



## **A Study on the Diversity of Butterfly Species in Hastinapur Wildlife Sanctuary, Uttar Pradesh, India**

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### **Abstract**

Field study was carried out to record the diversity of butterfly species at three selected sites in Meerut region of Hastinapur Wildlife Sanctuary from April 2021 to November 2022. A total of 1,171 individuals of 27 species from 22 genera which belongs to five families, Nymphalidae, Pieridae, Papilionidae, Lycaenidae and Hesperidae were recorded in the study area during the survey periods. Family Nymphalidae was found dominated with 13 and 48% species followed by Pieridae 6 and 22%. The least number of species 2 and 8% have been recorded in family Hesperidae. Out of 27 species of butterfly, 11 species were found either in all three zones of the sanctuary or in any two of the three zones while 16 species were found confined in a specific sanctuary zone. The Simpson Index of Diversity was found highest in Shanti Upvan zone (0.9) followed by Draupadi Temple zone (0.8) and Abhimanu zone (0.7). It is observed that Meerut region of Hastinapur Wildlife Sanctuary is rich in terms of diversity of butterfly species and further studies might be conducted to figure out the variation in butterfly species diversity in different habitats.

**Keywords:** Butterflies, Diversity, Study sites and Hastinapur Wildlife Sanctuary

### **Introduction**

Butterflies are considered an important organism since they are not only a good pollinator (Abaynew et al., 2018), but also a good indicator of environment quality (Kim, 1993) hence, they need to be conserve. Butterflies belong to order Lepidoptera which is the second largest order in the class Insecta. Order Lepidoptera includes approximately 1, 50, 000 species of moths and butterflies (New et al., 1991). There are about 19,238 butterfly species have been documented all over the world (Heppner, 1998). Butterflies are

very sensitive to change in the environment and anthropogenic activities (Habel et al., 2021; Akite, 2008). Many researches have already been conducted to record the diversity of butterfly species in the various ecosystems of the world (Evans, 1932; Talbot, 1939; Talbot, 1947). In India researches have been conducted to document the diversity of butterfly species in some protected areas i.e. northern, northern east and central part (Singh et al., 2001; Paul & Sultana, 2020; Dey et al., 2017). Many authors have contributed to record the species diversity of Butterfly in southern part of India (Yates, 1993);

Harsh et al., 2015; Sidiq Bukhari et al., 2022; Basavarajappa et al., 2018). Butterfly species diversity in Nilgiri Biosphere and Eravikulam have been studied (Radhakrishna et al., 2001; Radhakrishna et al., 2002). Butterflies are very susceptible towards the climatic factors i.e. Extreme Temperature, Irregular Rainfall and Draught, changes in these factors are responsible for reducing the number of butterfly species (Kumar et al., 2017; Kavya et al., 2021). The reports from these studies clearly indicate that further researches must be conducted in various terrestrial ecosystems to understand the impact of climatic factors and food plants availability on the diversity of butterfly species. The present study was an attempt to record the diversity of butterfly species in Meerut region of Hastinapur Wildlife Sanctuary, U.P. India.

## Materials and Methods

### Geography of the study area:

Hastinapur Wildlife Sanctuary was established in 1986 and occupies 2,073 Km<sup>2</sup> area on both sides of the upper gangetic plain (Figure 1: Hastinapur Wildlife Sanctuary on map, <https://images.app.goo.gl?D1HL2s3q8cMGp2DW9>), spread across Bijnor, Muzaffarnagar, Meerut,

Amroha and Hapur district <https://images.app.goo.gl/f5vsNiPewczVjY1R8>. It is named after the ancient city of Hastinapur which lies on west bank of the Boodhi Ganga. HWS is situated between 28 46' - 29 35' N and 77 30' - 78 30' E, with an elevation gradient of 130-150 m above sea level. The overall sanctuary area is divided into microhabitats i.e. khola, khaadar, River Ganga and Boodhi Ganga. Khola region is covered with dense forest and khaadar region of the sanctuary mainly comprised of grasslands with a sprinkling of forests (Khan et al., 2013). The temperature of the region remains variable during the three main season i.e. hot in summer (April-June), moderate in monsoon (July-October) and cold in winters (November-March). The temperature reaches up to 42°C during the day time in summers and 32°C in the night. During winters the temperature drops to 10°C in the night and 22°C in the day time, temperature remains pleasant in monsoon season ranging from 32°C to 25°C. The average rainfall is 1000mm-1200mm. The vegetation of the sanctuary is comprised of tall wet grasslands, dry short grasslands, dry scrub grasslands and plantations (Nawab, 2000). This natural vegetation occupy only 17% of the sanctuary area the remaining 83% is covered under cultivation resulted in human disturbance (Khan et al., 2003).

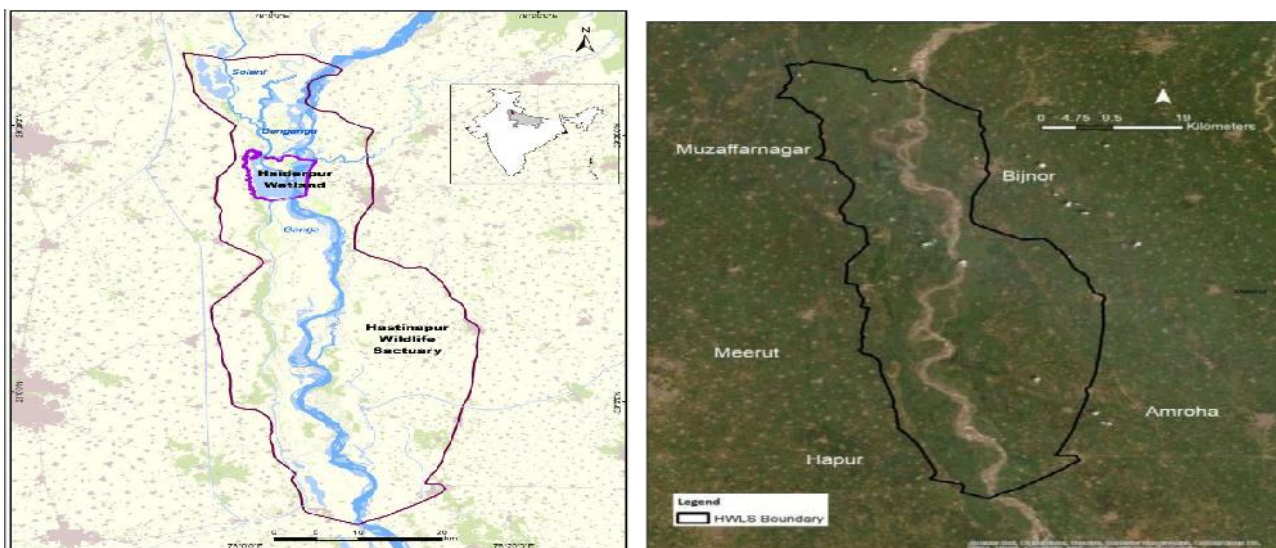


Figure 1: Location Map of Hastinapur Wildlife Sanctuary, (U.P.) India

## Survey Period and Sampling Method

The field study was carried out at three selected sites in Meerut region of Hastinapur Wildlife Sanctuary from April 2021 to November 2022. Surveys were conducted once in a month in each site in bright sunny days from 10 A.M. to 4 P.M when butterflies remain more active. Sampling was done by line transect method (Pollard, 1977). Each transect was divided into four segment of 100 meters. The counts were made by walking in a straight line up to 100 meters with a uniform pace. Butterflies were observed within 2.5 meters on both sides of the transect then spotted, captured, identified and released immediately at the spot. Species identification in relation with abundance was done with naked eyes, photographs taken by digital camera (Nikon D 5600) and magnifying lenses.

## Identification of species

Identification of species was done by analyzing the data which was in the form of photographs, taken by digital camera. Photographs were taken in both positions (open and closed wings). Species were identified on the basis of their morphological appearance like size, shape, color, design and pattern. Reference books, Literature, Internet data and Photographs were used for accurate identification (Kumar et al., 2016).

## Statistical Analysis

The butterfly species recorded in the study sites were analyzed by Simpson Index of Diversity (Abdullahi et al., 2019).

The Simpson Index of Diversity mathematical formula is as follows:

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

D = Diversity Index

= sum of (Total)

n = the number of individuals of a particular species

N = the number of individuals of all species

## Results

The butterfly species recorded in the study area are enlisted in (Table: 1,2&3). The results revealed that a total of 1,171 individuals of 27 species, belonging to 5 families were recorded in the study area. The number of individuals was found variable in each study site during the survey period. Maximum abundance was found in September, October and November while minimum abundance was recorded in December and January. Out of five families, Nymphalidae was found dominated with (13 and 48%) species followed by Pieridae with (6 and 22%) species. (3 and 11%) species of family Papilionidae and Lycaenidae and (2 and 8%) species of family Hesperidae have been recorded in the study area (Figure: 2 & 3). In the present study, out of three study sites Shanti Upvan zone was found more divers with total of (N=628) individuals of different species and families percentage were as follows (Nymphalidae 45%, Pieridae 23%, Papilionidae 14%, Lycaenidae 9% and Hesperidae 9%) followed by Draupadi Temple zone (N=360) with following families percentage (Nymphalidae 36%, Pieridae 29%, Papilionidae 7%, Lycaenidae 21% and Hesperidae 7%) respectively. The diversity in Abhimanu zone was found less as compare to other (N=183) with only 3 families (Nymphalidae 67%, Pieridae 22%, Papilionidae 11%) (Figure: 4). The Simpson index of diversity was found highest in Shanti upvan zone (0.9) followed by Draupadi Temple zone (0.8) and Abhimanu zone (0.7) presented in (Table: 4).

**Table 1: checklist of the butterfly species recorded at the survey sites of Sanctuary**

S.No.	Family	Scientific Name	Common Name	Individual Number of Butterflies
1	<b>Nymphalidae</b>	<i>Ariadne ariadne</i>	Angled Castor	45
2		<i>Atrophaneura latreillei</i>	Rose Windmill	31
3		<i>Danaus chrysippus</i>	Plain tiger	80
4		<i>Danaus genutia</i>	Common Tiger	32
5		<i>Hypolimnas bolina</i>	Blue Moon, Common eggfly	02
6		<i>Junonia almana</i>	Peacock pansy	15
7		<i>Junonia atlites</i>	Grey Pansy	02
8		<i>Junonia hierta</i>	Yellow Pansy	85
9		<i>Junonia orithya</i>	Blue pansy	20
10		<i>Melanitis leda</i>	Common Evening Brown	38
11		<i>Moduza procris</i>	Commander	38
12		<i>Phalanta phalantha</i>	Common Leopard	65
13		<i>Ypthima baldus</i>	Common Five-ring	10
14	<b>Pieridae</b>	<i>Catopsilia pomana</i>	Common Emigrant or Lemon Emigrant	54
15		<i>Cepora nerissa</i>	Common Gull	75
16		<i>Delias eucharis</i>	Common Jazebel	05
17		<i>Eurema hecabe</i>	Common Grass Yellow	108
18		<i>Ixias pyrene</i>	Yellow Orange-Tip	100
19		<i>Pareronia valeria</i>	Common Wanderer	02
20	<b>Papilionidae</b>	<i>Graphium doson</i>	Common Jay	20
21		<i>Papilio demoleus</i>	Lime Butterfly	84
22		<i>Papilio polytes</i>	Common Mormon	18
23	<b>Lycaenidae</b>	<i>Castalius rosimon</i>	Common Pierrot	73
24		<i>Glaucopsyche lygdamus</i>	Silver blue	105
25		<i>Talioda nyseus</i>	Red Pierrot	22
26	<b>Hesperiidae</b>	<i>Potanthus lydia</i>	Darts	25
27		<i>Telicota ancilla</i>	Dark Palm dart	17

**Table 2: Butterfly species recorded at specific study sites of Hastinapur Wildlife Sanctuary**

S.No.	Family	Scientific Name	Study Sites		
			Shanti Upvan Zone	Draupadi Temple Zone	Abhimanu Zone
1	<b>Nymphalidae</b>	<i>Ariadne ariadne</i>	+	-	-
2		<i>Atrophaneura latreillei</i>	+	+	+
3		<i>Danaus chrysippus</i>	+	+	+
4		<i>Danaus genutia</i>	+	+	+
5		<i>Hypolimnas bolina</i>	-	+	-
6		<i>Junonia almana</i>	+	-	-
7		<i>Junonia atlites</i>	+	-	-
8		<i>Junonia hierta</i>	-	-	+
9		<i>Junonia orithya</i>	+	-	-
10		<i>Melanitis leda</i>	-	-	+
11		<i>Moduza procris</i>	+	-	-
12		<i>Phalanta phalantha</i>	+	+	+
13		<i>Ypthima baldus</i>	+	-	-
14	<b>Pieridae</b>	<i>Catopsilia pomana</i>	+	+	+
15		<i>Cepora nerissa</i>	+	+	-
16		<i>Delias eucharis</i>	+	-	-
17		<i>Eurema hecabe</i>	+	+	+
18		<i>Ixias pyrene</i>	-	+	-
19		<i>Pareronia valeria</i>	+	-	-
20	<b>Papilionidae</b>	<i>Graphium doson</i>	+	-	-
21		<i>Papilio demoleus</i>	+	-	-
22		<i>Papilio polytes</i>	+	+	+
23	<b>Lycaenidae</b>	<i>Castalius rosimon</i>	+	+	-
24		<i>Glaucopsyche lygdamus</i>	+	+	-
25		<i>Talicoda nyseus</i>	-	+	-
26	<b>Hesperiidae</b>	<i>Potanthus lydia</i>	+	-	-
27		<i>Telicota ancilla</i>	+	+	-

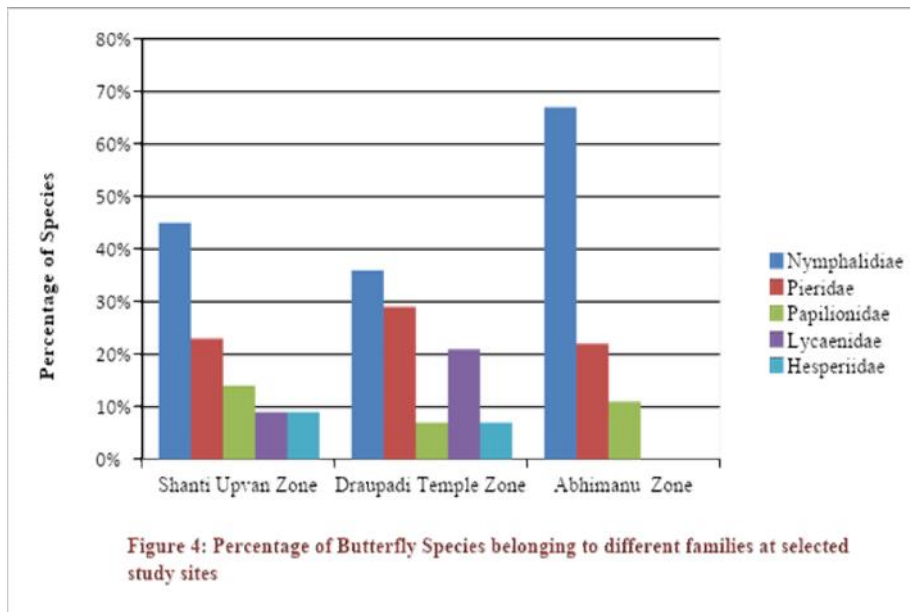
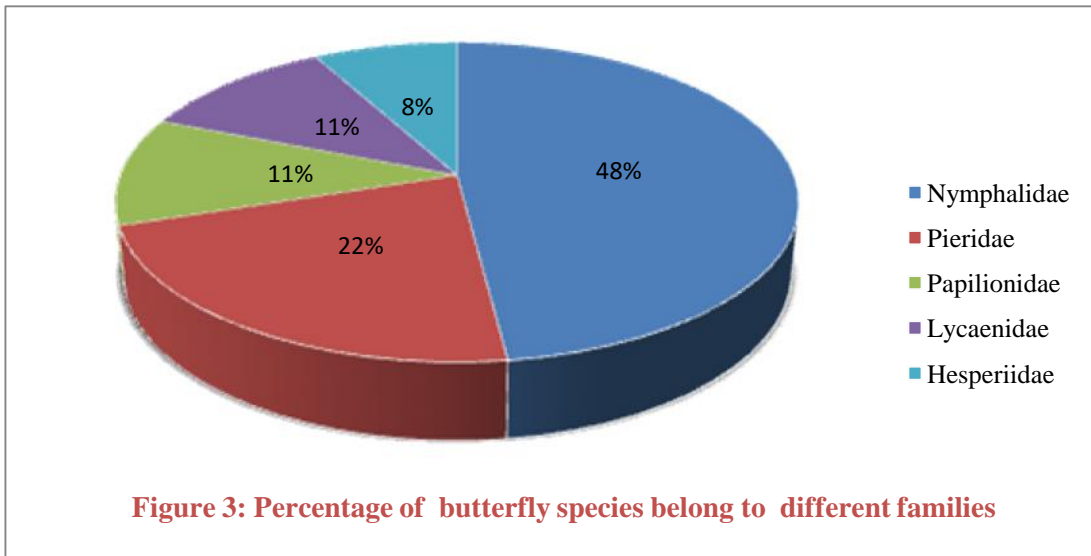
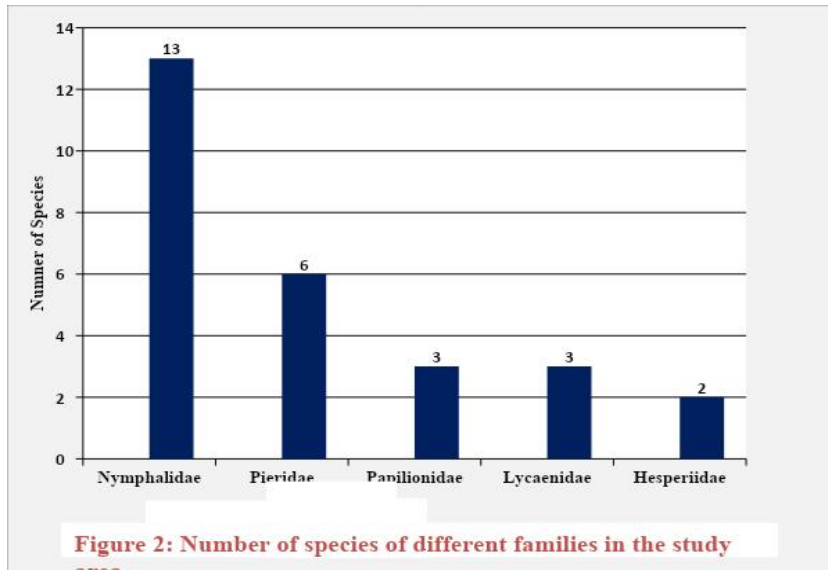








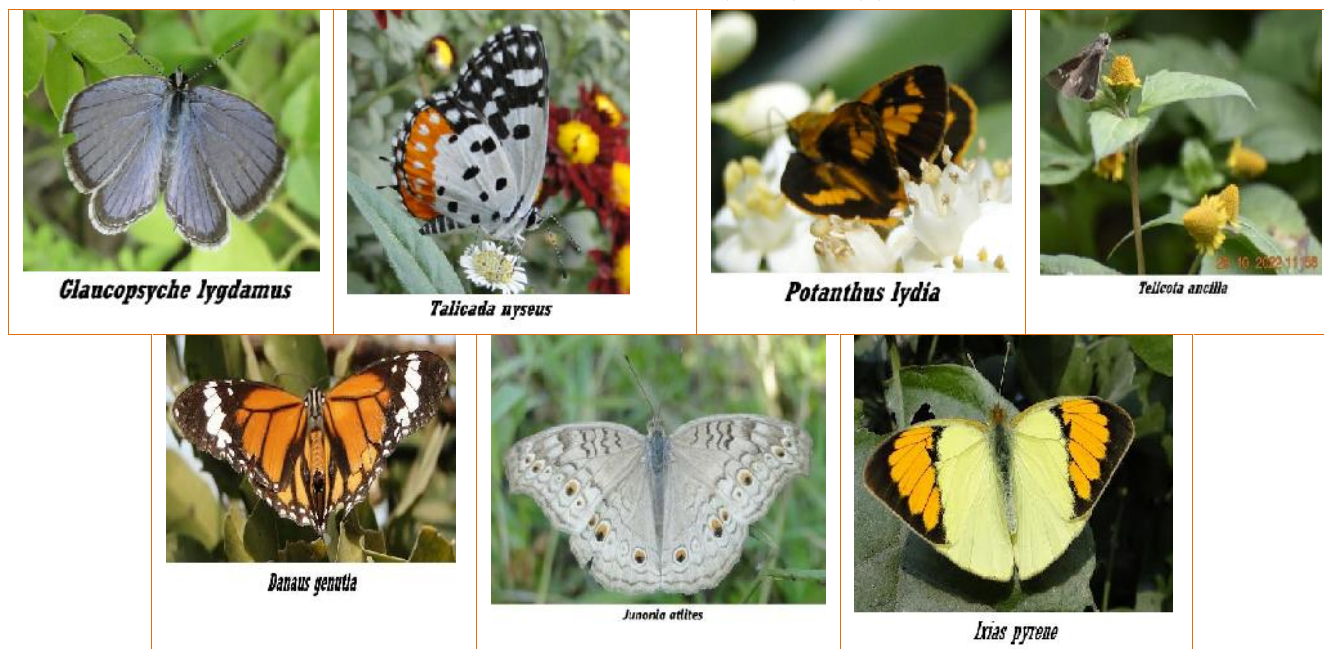


Table 3: Photographs of the butterfly species recorded in the study area

 <p><i>Ariadne ariadne</i></p>	 <p><i>Danaus chrysippus</i></p>	 <p><i>Hypolimnas bolina</i></p>	 <p><i>Atrophaneura latreillei</i></p>
 <p><i>Melanitis leda</i></p>	 <p><i>Junonia almana</i></p>	 <p><i>Junonia crithya</i></p>	 <p><i>Junonia heurtia</i></p>
 <p><i>Moduza procris</i></p>	 <p><i>Phalanta phalantha</i></p>	 <p><i>Ypthima baldus</i></p>	 <p><i>Catopsilia pomana</i></p>
 <p><i>Gepora nerissa</i></p>	 <p><i>Delias eucharis</i></p>	 <p><i>Eurema hecabe</i></p>	 <p><i>Pareronia valeria</i></p>
 <p><i>Graphium doson</i></p>	 <p><i>Papilio demoleus</i></p>	 <p><i>Papilio polytes</i></p>	 <p><i>Castalius rosimon</i></p>



**Table 4: Number of Butterflies and Simpson Index of Diversity in the Study area**

S.No.	Selected Site	Number of Butterflies	Simpson Diversity Index
1	Shanti Upvan Zone	628	0.9
2	Draupadi Temple Zone	360	0.8
3	Abhimanu Zone	183	0.7

## Discussion

According to the data, individuals of different species were found variable in different zones due to the availability of their host & food plants. Maximum abundance has been recorded from September to November when flowering was high while reduction in the number of individuals of different species was observed in December and January month due to less flowering. The diversity index in Shanti Upvan zone was highest among the study sites since this zone is richest in terms of diversity of flowering plants as well as abundance of weeds. The reason for the less diversity of butterflies in Draupadi Temple zone and Abhimanu zone might be due to less number of flowering plants, also Abhimanu zone is surrounded by agricultural land and remains disturb due to anthropogenic activities. Due to the use of chemical pesticides on agricultural land this area is highly susceptible for diversity loss. The distribution of butterfly families positively correlates with diversity and distribution of their host and food plants in the habitat (Fileccia et al.,

2015). Since flowering plants provide nectar to the adult butterflies which encourage the diversity of butterflies hence their habitats must have sufficient adult and larval food resources.

## Conclusion

On the basis of the results obtained from the study area it is concluded that the diversity of butterfly species is high in Meerut region of Hastinapur wild life sanctuary. Family, Nymphalidae was found dominated with 13 species of 9 Genera. Among the three survey sites, Shanti Upvan zone with high plant diversity holds high number of butterfly species. Butterflies are considered as ecologically important organisms since these are good pollinator and also good indicator of environmental quality (Brereton et al., 2010; Fleishman & Murphy, 2009). Hence further studies must be conducted to conserve the diversity and their natural habitat.

**Conflicts of Interest:** The authors declare no conflicts of interest.



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