Butterfly species and their plant association for roosting during winter in Eco-tourism park, West Bengal, India.

Prayas Auddy*[1,2], R. Nagarajan[1], Arjan Basu Roy[2], Sarika Baidya[2], Souparno Roy[2], Namrata Das[2] and Arpita Roy[2]

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Abstract

The butterfly species roosting and their plant association for roosting in Eco-tourism Park, West Bengal was investigated across the winter from January 2021 to April 2021. A total of 659 individuals belonged to 24 species of butterflies from five different families were recorded. All are not listed in WPA, 1972 and were marked Unscheduled and on a global scenario, only one species i.e. *Danaus chrysippus* is listed under IUCN category as Least Concern and all others are under Not Evaluated category and also they were neither endemic nor migratory. Lycaenidae or the small blue butterflies were the most abundant. Among them, one was from family Papilionidae (lowest), three species from Pieridae, seven from Nymphalidae, ten belonged to Lycaenidae (highest) and three species from Hesperiidae. Trees were used mostly for roosting followed by shrubs and herbs and also used grass. Among the tree species used, *Butea monosperma*, *Polyalthia longifolia* and *Samanea saman* were used frequently. The butterfly species viz., *Zizina otis, Zizeeria karsandra, Danaus chrysippus, Danaus genutia, and Ypthima huebneri* used several species of plants for roosting. *Papilio demolues, Leptosia nina, Chilades pandava, Anthene lycaenina, Catochrysops strabo, Tarucus* spp., *Curetis thetis, Ampittia dipscorides, Matapa aria, and Telicota bambusae* species used only one plant for roosting. The shrub *Cuphea hyssopifolia* was used maximum almost in all cases by lycaenides followed by a grass species *Kyllinga monocephala.* Other species used were *Ageratum conyzoides*, *Mikania micrantha*, and *Wedelia chinensis*. Among the plants, *Mikania micrantha was used by different species of butterflies.* Among the substrates, the leaf was used extensively for roosting.

Key words: Butterfly, Family, Order, Plants, Roosting, Substrate, Winter

INTRODUCTION

Roosting is a state of reduced activity and reaches no-movement of individuals which mark the day to end in all living organisms. It is an interesting nocturnal phenomenon for diurnal animals and *vice-versa* which refers to settlement of most of the butterflies either solitarily or gregariously on the perch of plants for taking rest on a nightly basis (Roy *et al.*, 2018). Often larval host plants and nectar plants are the major limiting factors when it comes to the selection of microhabitat (Nair *et al.*, 2016) for roosting or hibernating sites of butterflies. These behaviours have been documented in several insect groups such as moths, dragonflies, bees, and wasps for over a century (Salcedo, 2010), and in each case, authors have proposed different hypotheses that usually involve important adaptations (e.g. Brower *et al.*, 2008). Not only in case of insects, roosting behaviour of the avian community (Chang *et al.*, 2020) as well as mammals (Mallet, 1986) have been investigated extensively. Synchronization of this aggregations depend on circadian rhythm, seasons or they can be permanent (Waller and Gilbert, 1982). Aggregation behaviour can be classified depending upon various components such as number of individuals competing for one spot, etc. Some species of butterflies while on their way to reach the desired destination rest in unusual places at unusual time of the day (DeVries *et al.*, 1987).

Roosting of butterflies takes up 12-13 hours of their day, which is much higher than other animal species (Finkbeiner, 2014). Communal roosting pattern in winter congregation population can be a thermal buffering strategy against low nocturnal temperature

Prayas Auddy

email: *prayasauddy4@gmail.com*

[1]PG and Research Department of Zoology & Wildlife Biology, A.V.C. College (Autonomous), Mannampandal, Mayiladuthurai, Tamil Nadu, India

[2]Nature Mates- Nature Club, Kolkata, India

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of the study site which can ultimately result in change of the microclimate of the roosting site to a preferable temperature and humidity (Brower *et al.*, 2008, Salcedo, 2010). Temporal pattern in the behaviour of a butterfly population is maintained by the daily activity of the individuals which is subsequently impacted by the population characteristics (Lambkin, 2016).

Selection of roosting site and roosting behaviour play an important role in determining individual fitness (Fischer *et al.*, 2004) which in consequence decide the energy requirements and predator avoidance among individuals (Chang *et al.*, 2020). Roosting substrate may vary from site to site and species to species, but generally Lepidoptera roosts are located in sheltered areas (e.g. under leaves, branches or stone outcrops, or in cave-like hollows), low and dense vegetation (e.g., grasses, bushes etc.) (DeVries *et al.*, 1987; Davis *et al.*, 2012). Considering critical butterfly habitats, major emphasis has been given only on larval host plants and plants from where butterflies can obtain their food or nectar while overlooking other critical habitats like their resting sites which are also important for their survival and population (Dennis, 2004).

STUDY AREA

This study was conducted in Eco-tourism Park cum Butterfly Garden in the North 24 Parganas district of West Bengal, India. This butterfly conservatory was created during 2015 which supports research work

Fig. 1. Google map of in Eco-tourism Park Butterfly Garden in the North 24 Parganas district of West Bengal, India

with an established laboratory and creating awareness as well as to educate the citizens on the importance of butterflies as well as other species (Fig. 1).

MATERIALS AND METHODS

Roosting Butterfly

The roosting butterfly survey was done six days a week (excluding Monday) during winter from January, 2021 from March, 2021. The survey was started around 16:30 in the afternoon and finished around 19:00 in the evening. All butterfly individuals visually encountered and sighted directly were taken into consideration. All microhabitats were surveyed on a daily basis to observe the roosting butterflies. As the study period was in winter season the butterflies were hard to sight and hence intensive search and care were taken to locate each roosting individual butterfly. Further, the whole study area was surveyed on a daily basis with torch light to find every roosting individual. All the photos of butterflies were taken in this study site by the researcher Prayas Auddy.

Plant-Butterfly Association

Every individual butterfly whether communal or solitary uses a site where they roost were noted. All the butterflies sighted during the roosting survey were taken into account and which plant species and type of plant (e.g., Tree, Herb, Shrub or Grass) they were roosting were noted (Blozan, 2006). Also the roosting plant species was recorded for each individual butterfly using torch light during dusk and dawn. Sometimes, due to the distance and visual blur of the roosting site of butterflies, digital camera was used to take pictures and determine the actual roosting plant species and butterfly species.

RESULTS

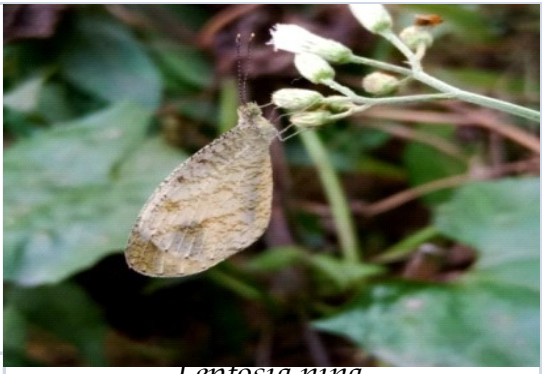
Roosting Butterfly Species

A total of total of 659 individuals of different species of butterflies were recorded across the study period from January 2021 to April 2021. Among these individuals, 24 species of butterflies from five different families were recorded. All the butterfly species found in this study are not listed in WPA, 1972 and were marked Unscheduled though they are not as abundant. On a global scenario, only one species out of 24 species which was encountered is listed under IUCN category as Least Concern (LC) and all of the others come under Not Evaluated (NE) category. The details and photographs of butterflies recorded are given in table 1 and shown in figure 1. All the butterfly species recorded in the study area were not endemic and are non-migratory. Lycaenidae or the small blue butterflies were the most abundant and species of Lycaenides were found more in number than other species. Among species, one was from family Papilionidae (lowest), three species from Pieridae, seven from Nymphalidae, ten belonged to Lycaenidae (highest) and three species from Hesperiidae (Table 1).

Plant-Butterfly Interaction

Trees were used mostly for roosting followed by shrubs and herbs. The butterflies used grass as well. The shrub *Cuphea hyssopifolia* was used maximum almost in all cases by lycaenides. The next most used plant was a grass species *Kyllinga monocephala* which was used

Papilio demoleus
(Family – Papilionidae)



Leptosia nina
(Family – Pieridae)

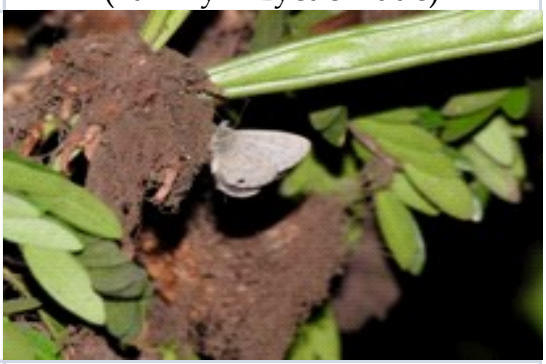
Eurema hecabe
(Family – Pieridae)

Appias olferna
(Family – Pieridae)

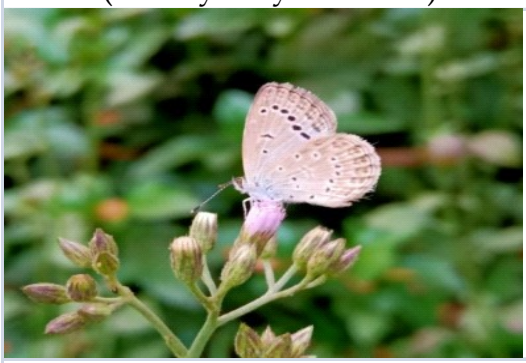
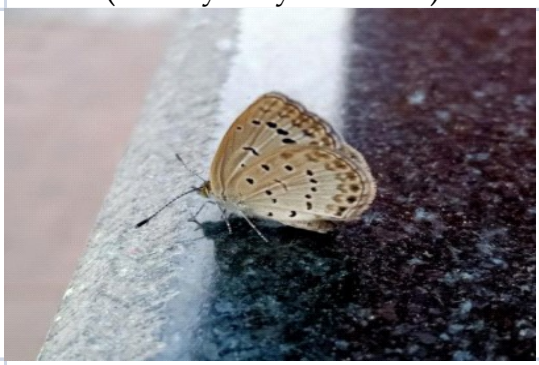
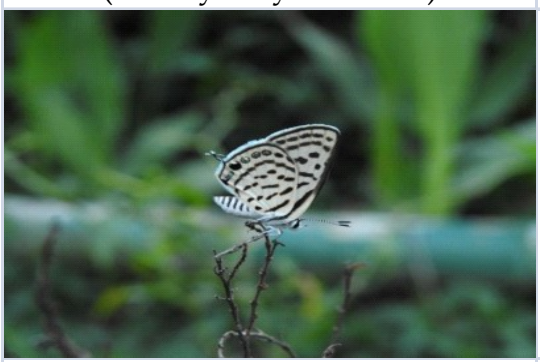
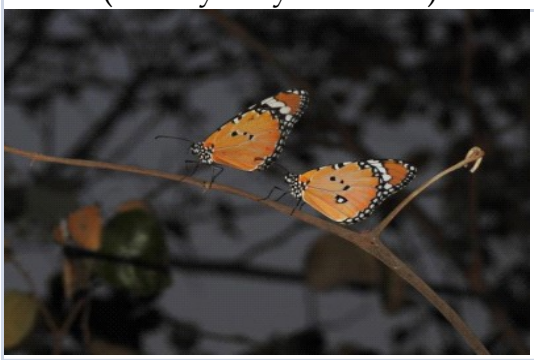
Spalgis epius
(Family – Lycaenidae)

Chilades pandava
(Family – Lycaenidae)

Anthene lycaenina
(Family – Lycaenidae)



Prosotas nora
(Family – Lycaenidae)

		
Catochrysops strabo (Family – Lycaenidae)		*Zizina otis* (Family – Lycaenidae)
		
Zizeeria karsandra (Family – Lycaenidae)		*Pseudozizeeria maha* (Family – Lycaenidae)
		
Tarucus sp. (Family – Lycaenidae)		*Curetis thetis* (Family – Lycaenidae)
		
Danaus chrysippus (Family – Nymphalidae)		*Danaus genutia* (Family – Nymphalidae)

Moduza procris
(Family – Nymphalidae)

Ypthima huebneri
(Family – Nymphalidae)

Ariadne merione
(Family – Nymphalidae)

Melanitis leda
(Family – Nymphalidae)

Mycalesis sp.
(Family – Nymphalidae)

Ampittia dioscorides
(Family – Hesperiidae)

Matapa aria
(Family – Hesperiidae)

Telicota bambusae
(Family – Hesperiidae)

Fig. 2. Butterfly species observed in the winter season (January 2021 to April 2021) in Eco-tourism Park, the North 24 Parganas district of West Bengal, India. Photographs were taken by Prayas Auddy. Pictures of butterfly species are arranged based on the family and refer Table 1 for details.

Table 1: List of butterfly species, common name, their family, key morphological characteristic features, habitat, feeding habit and IUCN and WPA 1972 category of butterflies roosted in Eco-tourism Park, West Bengal, India during winter from January 2021 to April 2021.

S.No	Species Name	Common Name	Family	Morphological Character	Habitat	Feeding habit	IUCN Category	WPA 1972
1	*Papilio demolues*	Lime Swallowtail	Papilionidae	Absence of tail	Dense vegetation of shrubs and herbs with large trees.	Nectar	Not Evaluated	Unscheduled
2	*Leptosia nina*	Psyche	Pieridae	Mostly yellow and white in color and upper wings have two black spot on each wing	Dense vegetation of shrubs and herbs. Rarely leaves the ground level.	Nectar	Not Evaluated	Unscheduled
3	*Eurema hecabe*	Common Grass Yellow	Pieridae	Bright yellow in color with small black spots	Dense vegetation of shrubs and herbs.	Nectar	Not Evaluated	Unscheduled
4	*Appias olferna*	Eastern Striped Albatross	Pieridae	Black striped all over the white wings and base of the wings is yellow in color partly.	Dense vegetation of shrubs and herbs with large trees.	Nectar	Not Evaluated	Unscheduled
5	*Spalgis epius*	Apefly	Lycaenidae	Upperside dark brown, underside pale, silky, brownish white.	Dense vegetation of shrubs and herbs with large trees.	Plant Hopper	Not Evaluated	Unscheduled
6	*Chilades pandava*	Plains Cupid	Lycaenidae	Presence of eye spot at the edge of the hind wings.	Vegetation of herbs and grasses.	Nectar	Not Evaluated	Unscheduled
7	*Anthene lycaenina*	Pointed Ciliate Blue	Lycaenidae	Black spot present at the base of hind wings.	Vegetation of herbs and grasses.	Nectar	Not Evaluated	Schedule II
8	*Prosotas nora*	Common Lineblue	Lycaenidae	Linear markings on the wings.	Vegetation of herbs, shrubs and grasses.	Nectar	Not Evaluated	Unscheduled
9	*Catochrysops strabo*	Forget-me-not	Lycaenidae	Two black spots present on the forewing.	Vegetation of herbs, shrubs and grasses.	Nectar	Not Evaluated	Unscheduled
10	*Zizina otis*	Lesser Grass Blue	Lycaenidae	'V' shaped marking present on the forewing.	Vegetation of herbs, shrubs and grasses.	Nectar	Not Evaluated	Unscheduled
11	*Zizeeria karsandra*	Dark Grass Blue	Lycaenidae	Small in size almost similar to Pale grass blue and can only be differentiated by seeing upper wing.	Vegetation of herbs, shrubs and grasses.	Nectar	Not Evaluated	Unscheduled
12	*Pseudozizeeria maha*	Pale Grass Blue	Lycaenidae	Small in size almost similar to Dark grass blue and can only be differentiated by seeing upper wing	Vegetation of herbs, shrubs and grasses.	Nectar	Not Evaluated	Unscheduled

S.No	Species Name	Common Name	Family	Morphological Character	Habitat	Feeding habit	IUCN Category	WPA 1972
13	*Tarucus* spp.	Pierrot sp.	Lycaenidae	Black striped on white wings	Flowers, herbs, shrubs	Nectar	Not Evaluated	Unscheduled
14	*Curetis thetis*	Indian Sunbeam	Lycaenidae	White in color from outside. Scorching orange from inner side in case of male and grey in case of female.	Dense vegetation of shrubs and herbs with large trees.	Nectar	Not Evaluated	Not Evaluated
15	*Danaus chrysippus*	Plain Tiger	Nymphalidae	Presence of Brush feet	Vegetation of herbs, branches of trees, shrubs	Nectar	Least Concerned	Unscheduled
16	*Danaus genutia*	Striped Tiger	Nymphalidae	Both sexes of the butterfly have tawny wings with veins marked with broad black bands.	Dead branches of trees, leaves of trees, shrubs, herbs	Nectar	Not Evaluated	Unscheduled
17	*Moduza procris*	Commander	Nymphalidae	White and brown colored upper as well as under wings	Dense vegetation of shrubs with large trees.	Nectar, Ov	Not Evaluated	Unscheduled
18	*Ypthima huebneri*	Common Four-ring	Nymphalidae	Presence of five rings on their wings	Leaf, grasses, flowers	Nectar	Not Evaluated	Unscheduled
19	*Ariadne merione*	Common Castor	Nymphalidae	Brownish in color from inside having curved markings on the wings	Vegetation of shrubs and herbs with large trees.	Nectar	Not Evaluated	Unscheduled
20	*Melanitis leda*	Common Evening Br	Nymphalidae	Chocolate coloured butterflies with different characters in different seasonal forms	bushes, shrubs, herbs, ground	Nectar, Ov	Not Evaluated	Unscheduled
21	*Mycalesis* spp.	Bush brown	Nymphalidae	Black spots at the tail end of wings.	Vegetation of shrubs and herbs and grasses, gloomy forests	Unidentifi	Not Evaluated	Unscheduled
22	*Ampittia dipsoride*	Bush Hopper	Hesperiidae	Forewing bright golden yellow with black slender spot	bushes, herbs and shrubs	Nectar	Not Evaluated	Unscheduled
23	*Matapa aria*	Common Branded Re	Hesperiidae	Eyes are red in color.	bushes, herbs and shrubs	Nectar	Not Evaluated	Unscheduled
24	*Telicota bambusae*	Dark Palm Dart	Hesperiidae	Yellow in color, present of dark spot on hind wings.	bushes, herbs and shrubs	Nectar	Not Evaluated	Unscheduled

Table 2: Roosting plant, parts used by roosting butterflies in Eco-tourism Park, West Bengal, India during winter from January 2021 to April 2021

Sl. No	Butterfly Species	Plant Used	Substrate Used
1	*Papilio demolues*	*Heliconia* sp.	Leaf, Under leaf
2	*Leptosia nina*	*Mikania micrantha*	Leaf
3	*Eurema hecabe*	*Wedelia chinensis, Mikania micrantha, Ageratum conyzoides*	Leaf, Under leaf
4	*Appias olferna*	*Mikania micrantha, Ageratum conyzoides*	Flower, Leaf
5	*Spalgis epius*	*Ployalthia longifolia, Butea monosperma*	Leaf
6	*Chilades pandava*	*Butea monosperma*	Leaf
7	*Anthene lycaenina*	*Butea monosperma*	Leaf
8	*Prosotas nora*	*Zizyphus* sp., *Pongamia pinnata*	Dead branch, Dry leaf, Leaf
9	*Catochrysops strabo*	*Butea monosperma*	Leaf, Under leaf
10	*Zizina otis*	*Ageratum conyzoides, Kyllinga monocephala, Cuphea hyssopifolia, Crotalaria* sp., *Mikania micrantha, Wedelia chinensis, Cynodon dactylon, Imperata cylindrical*	Dead branch, Flower, Fruit, Leaf, Stem, Grass
11	*Zizeeria karsandra*	*Ageratum conyzoides, Kyllinga monocephala, Cuphea hyssopifolia*	Dead branch, Flower, Grass
12	*Pseudozizeeria maha*	*Wedelia chinensis, Kyllinga monocephala*	Leaf, Grass
13	*Tarucus* spp.	*Cuphea hyssopifolia*	Flower
14	*Curetis thetis*	*Polyalthia longifolia*	Under Leaf
15	*Danaus chrysippus*	*Mangifera indica, Crotalaria* sp., *Bauhinia purpurea, Michelia champaca, Phyllanthus* sp.,	Dead branch, inflorescence, Leaf
16	*Danaus genutia*	*Samanea saman, Thespesia populnea, Mikania micrantha, Wedelia chinensis, Heliconia* sp., *Butea monosperma, Pongamia pinnata*	Dead branch, Leaf, Branch
17	*Moduza procris*	*Butea monosperma, Heliconia rostrata*	Under Leaf
18	*Ypthima huebneri*	*Ageratum conyzoids, Wedelia chinensis, Kyllinga monocephala, Cuphea hyssopifolia*	Flower, Leaf, Grass
19	*Ariadne merione*	*Heliconia* sp., *Butea monosperma*	Leaf, Under leaf
20	*Melanitis leda*	*Wedelia chinensis, Mikania micrantha*	Leaf
21	*Mycalesis* spp.	*Wedelia chinensis, Mikania micrantha, Crotalatia* sp., *Brachiaria mutica*	Dry Leaf, Fruit, Leaf
22	*Ampittia dipscorides*	*Mikania micrantha*	Leaf
23	*Matapa aria*	*Mikania micrantha*	Leaf
24	*Telicota bambusae*	*Pongamia pinnata*	Leaf

and same as *Cuphea hyssopifolia* which was also mostly used by lycaenides. Other important species used for roosting were *Ageratum conyzoides*, *Mikania micrantha*, and *Wedelia chinensis*. Among the tree species used, *Butea monosperma*, *Polyalthia longifolia,* and *Samanea saman* were used most frequently (Table 2).

The butterfly species viz., *Zizina otis, Zizeeria karsandra, Danaus chrysippus, Danaus genutia, and Ypthima huebneri* used several species of plants for roosting. *Papilio demolues, Leptosia nina, Chilades pandava, Anthene lycaenina, Catochrysops strabo, Tarucus* spp. *Curetis thetis, Ampittia dipscorides, Matapa aria, and Telicota bambusae* species used only one plant for roosting. Among the plants, *Mikania micrantha was used by different species of butterflies.* Among the substrates, the leaf was used extensively for roosting (Table 2).

DISCUSSION

In this study, 24 butterfly species were found roosting inside the Eco-tourism Park cum Butterfly Garden during the winter season of January-April, 2021 which indicated that the park has wealthy distribution and diversity of butterflies. Individuals of most species of butterflies have solitary roost staying and sleeping at night in the place where they find themselves at the end of the day late afternoon (Chang et al., 2020). Finkbeiner (2014) recorded that the roosts were likely established by a single butterfly that had been roosting continuously in the same place which then eventually attract more individuals to recruit over the period of time.

Butterfly species from family Lycaenide (10 out of 24) were dominant during the study period which could be due to the winter season (Lambkin, 2016). The shrub *Cuphea hyssopifolia* was used maximum times and almost in all cases by lycaenides followed by a grass species *Kyllinga monocephala* which was also mostly used by lycaenides. Additionally the important plant species used for roosting were *Ageratum conyzoides*, *Mikania micrantha*, and *Wedeliachinensis* which showed that roosting butterflies have a preferred vegetations (Davis *et al.*, 2012) surrounding them in the park. As it was seen that different species of butterflies choose various kinds of plants and their different parts to roost, which clearly indicated that the suitable habitat and substrate to roost (DeVries *et al.*, 1987) were available in the park and thus the butterfly richness was considerably higher during winter. A particular habitat/area might be appropriate to the butterflies for collecting food resources but not for them to roost and in such situations the butterflies choose adjoining areas for roosting which were closer to such food patches. Thus, mostly they were found less in such foraging area while roosting or after dark. It is well established that butterflies choose the vegetation for roosting based on plant species, type of vegetation, distance to foraging area and surrounding habitats (e.g. *Waller and Gilbert, 1982;* Davis *et al.*, 2012).

Zizina otis, Zizeeria karsandra, Danaus chrysippus, Danaus genutia and *Ypthima huebneri* used several species of plants for roosting. One plausible explanation for this behaviour could be that the abundance of smaller butterflies (Lycaenides) due to the winter season impacted their partitioning of resources thus resulting in the utilisation of several plant species for roosting (Chang et al., 2020). Further, Gilbert (1976) reported that the females mated with a male were unlikely to mate with the male again hence the males would have changed the roosts frequently. On the other hand, Nymphalides, the larger butterflies showed communal as well as solitary roosting in winters. Plants with suitable substrates for them to have both kind of solitary and communal roosting and keeping themselves warm and safe from predation could be another explanation for these species (Finkbeiner *et al.*, 2012). The butterfly species *viz., Papilio demolues, Leptosia nina, Chilades pandava, Anthene lycaenina, Catochrysops Strabo, Tarucus* spp., *Curetis thetis, Ampittia dipscorides, Matapa aria and Telicota bambusae* utilized only one plant for roosting. The roosting records of these butterflies were limited as *Papilio demolues* was sighted only twice and there is not enough evidence to affirm their selection of perch. Similarly, with *Leptosia nina* (sighted only once), *Anthene lycaenina* (sighted only once), *Chilades pandava* (sighted only 4 times), *Tarucus* spp. (sighted only once), *Ampittia dipscorides* (sighted only twice), *Matapa aria* (sighted only once), *and Telicota bambusae* (sighted only twice). However, Finkbeiner (2014) observed that many individuals of butterflies stay loyal to their roost for several months and even until demise. Such spatial preference could be established over time as a result of repeated visits to the roost (Salcedo, 2006). Further, roosting butterflies Heliconius charithonia usually use the same pollen plants that were within close proximity to their roost (Waller and Gilbert, 1982)

Catochrysops strabo and *Curetis thetis* were found on the same plant species using the same substrate for all the observations. Both species were Lycaenides and chose tall trees *i.e. Butea monosperma* and *Polyalthia longifolia* as their roosting site. They showed preference towards a particular site because it could have served them as a safe refuge for repeated days and the site fidelity could have reduced the competition for the site that might be a probable reason (Santos, 2013). The abundance of Lycaenides resulted in higher selection of herbs, shrubs and grasses like *Mikania micrantha, Wedelia chinensis, Cuphea hyssopifolia* and *Kyllinga*

monocphala and their short heights served as suitable roosting habitat for them (Davis et al., 2012) which would have avoided the aerial predators.

Leaf was utilised extensively as roosting substrate by various species of butterflies. Leaf is the only part of the plant which can be found in every group of plants whether it is herbs, shrubs or trees and in winter and the number of flowering plants also are less, so, the availability of flowers were also lesser than that of leaves. Thus, leaves stood out among other substrates and were used more number of times (Fischer *et al*., 2004). Chang *et al*. (2020; refer Table 1) reviewed typical nocturnal roosting sites of 25 species of butterfly species belonging to the families of Hesperiidae, Nymphalidae, Papilionidae, Pieridae and Lycaenidae from various studies and found that the butterflies roosted on: at the top of dead flower-heads, on bracken fronds or on the flowers of rushes, in a head-downwards posture at the top of grass heads, gregariously on various types of trees or shrubs (with a general preference for maples and conifers, pecans and oaks), gregariously on leafless twigs of *Anguria* trees, gregariously on leafless fine twigs or tendrils of dead vines, gregariously on leafless twigs, shaded areas with plenty of thin dry vines and branches under relatively dense vegetation mats, under leaves, under the lower boughs of trees or crevices in banks and walls, on fences, in shaded embankments, tree holes, and other dark hiding places, in a head-downwards posture at the top of grass heads, on the underside of the leaves of rubiaceous trees or other small trees, in a head-downwards posture at the top of grass heads, gregariously in cavities of lava walls, tree trunks and on the underside of concrete slabs roofing alleys between sheds, primarily on inflorescences, or apices, but also on stems, scapes or culms of daisies, other herbs and grasses, roost singly, singly or gregariously in dense grass, in dense crown vetch, on the leaves of emergent forbs, gregariously on the yellow-green leaves of vines, gregariously on leaves or stems of the upper branches of *Pittosporurn undulatum Vent. Var. val'iegatum*, on the flower-heads and stems of grasses and other plants, in small groups on tall vegetation, on shrubs (bramble, gorse) and tall herbs (rank bunched grasses such as *Dactylis glomerata*, bracken and flowering herbs), on the tips of dead stalks/dry flower heads of *Jasonia montana*, and on low vegetation or on bushes. Chang et al. (2020) found that *Zizina otis riukuensis* and *Zizeeria maha okinawana* roosted primarily on flowers and fruits of *Tridax procumbens* and *Vernonia cinerea* formed conspicuous roosting aggregations with significant positive associations between the flowers and fruits of both.

Finkbeiner (2014) emphasized that roosts are first established by a single butterfly roosting consecutively in the same location that later recruits butterflies, males depart roosts earlier than females in the morning, older butterflies tend to roost on the same perch in the same roost every night, roost-mates share the same resource traplines, and most butterflies in a population participate in roosts based on study of Communal roosting in *Heliconius* passion-vine butterflies (Nymphalidae). Hence, conducting a long term study by collecting data on the behaviour of all different species of butterflies and between sexes by incorporating the vegetation and their characteristic features would yield the roosting association of butterflies with vegetation and management improvement for attracting more species and number of butterflies as it is a Eco-tourism Park cum Butterfly Garden.

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