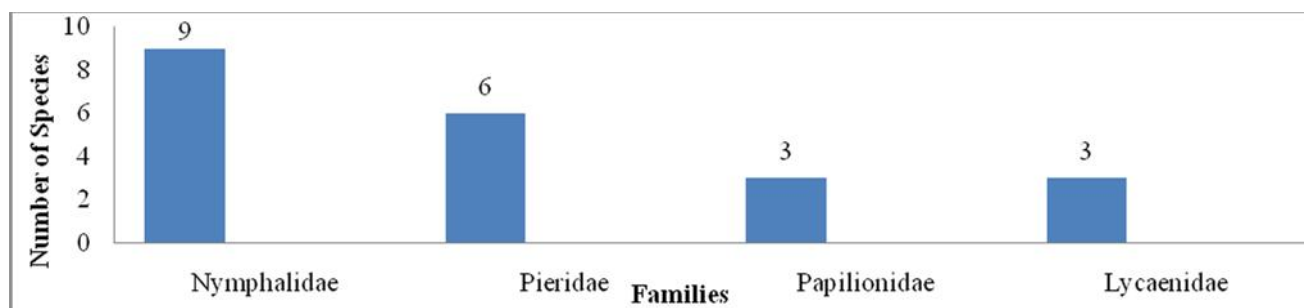| Plain Tiger	Common Tiger	Common Crow
Common Leopard	Common Sailer	Painted Lady
Tawny Coster	Danaid Eggfly	Blue Tiger
Common Grass Yellow	One Spot Grass Yellow	Common Emigrant
Pioneer	Common Jezebel	Common Albatross
Common Blue Jay	Common Mormon	Lime Butterfly
Plains Cupid	Dark Grass Blue	Pale Grass Blue

Fig. 1: Number of the species of butterfly in a family wise composition in the study area.
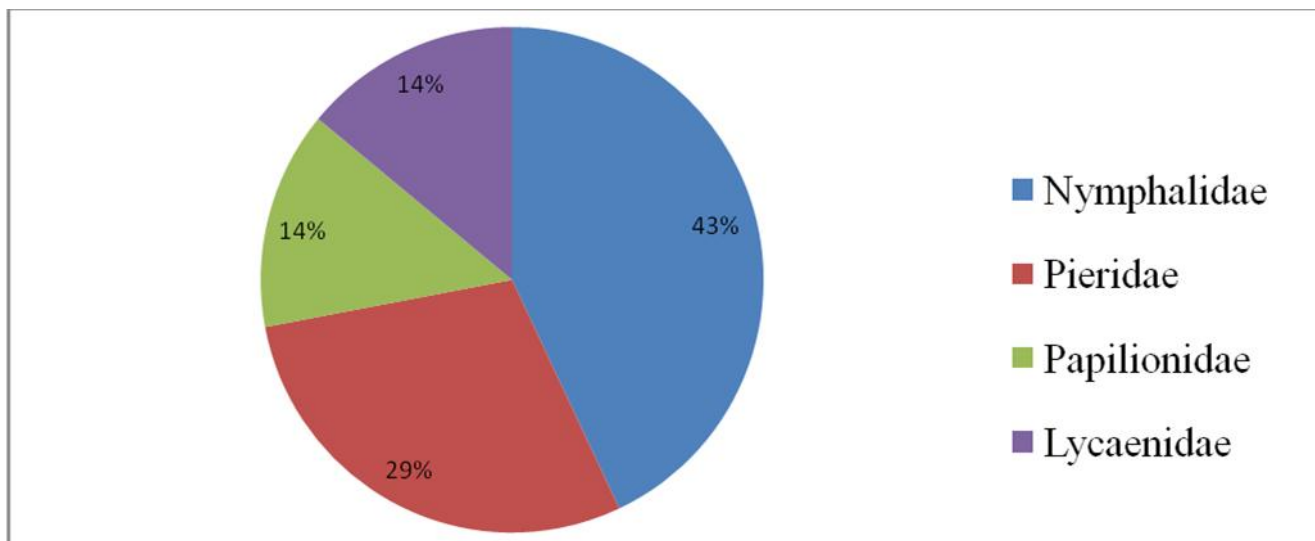
Fig. 2: Family wise percentage composition of the species of butterfly in the study area

Diversity of the species of butterfly in the study area

The diversity of the species of butterfly observed in the study area is presented in (Table 3). The result showed that the highest number of butterflies and Simpson index of diversity was observed in Company bagh site (114 and 0.8) followed by Shuats campus and kushrobagh sites showing (107 and 0.7) and (95 and 0.6) respectively.

Table 3: Number of butterflies and Simpson Index of Diversity in the study area

S/N	Site	Number of butterflies	Simpson Index of Diversity
1.	Company Bagh	114	0.8
2.	Shuats Campus	107	0.7
3.	KushroBagh	95	0.6

Discussion

Checklist of the species of butterfly

Based on family wise composition of checklist of the species of butterfly observed in the study area, Nymphalidae family was the highest number and percentage of the species of butterfly among the other families, which may be due to adaptation and habitat preference of the species. Similar studies reported by Singh and Chib (2014) on a preliminary checklist of butterflies that recorded 125 species of butterfly from 78 genera belong to 5 families.

Nymphalidae family was described as the highest in the study area. Also this finding is in close agreement with the findings of Charn (2015) who listed 54 species of butterfly belong to 7 families from the forest strip of Punjab. Nymphalidae family indicated as dominant during the study period with the highest number of the species of butterfly. In addition,the result is supported by Bubesh *et al.* (2012) who observed 50 species of butterfly belong to 5 families. Nymphalidae and Lycaenidae families were the highest number of the species of butterfly in the study area. The result of this study conceded with the findings of Sayeswara (2018) who was recorded higher percentage of the species of butterfly from Nymphalidae family with 44.4%, followed by Papilionidae of 22.2%, Lycaenidae having 8.33% and Hesperidae was the least percentage of the species of butterfly in the study area. Another relevant studies reported by Saurav *et al.* (2017) who was found that the Lycaenidae family having the maximum percentage of the species of butterfly with 34.9%, followed by Nymphalidae of 28.3%, Hesperidae 19.81%, Pieridae 9.43%, Papilionidae 6.6% and Riodinidae 0.94% respectively. This finding agrees with that of koneri and Nangoy (2019) who observed the status of Sangihe Island butterflies and recorded maximum number of the species of butterfly from Nymphalidae family constituted with 53.81%, followed by Papilionidae of 22.67%, Pieridae with 15.57%, Lycaenidae having 7.31% and Hesperidae with only 0.64% in the study area. Further, the results are in strong agreement with Sethy*et al.*(2014) who also reported that Nymphalidae represent the dominant family in the study area with 42.5%, followed by Papilionidae of 21.2%, Lycaenidae 15.1%, Pieridae 14.1% and Hesperidae with 7.1%.

Diversity of the species of butterfly

The greatest Simpson index of diversity was observed in company bagh site (0.8) among the other sites, indicating that the study area is more diverse of the species of butterfly. However, the maximum number individual of butterflies recorded may lead to the greatest diversity of the species of butterfly in the study area. Previous studies reported by Ashok (2017) who was recorded high diversity of the species of butterfly from five habitats of Jhansi. Narayan bagh was the highest diversity (0.7440) and the lowest diversity was observed from Jhansi Gwalior (0.6916) in the study area. In addition Savarimuthu*et al.* (2012) also stated that the maximum Simpson index of diversity was observed in the month of April from

river bank (0.9743) followed by crop area (0.9819) then forest area (0.9661) during the study period.Among the species of butterfly observed in the study area, 4 of them were abundantly (*Danaus chrysippus*, *Danaus genutia*, *Catopsilia pomona*, *Acreae violae*) and 2 species were common (*Eurema andersoni*, *Chilades pandava*) while 8 number of the species of butterfly were less common (*Euploea core*, *Tirumala limniace*, *Eurema hecabe*, *Delias eucharis*, *Appias albino*, *Graphium doson*, *Zizeeria karsandra*, *Papilio demoleus*). 7 numbers of the species of butterfly was found occasionally in the study area (*Pseudozizeeria maha*, *Hypolimnas misippus*, *Venessa cynthia*, *Anaphaeis aurota*, *Phalanta phalantha*, *Neptis hylas*, *Papilio polytes*) as shown in (Appendix 4, 5 & 6). The vegetation and habitat types in the study area might be reason for the above common occurrences of the species of butterfly. Each and every site had various habitats pattern. In addition to that, the sites were found with gardens, orchards, farmland, landscape and agroforestry/forest nursery area etc. The results are in accordance with the findings of Kanagaraj and Kathirvely (2018) who recorded and categorized various species of butterfly as very common (6), common (28), less common (16) and rare (2) respectively. Also similar observation was made by Bora and Meitei (2014) who find out diversity of butterflies in Assam University campus and observed very common (20), common (34), uncommon (29), rare (9) and very rare (4) of the species of butterfly in the study area.

Conclusion

Based on the results obtained from the study on butterfly diversity in the study area, Nymphalidae family was found maximum in number and percentage of the species of butterfly among all the families. Also company bagh was found highest among the other sites in terms of individual number of butterflies and Simpson index of diversity.

Therefore, it is concluded that the study area is rich in butterfly diversity and further research could be conducted to obtain details and documentation on butterfly diversity for the conservation and butterfly parks.

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