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A comparative study of butterfly diversity in varying habitats of urban green spaces

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Abstract

A comparative study of butterfly diversity was conducted in the campus of Dharmaram Vidya Kshetram and Lalbagh botanical garden in Bangalore. The objective of this study was to compare the butterfly diversity between the garden maintained by the campus and a botanical garden. A total of 43 species was recorded belonging to 5 families. Among the recorded families Nymphalidae was found to be higher in number with 20 species. Family Pieridae was found to be the second most abundant with 8 species followed by Hespiiridae (7), Papilionidae (5) and Lyceanidae being the least abundant with only 3 species. The Simpson diveristy index was found to be higher in Dharmaram Vidya Kshetram Campus (0.9) followed by Lalbagh botanical garden (0.8).

Keywords: Butterfly, diversity, Lalbagh.

Introduction

Phylum Arthropoda is considered to be the largest among all the other species in the Animal Kingdom. Arthropods have evolved to survive at very extreme and harsh conditions as they possess characters like high adaptability to changing climatic conditions, living is diverse habitats and a tough exoskeleton to protect them from external harm which allows them to overcome the pressure of natural selection and show high survival rate. Butterflies belong to the Class Insecta and Order Lepidoptera.They are found to be in various colors and patterns. Some of the species exhibit excellent mimicry mechanisms and camouflage themselves among leaves and branches of trees to avoid being attacked by predators. Butterflies play a major role in the process of pollination by helping in the transfer of pollen grains. The technical term given for pollinating butterflies are called Psychophily (Palatty Allesh Sinu, 2016).

Study Area

Site 1: Dharmaram Vidya Kshetram

Dharmaram Vidya Kshetram is an institution for higher education located at DVK road, Bhavani Nagar next to Christ University Hosur Road campus in Bangalore. This

campus also is home to various varieties of flora and fauna. It is located at a latitude of 12.5601^0N and a longitude of 77.3624^0E and spread over an area of 100 acres. One of the smallest butterfly and the fifth largest butterfly in the country was recorded in this site. The study area is found to be having flora ranging from small flowering plants to huge coconut trees. The regular watering and maintenance of the greenery invites large number of animals and insect visitors.

Site 2: Lalbagh Botanical Garden

Lalbagh Botanical Garden has a great role in introducing ornamental plants and exotic flowers attracting a wide range of butterflies and insect pollinators. The whole garden serves as a recreational space and attracts tourists from various parts in and around Bangalore. It is located in Mavalli, south Bangalore. The whole area measures to around 240 acres, located a latitude of 12.5707^0N and a longitude of 77.3508^0E housing over 1,000 species of plants. The Band stand area was selected as a region for the study.

Materials and Methods

The survey was conducted over a period of four months spanning from January 2022 to April 2022. Observations were made by making point transects at the area of survey and observations at each transect lasted for 10 minutes (Sevilleja C.G *et al*, 2019). The study was carried out thrice a week between 12PM to 4PM as Butterflies are found to be the most active at the hottest hours of the day. The butterfly species documented were identified using the field guide 'Bengaluru Butterflies' by O.K. Remadevi *et al*, 2018.

Fig. 1. Dharmaram Vidya Kshetram Campus (PC:Google maps)

Fig. 2. Lalbagh Botanical Garden (PC:Google maps)

Results

The analysis of the data collected on both the sites suggested that the area has a rich butterfly diversity along with other Fauna. There was a total of 3643 individuals recorded at Dharmaram Vidya Kshetram Campus and 1139 individuals at Lalbagh Botanical Garden. 43 species of Butterflies belonging to 5 families were analyzed. Family Nymphalidae was the most abundant with 20 species showing 46.51% of participation, Pieridae (8) was the second most abundant with 18.60% of participation followed by Hespiiridae (7) – 16.27%, Papilionidae (5) – 11.62% and Lycaenidae (3) being the least abundant with 6.97% of participation.

The Statistical Analysis of the data was done by using Simpsons Diversity Index which is given as:

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

Where,

n = number of individuals of each species

N = total number of individuals of all species

The diversity of the species observed and the analysis of the data with the Diversity index suggested that the highest number of Butterflies were found at Dharmaram Vidya Kshetram Campus (3643, 0.9) which was followed by Lalbagh Botanical Garden (1139, 0.8).

Table 1. Checklist of Species

Sl. No.	Scientific Name	Common Name	Family	DVK Campus (Number)	Lalbagh (Number)
1	*Graphium agamemnon*	Dakhan Tailed Jay	Papilionidae	278	2
2	*Grapium doson*	Common Jay	Papilionidae	303	5
3	*Junonia iphata*	Oriental Chocolate Pancy	Nymphalidae	108	7
4	*Papilio polytes*	Common Mormon	Papilionidae	93	8
5	*Junonia lemonias*	Chinese Lemon Pancy	Nymphalidae	736	333
6	*Danaus chrysippus*	Oriental Plain Tiger	Nymphalidae	172	49
7	*Neptis hylas*	Indian Common Sailor	Nymphalidae	36	4
8	*Delias eucharis*	Common Jezbel	Pieridae	20	4
9	*Eurema sp*	Grass Yellow Species	Pieridae	363	35
10	*Hypolimnas bolina*	Great Eggfly	Nymphalidae	93	-
11	*Hypolimnas missipus*	Danaid Eggfly	Nymphalidae	79	4
12	*Papilio polymnestor*	Blue Mormon	Papilionidae	73	-
13	*Pelopidas mathias*	Small Branded Swift	Hespiiridae	4	-
14	*Ariadne indica*	Angled Castor	Nymphalidae	13	1
15	*Ariadne merione*	Common Castor	Nymphalidae	16	3
16	*Melanitis leda*	Common Evening Brown	Nymphalidae	9	-
17	*Belenois aurota*	Indian Pioneer	Pieridae	11	7
18	*Elymnias caudata*	Tailed Palmfly	Nymphalidae	10	-
19	*Chilades pandava*	Plains Cupid	Lycaenidae	603	293
20	*Badamia exclamationis*	Brown Awl	Hesperiidae	1	-
21	*Pothanthus sp*	Dart Sp	Hesperiidae	3	-
22	*Lethe europa*	Bamboo Treebrown	Nymphalidae	1	-
23	*Oriens goloides*	Smaller Dartlet	Hespiiridae	1	-
24	*Junonia orithya*	Blue Pancy	Nymphalidae	2	2
25	*Jamides celeno*	Common Cerulean	Lyceanidae	2	1
26	*Telicota bambusa*	Dark Palm Dart	Hesperiidae	1	-
27	*Gangara thyrsis*	Giant Redeye	Hesperiidae	1	-
28	*Mycalesis perseus*	Common Bushbrown	Nymphalidae	1	-
29	*Spalgis epeus*	Oriental Apefly	Lycaenidae	2	-
30	*Appias albina*	Common Albatross	Pieridae	89	36
31	*Euploea core*	Common Crow	Nymphalidae	53	8
32	*Phalanta drury*	Common Leopard	Nymphalidae	19	47
33	*Ypthima asterope*	Common Three Ring	Nymphalidae	149	-
34	*Hebomoia glaucippe*	Sahyadri Great Orange Tip	Pieridae	64	81
35	*Hasora chromus*	Banded Awl	Hespiiridae	3	-
36	*Junonia hierta*	Yellow Pancy	Nymphalidae	1	11
37	*Acraea terpsicore*	Tawny Coaster	Nymphalidae	1	30
38	*Tirumala limniace*	Blue Tiger	Nymphalidae	10	-
39	*Papilio demoleus*	Lime Butterfly	Papilionidae	4	29
40	*Catopsilia pyranthe*	Mottled Emigrant	Pieridae	207	131
41	*Catopsilia pomona*	Common Emigrant	Pieridae	8	-
42	*Junonia almana*	Peacock Pancy	Nymphalidae	-	7
43	*Pareronia hippia*	Indian Wanderer	Pieridae	-	1

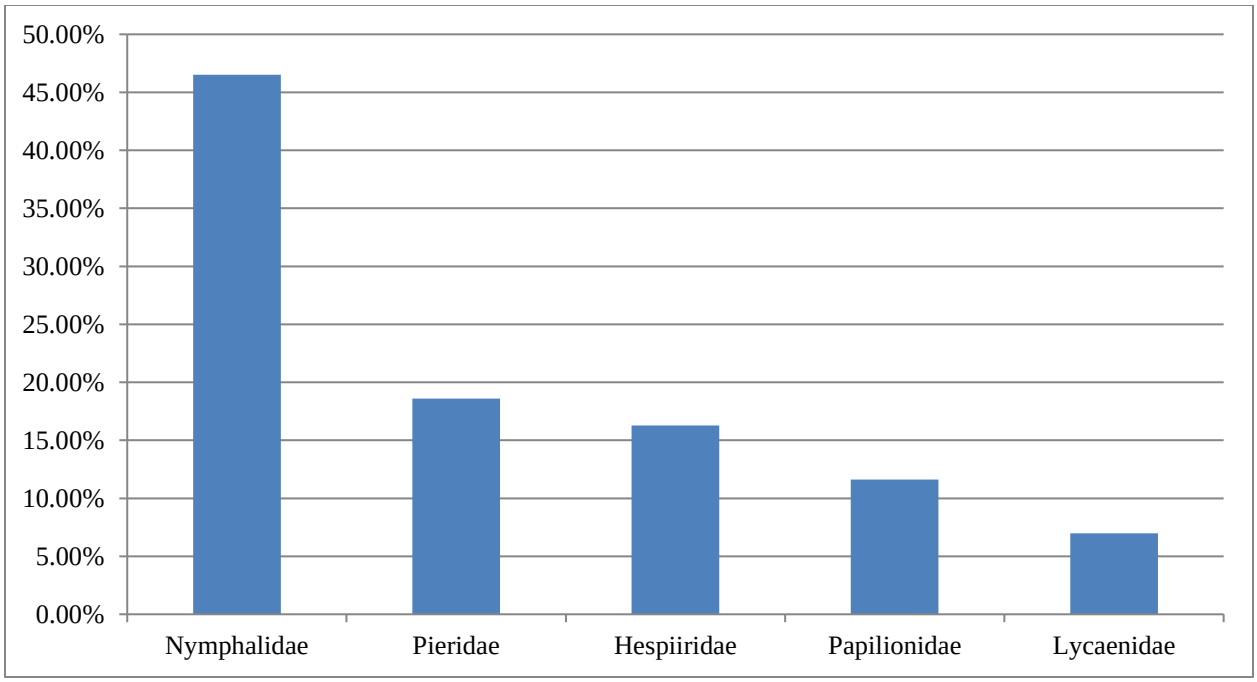
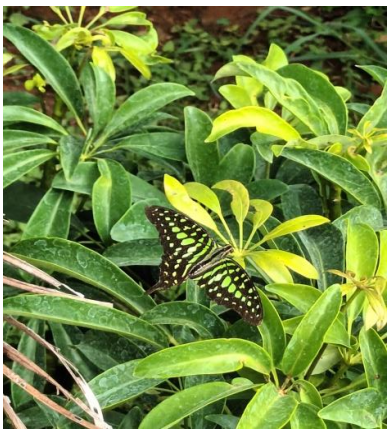
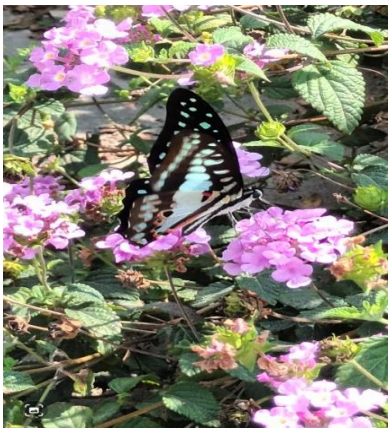


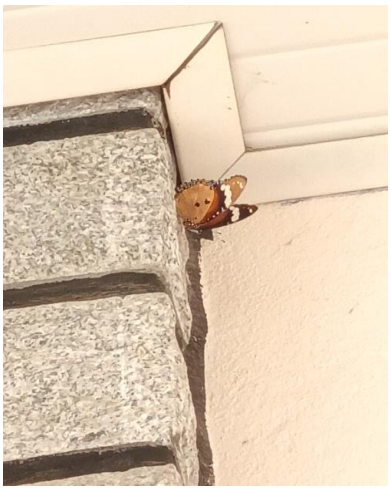
Fig. 3. Graphical Representation of Family comparison

Table 2. Simpson Diversity Index of the Study Area

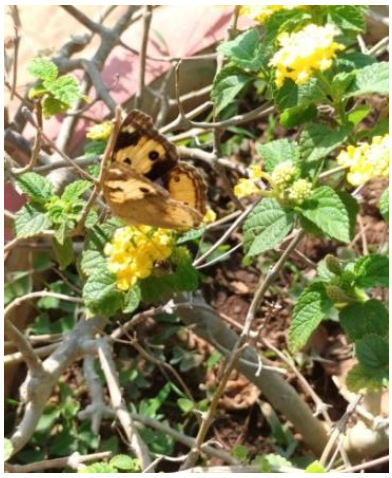
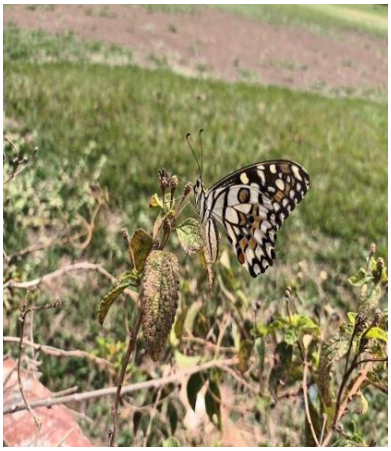
Sl. No.	Study Area	Total Number of Butterflies	Simpson Diversity Index
1	Dharmaram Vidya Kshetram Campus	3643	0.9
2	Lalbagh Botanical Garden	1139	0.8

Table 3. Pictures of species

		
Dakhan Tailed jay	Common Jay	Chocolate Pancy
		
Common Mormon Male	Common Mormon Female	Lemon Pancy
		
Plain Tiger	Common Sailor	Grass Yellow sp

		
Mottled Emigrant	Common Emigrant	Great Eggfly Male
		
Great Eggfly Female	Danaid Eggfly Male	Danaid Eggfly Female
		
Small Branded Swift	Angled Castor	Common Castor

 Common Evening Brown	 Pioneer	 Brown Awl
 Pothanthus sp	 Smaller Dartlet	 Blue Pancy
 Common Cerulean	 Dark Palm Dart	 Giant Redeye
 Tailed Palmfly	 Plains Cupid	 Common Bushbrown

 Apefly	 Common Albatross	 Common Leopard
 Common Three Ring	 Sahyadri Great Orange Tip	 Common Banded Awl
 Yellow Pancy	 Tawny Coaster	 Lime Butterfly

Discussion

Family Nymphalidae are commonly called brushfooted butterflies and range from being medium to large in size. Each member in the family vary in appearance and are considered to be good fliers. White and yellow butterflies come under the family Pieridae. With the sizes ranging from small to medium the males are brightly colored and females are dull and larger in size. Family Hespiiridae consists of species active during the dawn and dusk. They are commonly called Skippers. Having a small body size, they completely differ from other butterflies in terms of body details. The world's largest butterflies called birdwings come under the family Papilionidae. They are commonly called Swallowtails as they have tailed hindwings with various patterns like forked and sword tails. They are considered to be very fast and restless. Small and blue butterflies come under family Lycaenidae. They have tufts in their hind wings which is a mechanism to protect themselves (O.K Remadevi *et al*, 2018). The Statistical data of the study suggested that the Simpson diversity index was found to be greater in the Dharmaram vidya kshetram campus (3643, 0.9) followed by Lalbagh botanical garden (1139, 0.8). Species belonging to five families were documented during the study. With a distribution of over 6000 species worldwide, Nymphalidae is the most diverse and distributed family In this study since twenty species out of fourty three belonged to Nymphalidae, it is considered to be the most diverse. With other families being moderately distributed, only three species were found under Lyceanidae making it the least abundant. This approves that both the sites that were studied are rich in butterfly distribution. This survey shows that Butterflies are not only found in a botanical gardens but also can be found in very large numbers in an enclosed green space like an educational institution if the greenery and plant population is well maintained. The reduced number of individuals in the botanical garden when compared to the educational institution can be due to continuous cutting down trees and making it a social space for visitors and tourists and conversion of plantation areas into lawns and walking paths.

Conclusion

Butterflies are diurnal and take active participation in the process of pollination. They are not as effective as bees in the pollination process but surely contribute in the promotion of Agriculture and Horticulture. (O. K Remadevi.*et al*, 2018). Continuous cutting down of trees and removal of garden areas to make public amenities are affecting these insect populations. Butterflies long for a green and colorful environment that can provide them with nutrients. Non availability of food and lack of a green atmosphere are causing these insects to decrease in population and migrate to other places in search of proper sources. Taking small steps on daily basis to conserve them will help humans in horticultural activities and also promote the increase of pollinator population (Nicholas

Tew *et al*, 2022) Trees are found to be producing a greater number of fruits by insect pollinators than trees which self pollinate. A large variety of fruits and vegetables in demand are produced by insect pollination. Decline in their number will be a huge pressure to the artificial pollination technology to produce the same amount of horticulture products as that is being produced by insect pollinators. Butterfly gardening and growing of floral plants and trees should be taken up as a small initiative by Educational Institutions and Research Centers. This might promote awareness about pollination and its biological importance. This will help young students and researchers empower the need and significance of greenery conservation. A natural habitat like a butterfly garden can be maintained to allow flowering plants and butterflies to co-exist with eachother. Butterflies can see a greater number of colors when compared to other insects (Kentaro Arikawa, 2017), so a colorful garden with a variety of floral plants will attract these beauties. Using harsh pesticides on these plants should be avoided as they might chase away these butterflies and other useful insects. This type of gardening activities can give the real joy of being a true nature conservationist. (O.K Remadevi *et al.*, 2018).

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