



## Measurement of diversity and abundance of butterflies (Order- Lepidoptera) at Atal Harit Upwan, Rahimabad, Lucknow

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### Abstract

The analysis of diversity and abundance of butterflies were conducted in Atal Harit Upwan, Rahimabad, Lucknow from March 2023 to May 2023. Butterflies help in pollination and are the vital part of the food chain and also indicate climate change as well as prosperity of the environment. The wide distribution of butterflies in the study site is an important element in the dynamic of this urban ecosystem. This study reveals that at study site family Nymphalidae is dominating by comprising 19 species, followed by 9 species of Lycaenidae, 8 species of Pieridae, 4 species of Papilionidae and 2 species of family Hesperidae. The abundance and diversity of each butterfly species usually depends upon the accessibility of their host plant, habitation as well as its environmental conditions. This study will cast light upon the species diversity as well as abundance of butterflies at Atal Harit Upwan, Rahimabad, Lucknow.

**Keywords:** Butterflies, Atal Harit Upwan, diversity, abundance, environment, habitat, host plant

### Introduction

The diversity is a measure of how individuals in an ecological community are distributed among the species. The number and available niches in the environment will be represented by the measure of fauna diversity. If niche heterogeneity is high, it will support a more diverse fauna, resulting in a higher co-efficient or index of the diversification (Saravanan and Venkat Ramalingam 2021) [11].

There are over one million known species of insects in the world and some experts estimate that there might be as many as 10 million. Lepidoptera is a very large order under class Insecta that includes some of the most beautiful species and many economically important pests. Butterflies are extremely important group of colorful insects. The trace of their evolution dates back in mid – Eocene epoch, about 40 – 50 million years ago after the appearance of angiosperms. All butterflies are included under group Macro Lepidoptera along with some larger moths. They prefer specific habitats and their diversity is restricted to different seasons (Kunte, 1997 [22] and Padhaye *et al.*, 2006). Butterflies have been studied systematically since the early 18th century and 19,238 species have been documented worldwide (Heppner, 1998) [6]. This figure is not constant because of continuous discovery of new butterflies (Lewis, 1973 [8]; Stokoe, 1974 [12]; Mani, 1986 [9]; Godden, 1997 [4]; Green and Huang, 1998 [5]; Barua *et al.*, 2004 [2]; Ambrose *et al.*, 2005 [1]; Xavier, 2006 [13]; Chandra *et al.*, 2007 [3]; Parag and Omkar, 2009) [10], and also due to ongoing disagreements between taxonomist over the status of many species.

Around the world, butterflies are regarded as one of the most well taxonomically and ecologically studied group of insects belonging to the order Lepidoptera (Robbins and Opler, 1997 [26]; Mihoci *et al.*, 2011) [25]. Kunte *et al.* (2012) [20] 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) [21].

Butterflies prefer a particular set of habitats and host plants for their survival. Being sensitive to the temperature, humidity and light levels and also to disturbances and changes in the quality of habitat they are regarded as potential indicator species of environmental quality and healthy ecosystems (Gunathilagaraj *et al.*, 1998 [27], Balmer and Erhardt, 2000 [28]; Hogsden and Hutchinson, 2004 [29] and Thomas, 2005) [30]. Their larvae or caterpillars feed on tender leafy plants but adults often visit flowers of nectariferous plants. Some of the species are attracted to saps of injured plants, rotten fruits, sugars, horse droppings and toddy. Their food plants may be specific or many. Jungles, forests or upland meadows and flower gardens are considered favorable collecting places (Majumdar 2012).

The distribution of butterflies involves both expanding and contracting ranges, but natural changes in the distribution of species can be difficult to deduce because they tend to be slower and subtler than the dramatic changes caused by man. Unfortunately, most expanding ranges involve introduced species and most contracting ranges are due to the destruction of natural habitats (Lafontaine, 1997) [7]. The present study was undertaken at our campus of Atal Harit Upwan, Rahimabad. It is a lush green campus which is rich in its biodiversity, housing many endemic and endangered species of flora and fauna. This campus also comprises various species of butterflies belonging to family Papilionidae – swallowtails, Pieridae – white and yellow Nymphalidae – Brush footed butterfly, Lycaenidae – blues, and Hesperidae – skippers. Hence, this present study was set about to provide baseline information on the checklist of butterflies and their diversity and abundance in the given study area.

## Materials and Methods

### 1. Study Area

Atal Harit Upwan (N 26° 44' 18" E 80° 53' 06") comprises 15 acres of land (figure 1) which has various habitats including grassland, marshland and forests. The butterfly park (Image 1) is also present in this campus which comprises of various host plants and nectariferous plants for butterflies. The soil of this study area is a new alluvial soil with more sand and silt than clay.

### 2. Field Methods

Data on daily basis from March 2023 to May 2023 has been recorded in survey data sheet in morning shift. The temperature and humidity which are the crucial factors for diversity of butterflies has also been recorded daily in survey data sheet by using Thermo Hygrometer. The butterflies were recorded directly in the field by the "Pollard walk" method as used by (Moore,1975 [14]; Pollard *et al*,1975 [15]; and Walpole and Sheldon,1999) [16]. The number of butterflies were recorded by direct watching and through the photographic confirmations. The collection of specimens was strictly avoided. The butterflies that could be identified in the field were not captured while those that could not be identified were captured by the sweep net method and identified using suitable keys (Gay *et al*,1992; Haribal,1992; Parasharya and Jani,2007 [17]; Kehimkar,2008) [18] and released back in same habitat with least disturbance. The individuals observed were classified into different families as per the classification. Photographs were taken from different angles with (Nikon D5600) DSLR Camera. On the basis of constant sighting of the butterfly species has been divided into four categories namely Very Common, Common, Rare and Very Rare. All the scientific name and identification of Butterflies followed in the present study is referred from (Varshney,1983 [32]; Wynter – Blyth, 1957 [31]; Peter Smetacek, 2017) [33].

### Statistical Analysis

- The collected data from study site has been calculated by following formulas: -

Simpson's Diversity Index - It is denoted by  $D$  and this index is calculated as:

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

Where;  $n$  = the total number of butterflies of a particular species.

$N$  = the total number of butterflies of all species.

- The value for Simpson's Diversity Index ranges between 0 and 1.

The Shannon – Weiner Diversity Index - It is denoted by  $H$  and calculated as follows: -

$$H = -\sum p_i \ln(p_i)$$

Where;  $\Sigma$  = A Greek symbol that means "sum".

$\ln$  = Natural log

$p_i$  = The proportion of the entire community made up of species  $i$ .

(Divide number of individuals of species  $i$  by total number of samples)

- Genus (%) = [(Total number of genus in a family) / (Total number of genera in all families)] × 100
- Species (%) = [(Total number of species in a family) / (Total number of species in all families)] × 100

## Results and Discussions

The diversity and abundance of butterflies was conducted in Atal Harit Upwan, Rahimabad, Lucknow during March 2023 to May 2023. The total 42 species belonging to 5 families of 29 genera were recorded from the study site (Table 1). The total number of individuals in different months along with their abundance is given in (Table 3; Figure 3). The results shows that the highest relative abundance of butterflies was recorded in the month of April (2.989) and least in the month of May (2.29) (Table 3; Figure 3). Table 3 shows the diversity of butterflies in different months which has been calculated by Simpson Diversity Index ( $D$ ). Month of April shows the highest diversity index (0.912) while the month of March and May has the same diversity (0.902) (Table 3; Figure 2). The present study shows that the highest genera percentage was recorded from the family Nymphalidae 11 genera (37.93%), followed by Lycaenidae 8 genera (27.58%), Pieridae 6 genera (20.68%), Papilionidae 3 genera (10.34%) and Hesperidae 1 genera (3.44%) given in (Table 4; Figure 4). The highest species percentage composition of butterfly was recorded from the Nymphalidae 19 species (45.23%) followed by Lycaenidae 9 species (21.42%); Pieridae 8 species (19.04%); Papilionidae 4 species (9.52%) and Hesperidae 2 species (4.76%) given in (Table 4; Figure 4). This is the first study at Atal Harit Upwan, Rahimabad related to butterflies and this study area provides a good prospect for protection and conservation of wildlife biodiversity in urban areas.

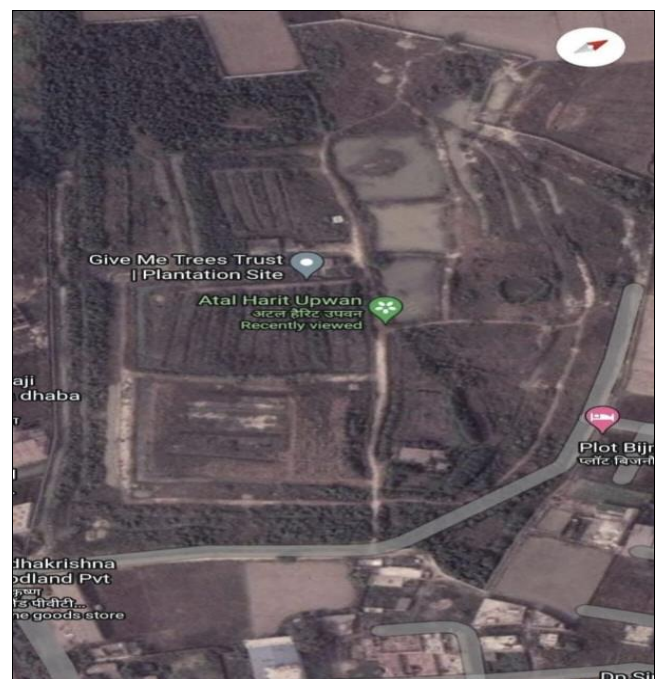
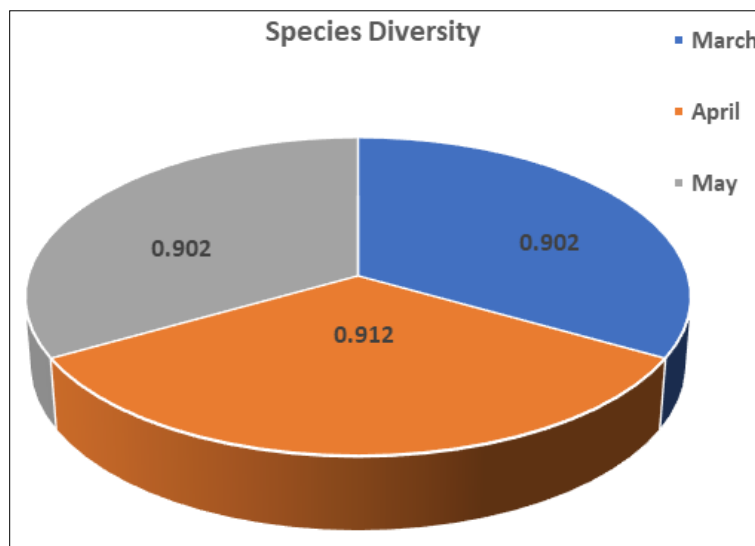


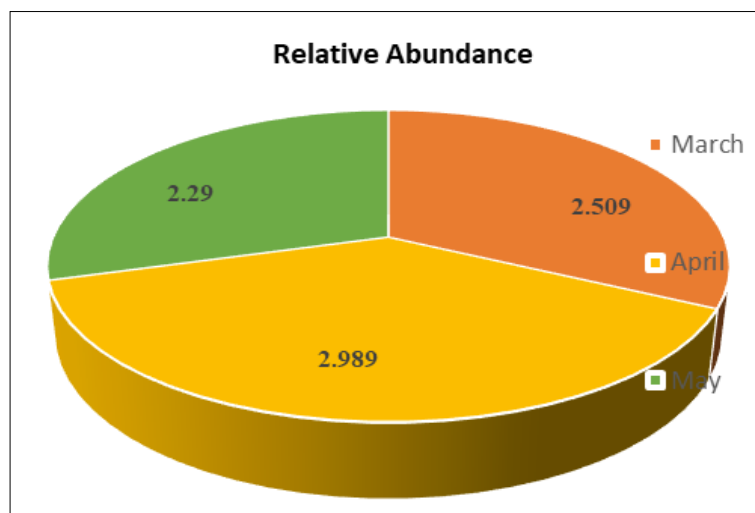
Fig 1: Map of the study area



**Image 1:** Butterfly Park at Atal Harit Upwan



**Fig 2:** Species diversity of butterfly in three different months recorded from study area.



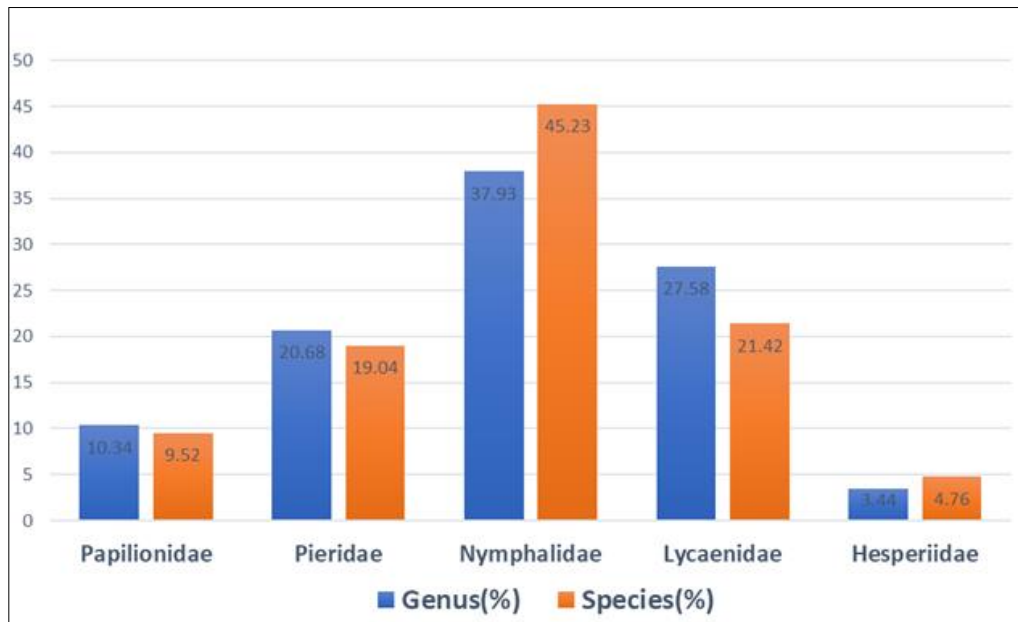
**Fig 3:** Relative abundance of butterfly in three different months recorded from study area

**Table 1:** Total number of individuals; species diversity and relative abundance of butterfly in Atal Harit Upwan, Rahimabad; Lucknow.

S.No.	Month	Total no. of individual	Species diversity	Relative abundance
1.	March	1966	0.902	2.509
2.	April	2138	0.912	2.989
3.	May	2140	0.902	2.29

**Table 2:** List of families with number of genus and species of butterflies recorded from the butterfly park of Atal Harit Upwan, Rahimabad; Lucknow.

S. No.	Family	Genus (29)	Species (41)	Genus (%)	Species (%)
1.	Papilionidae	3	4	10.34	9.52
2.	Pieridae	6	8	20.68	19.04
3.	Nymphalidae	11	19	37.93	45.23
4.	Lycaenidae	8	9	27.58	21.42
5.	Hesperiidae	1	2	3.44	4.76



**Fig 4:** Family wise percentage compositions of Butterflies Species recorded in study area.

**Table 3:** Status of each butterfly species recorded in the butterfly park of Atal Harit Upwan, Rahimabad; Lucknow during study period.

S.NO.	Common name	Scientific name	Status
Family – Papilionidae 3/4 (Genera/Species)			
1	Common Rose	<i>Pachliopta aristolochiae</i>	VR
2	Common Mormon	<i>Papilio polytes</i>	VR
3	Lime Butterfly	<i>Papilio demoleus</i>	VC
4	Common Jay	<i>Graphium doson</i>	VR
Family – Pieridae 6/8 (Genera/Species)			
5	Psyche	<i>Leptosia nina</i>	VR
6	Small Grass Yellow	<i>Eurema brigitta</i>	VC
7	Common Grass Yellow	<i>Eurema hecabe</i>	VC
8	Pioneer	<i>Belenois aurota</i>	C
9	Common Gull	<i>Cepora nerissa</i>	R
10	Mottled Emigrant	<i>Catopsilia pyranthe</i>	C
11	Common Emigrant	<i>Catopsilia pomona</i>	VC
12	Common Wanderer	<i>Pareronia valeria</i>	VR
Family – Nymphalidae 11/19 (Genera/Species)			
13	Common Tiger	<i>Danaus genutia</i>	VC
14	Plain Tiger	<i>Danaus chrysippus</i>	VC
15	Common Crow	<i>Euploea core</i>	VR
16	Common Palmfly	<i>Elymnias hypermnestra</i>	VR
17	Tawny Coster	<i>Acraea violae</i>	VR
18	Painted Lady	<i>Vanessa cardui</i>	VR
19	Lemon Pansy	<i>Junonia lemonias</i>	VR
20	Chocolate Pansy	<i>Junonia iphita</i>	VR
21	Peacock Pansy	<i>Junonia almana</i>	VR
22	Blue Pansy	<i>Junonia orithya</i>	VR

23	Great Eggfly	<i>Hypolimnas bolina</i>	VR
24	Danaid Eggfly	<i>Hypolimnas misippus</i>	VR
25	Angled Castor	<i>Ariadne ariadne</i>	VR
26	Common Castor	<i>Ariadne merione</i>	VR
27	Common Evening Brown	<i>Melantis leda</i>	VR
28	Dark Evening Brown	<i>Melantis phedima</i>	VR
29	Common Three ring	<i>Ypthima asterope</i>	VC
30	Common Four Ring	<i>Ypthima huebneri</i>	VC
31	Blue Tiger	<i>Tirumala limniace</i>	VR
Family – Lycaenidae 8/9 (Genera/Species)			
32	Plains Cupid	<i>Chilades pandava</i>	VR
33	Lime Blue	<i>Chilades lajus</i>	VC
34	Pale Grass Blue	<i>Pseudozizeeria maha</i>	VC
35	Dark Grass Blue	<i>Zezeeria karsandra</i>	VC
36	Pea Blue	<i>Lampides boeticus</i>	VC
37	Common Pierrot	<i>Castalius rosimon</i>	VR
38	Zebra Blue	<i>Leptotes plinius</i>	R
39	Tiny Grass Blue	<i>Zizula hylax</i>	VC
40	Grass Jewel	<i>Freyeri trochylus</i>	VR
Family – Hesperidae 1/2 (Genera/Species)			
41	Rice Swift	<i>Borbo cinnara</i>	VR
42	Bevan's Swift	<i>Borbo bevani</i>	VR

**Abbreviations:** VC = Very common, C = Common, VR = Very rare, R = Rare.

\*Markings of status is strictly based on sightings in particular study area/site.

## Conclusion

In the present study a total of 42 species of butterflies belonging to 29 genera and five families were recorded. Butterfly Park of Atal Harit Upwan comprises of natural vegetation which has mud puddling area for butterflies and proper availability of food plants i.e., host plant and nectariferous plants which gives complete conditions for the flourishing of various species of butterflies. We should conserve our biodiversity to attain the sustainable development that will help in maintaining our ecosystem.

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