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An approach for butterfly conservation through setting up a garden in an urban area, Kolkata, India

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ABSTRACT

Biodiversity declines due to unplanned urbanization as well as anthropogenic activities. It has already been documented that native flora and fauna are disappearing as an impact of biodiversity loss. There should be urgent need to restore our lost habitats through conservation techniques. The present study was aimed to conserve and restore lost habitat of pollinators with special reference to butterflies in an urban area through setting up a garden. The study was divided into two phases. In the first phase survey of butterflies found within an unmanaged garden in the campus (Lady Brabourne College, Kolkata) was performed prior to construction activity (May 2012 to October, 2012) and it was observed previously total 31 species of butterfly visited the garden. Developmental activities caused a sharp decline in their population causing an approach to relocate our garden in another area of college campus. In the second phase, setting up a garden in an alternative sites of same campus with plantation of host plants preferred by butterfly species was done and observed for butterfly visit. A slow increase in sighting over a study period of two years (between October, 2012 to June, 2015) was recorded. The results clearly indicate that total 43 species of butterflies were recorded in the garden including 9 species, which were not seen before and with 8 species completing their life cycles. In conclusion, declining of butterfly species can be increased and conserved through setting up of a garden. Presently the garden is flourishing but problems of increase in natural enemies as birds and other anthropogenic disturbances such as excess noise and vibration, street lighting, human interference etc. should be addressed in future within present conservation approach.

Keywords: Butterfly garden, habitat restoration, butterfly conservation, urbanization, human interference, eco-restoration

1. INTRODUCTION

Human needs for modernization and urbanization, lead to rapid destruction to the environment, by unplanned developmental activities [1]. It was reported that major native plant and animal species are disappearing in the habitat due to concrete constructions, strong lights, excess noise, etc. in an urban area [1-7]. On the other hand, few revegetated gardens and parks in an urban area may fulfil the previous loss of plant and animal diversity [8-10]. Thus, there is a scope to restore ecological balance by using *ex-situ* conservation of both plant and animal species. Like other macroinvertebrates, butterfly is an important fauna and known as a valuable pollinator. These pollinators are indicator of good environmental health [7,11-15]. However, butterfly diversity is directly dependent on particular plant species for availability of nectar [16-19]. On the other hand, host plants and their parts are also useful as food for different butterfly species [19-20]. Previous study clearly documented that nectar resources, preferred color and fragrance attract these pollinators and setting up a garden and/or park through urban designing may restore butterfly diversity. A choice of feeding as well as egg laying preferences onto the particular plant species by butterflies have been reported [21-22].

There is a growing need to restore the lost habitats to conserve biodiversity in available open space of urban area. It is well recognized by researchers that from the point of biodiversity conservation, the setting up of butterfly gardens are an important research area, for *in situ* conservation as well as promoting environmental education [23-25]. Pyle [26] has documented an account of butterfly exhibitory and butterfly farming ventures in various countries. As a business-cum-educational enterprise, butterfly gardens and butterfly houses are becoming increasingly popular in many countries such as Australia, Singapore, Malaysia, Papua New Guinea, the UK and Canada. A Butterfly Park at the Bannerghatta Biological Park, Bangalore set up in 1986, is established over an area of 3.04 ha, and has a butterfly garden, butterfly conservatory, museum and a curio shop. In Kerala, *In-situ* study on butterfly diversity was done through set up of a butterfly garden about 0.5 hectare within degraded moist deciduous forest patch [25] while total 77 numbers of public gardens have been used for butterfly garden at Banyan city, Vadodara, Gujrat, India [20]. Even if a large area is not available for establishing a big butterfly park for attracting pollinators and to maintain ecological balance, a butterfly garden can be set up in places available in urban, semi urban areas.

The butterfly conservation researches have been reported majorly in *in situ* environment [25; 27-29] while fewer studies have been conducted in gardens and parks (artificially revegetated) in an urban area to enhance *ex situ* conservation and maintain ecological balance along with pollination restoration, etc. [30-31]. In addition, several botanical gardens have capability to restore biodiversity of flora and fauna whether these may be natural or artificial in nature [32-34]. Mukherjee et al. [29] have studied a combined approach for butterfly diversity in rural, suburban, urban area as well as in and around Kolkata Metropolitan area. According to them, conservation of butterfly species is an important effort to maintain

environmental sustainability in the urban area. The present study was attempted to restore the lost habitat of butterflies in campus area of Lady Brabourne College situated in a densely populated urban area of central East Kolkata. The importance of avian predation and some anthropogenic disturbances on the species profile of butterflies was also pointed out.

2. MATERIALS AND METHODS

2. 1. Study Area

The campus of Lady Brabourne College is situated in the central east side of Kolkata, West Bengal, India at 22°32'40.8" N, 88°22'05" E, and elevation 7 meter MSL (calculated by GPS survey and locations of the point determined by Prismatic compass). The campus building is surrounded by garden. There is a large public maidan or field, and a nursery on the East side and buildings on all other sides. The sprawling campus had good vegetation with different herbs, shrubs and trees. The rear side of the building (West) had wild plants growing along with cultivated plant species. For the expansion of the buildings, some of the garden had been used for construction of buildings. The site chosen for setting up the garden is on the south side of the campus in the hostel premises. The findings presented here are based on a field survey and investigation carried out on a daily basis. The Google earth image of study area is depicted in Fig. 1.



Figure 1. The study area and its surroundings (Source: Google earth; N = North)

The plot of land about 30 meters by 14 meters was chosen for butterfly gardening. It was a barren land, full of rubbish. For landscaping, it was divided in three parts. Nectar plants and host plants were planted in different groups. The top soil with sand and pebbles were dug out. Good quality soil was put over the whole land. Paths were made for walking in between the plots. A specific area was assigned for mud puddling of butterflies.

Soil test for determining pH and carbon, nitrogen and phosphate content was conducted by Soil Test kit (purchased from BS Syndicate). The soil was found slightly acidic. To enrich the soil, fertilizer was used (TCL's phosphatic fertilisers, brand name 'Paras'). Natural manure such as cow dung, mustard seed husk was added to it to increase its fertility. The lands had to be left fallow for two weeks. When the land was ready to some extent, plantation was started. After cleaning of the plot, nectar plants and larval host plants were planted. New checklist was prepared to monitor butterfly species visiting in the newly set up garden. The study area as top view and layout is depicted in Fig. 2.

2. 3. Survey and identification of butterflies

The study was conducted between October, 2012 to June, 2015 in the set up garden. Prior to study in the set up garden, first phase survey of butterflies found within an unmanaged garden in the campus (Lady Brabourne College, Kolkata) was performed during construction activity (May 2012 to October, 2012). A status survey of butterfly species and other pollinators was done in the college campus and in the adjoining areas before setting up the garden. Separate Checklist of butterflies, nectar plants and larval food plants was also prepared. The butterfly species were identified directly in the field or in difficult cases photographed. Butterflies were mostly identified by using taxonomic keys and by expert opinions. Butterflies were identified from standard references on butterflies of India [27-29]. Adults of different butterflies collected from college garden and other places by using a butterfly catching net, were released later after photography.

2. 4. Rearing of butterflies and life cycle study

For butterfly rearing, clean, disinfected glass jars or plastic jars covered with muslin clothes for aeration were used. Culture was maintained in laboratory under room temperature. Eggs and first instar larvae of different butterfly species were collected with leaves of their respective host plant. Fresh leaves were given daily. After pupation, jar was kept undisturbed till emergence. Butterflies were released in the garden after emergence. Fig. 3 shows rearing of butterflies in the study area.

2. 5. Introduction of new butterfly species by captive breeding

Adults and larvae of butterfly species like Tawny Coster, Blue Tiger and Common Rose were collected from different areas. Those were kept within a confined area (enclosed by mosquito net, as shown in figure 3). Nectar plants and host plants of the respective butterflies were kept within the enclosed area. The adults were allowed to mate there and females laid eggs on the respective host plants. New individuals, which emerged from the pupa were released in the open environment of the garden. Those individuals mated in the garden also and laid eggs on their respective host plants, which were present in the unenclosed part of the garden.



Figure 3. Rearing of butterflies in the study area

3. RESULT AND DISCUSSION

The present results indicated that diversity of butterfly species can be enhanced through setting up a garden in an urban area, if suitable measures are taken. Table 1, gives checklist of butterfly species inhabiting the study area (located in West Bengal) previously and species found after the setting up of butterfly garden.

Six species were observed under Papilionidae family, which were *Papilio polytes*, *Papilio demoleus*, *Graphium doson*, *Graphium agamemnon*, *Atrophaneura aristolochiae* and *Chilasa clytia*. All of these species were observed during study period of which three species viz. *Graphium agamemnon*, *Atrophaneura aristolochiae* and *Chilasa clytia* were not seen before and *Graphium doson*, which was rarely seen previously was observed in high number. In West Bengal, 39 species have been found. 15.00% of this have been observed in our area.

Seven species under Pieridae family were observed, these species were *Eurema blanda*, *Eurema hecabe*, *Catopsilia pomona*, *Catopsilia pyranthe*, *Appias libythea*, *Delias eucharis* and *Leptosia nina*. All the species were observed during study period but two species viz. *Catopsilia pyranthe* and *Delias eucharis* were new sightings. In West Bengal, 39 species have been found. 18.00% of this have been observed in our area.

Eight species were found under Lycaenidae family. These were *Rathinda amor*, *Castalius rosimon*, *Catochrysops starbo*, *Lampides boeticus*, *Pseudozizeeria maha*, *Euchrysops cnejus*, *Chilades pandava* and *Chilades lajus*. All these species were seen earlier but two species viz. *Rathinda amor* and *Castalius rosimon* seen previously, were not observed during study period. In West Bengal, 125 species have been found. 6.40% species was recorded in our area.

Under Nymphalidae family, nineteen species such as *Tirumala limniace*, *Danaus genutia*, *Danaus chrysippus*, *Euploea core*, *Melanitis leda*, *Elymnias hypermnestra*, *Mycalasis perseus*, *Ypthima baldus*, *Ypthima huebneri*, *Phalanta phalantha*, *Moduza Procris*, *Neptis jumbah*, *Ariadne merione*, *Junonia atlites*, *Junonia almana*, *Junonia lemonias*, *Junonia iphita*, *Euthalia aconthea* and *Acraea terpsicore* were found in the study area. Sightings of following species viz. *Tirumala limniace*, *Euploea core*, *Elymnias hypermnestra*, *Junonia lemonias*, *Junonia iphita*, *Euthalia aconthea* and *Acraea terpsicore* were recorded which had not been seen earlier. Two species viz. *Danaus genutia* and *Phalanta phalantha* seen earlier could not be sighted during the study period. (however at present these have been sighted specially Striped Tiger *D. genutia*). In West Bengal 178 species have been found of which 10.67% species was recorded in our area.

Under family Hesperiiidae, three species such as *Spialia galba*, *Borbo cinnara* and *Pelopidas mathias* were observed. All these species were observed before and during the study period. West Bengal has 71 known species of which 4.22% was observed during our study period.

As has been mentioned before, the butterfly garden was established from unkempt, gravel and sand filled land. The top soil had to be dug out and then filled with good soil and fortified with natural manures and fertilizers. Growth and successful propagation of host and nectar plants resulted in many species of butterflies relocating in the study area or garden for successfully completing their life cycles. Plenty of nectar was available for adults in host plants. They laid eggs, passing through caterpillar and pupal stage, life cycles were completed and adults emerged.

Table 1. Checklist of the butterflies species observed in the garden

Family	Common Name	Scientific Name	Previously Seen	Recent
Papilionidae				
	Common Mormon	<i>Papilio polytes</i>	+	+
	Lime Butterfly	<i>Papilio demoleus</i>	+	+
	Common Jay	<i>Graphium doson</i>	+ (rare)	+
	Tailed Jay	<i>Graphium agamemnon</i>	–	+
	Common Rose	<i>Atrophaneura aristolochiae</i>	–	+*
	Common Mime	<i>Chilasa clytia</i>	–	+
Pieridae				
	Three Spot Grass Yellow	<i>Eurema blanda</i>	+	+

	Common Grass Yellow	<i>Eurema hecabe</i>	+	+
	Common Emigrant	<i>Catopsilia pomona</i>	+	+
	Mottled Emigrant	<i>Catopsilia pyranthe</i>	–	+
	Striped Albatross	<i>Appias libythea</i>	+	+
	Common Jezebel	<i>Delias eucharis</i>	–	+
	Psyche	<i>Leptosia nina</i>	+	+
Lycaenidae				
	Monkey Puzzle	<i>Rathinda amor</i>	+	–
	Common Pierrot	<i>Castalius rosimon</i>	+	–
	Forget-Me-Not	<i>Catochrysops starbo</i>	+	+
	Pea Blue	<i>Lampides boeticus</i>	+	+
	Pale Grass Blue	<i>Pseudozizeeria maha</i>	+	+
	Gram Blue	<i>Euchrysops cnejus</i>	+	+
	Plains Cupid	<i>Chilades pandava</i>	+	+
	Lime Blue	<i>Chilades lajus</i>	+	+
Nymphalidae				
	Blue Tiger	<i>Tirumala limniace</i>	–	+*
	Striped Tiger	<i>Danaus genutia</i>	+	–
	Plain Tiger	<i>Danaus chrysippus</i>	+	+
	Common Crow	<i>Euploea core</i>	–	+
	Common Evening Brown	<i>Melanitis leda</i>	+	+
	Common Palm fly	<i>Elymnias hypermnestra</i>	–	+
	Common Bush brown	<i>Mycalesis perseus</i>	+	+
	Common Five Ring	<i>Ypthima baldus</i>	+	+

	Common Four Ring	<i>Ypthima huebneri</i>	+	+
	Common Leopard	<i>Phalanta phalantha</i>	+	-
	Commander	<i>Moduza procris</i>	+	+
	Chestnut-Streaked Sailor	<i>Neptis jumbah</i>	+	+
	Common Castor	<i>Ariadne merione</i>	+	+
	Grey Pansy	<i>Junonia atlites</i>	+	+
	Peacock Pansy	<i>Junonia almana</i>	+	+
	Lemon Pansy	<i>Junonia lemonias</i>	-	+
	Chocolate Pansy	<i>Junonia iphita</i>	-	+
	Common Baron	<i>Euthalia aconthea</i>	-	+
	Tawny Coster	<i>Acraea terpsicore</i>	-	+*
Hesperiidae				
	Indian Skipper	<i>Spialia galba</i>	+	+
	Rice Swift	<i>Borbo cinnara</i>	+	+
	Small Branded Swift	<i>Pelopidas mathias</i>	+	+

+ = Yes; - = No; * = introduced species

Table 2, depicts nectar and food plants planted in the garden and host plant specificity for butterfly species. In a detailed study of host and nectar plant preference of butterflies in the study area, it was observed that particular herbs with special reference to weeds and ornamental plants attract specific butterflies.

The garden was created by planting several host and/or nectar bearing plants for the inhabiting butterfly species [the study area and its surroundings already had some trees like *Mangifera indica* (mango), *Saraca asoca* (asok), *Mimosops elengi* (bokul), *Polyalthia* sp. (debdaru), *Taberne* sp., some species of palm etc]. In the present study, it was observed that specific plants attract different species of butterfly and sometime one food plant attracts more than one species of butterflies (Table 2). Interestingly, Munshi and Moiz [21] have emphasized that the larvae of butterfly species feed on particular plant, hence the adults laid eggs onto specific plant species. In other words, butterflies are called as phytophagous and there is a close relationship between butterfly species and their chosen plant species. According to Tiple et al. [22], identification of plant species for the preference of butterflies is one of the important criteria for the conservation biologists. The present garden or study area

was planted with specific plants to attract butterfly species for conservation or restoration of butterflies in an urban area. Moreover, the garden should be maintained in such a way where anthropogenic stresses and human interference will be lower and enhance the resources that comprises a suitable habitat [30,31,35-37]. It was found in previous studies that nectar resources from plants led to higher butterfly diversity and species richness in urban localities of Banyan city - Vadodara, Gujarat, India [20]. The present study showed with an evidence of other studies that useful resources as nectar and host plant support butterfly restoration in an urban garden. Creation of the butterfly garden attempted as a conservation priority in an urban surrounding, which can to some extent restore the habitat and offset effects of anthropogenic disturbance.

Generally, in urban areas, threats from anthropogenic effects such as excess noise and vibration, lights exposure, vehicular air emission, as well as change in land use pattern for urbanization affect organisms. It degrades ecosystem functions [6]. The present garden set up in urban area has street lights surrounding the campus and inside the hostel area. In the initial study period, it was observed that, even though many larvae of different species of butterflies were seen, often their numbers reduced in a short span of time. There was a perceptible increase in bird and lizard population. The constant source of night light in the hostel area could be a problem with the life cycle of butterflies. It also disturbed the photoperiodism of the flowering plants. The human activity around the garden could also be a disturbing element especially during nectaring.

In a review article to assess evolutionary responses to anthropogenic light and sound, Swaddle et al. [6] have discussed how human activities have caused a near-ubiquitous and evolutionary unprecedented increase in environmental sound levels and artificial night lighting. It has been reported that rapid evolutionary changes could take place in response to light, noise and vibration, considering their magnitude, geographical limit, and degree in which they exhibit unprecedented environmental circumstances [6]. Studies on effects of anthropogenic light on regulation of physiology and species interactions have showed effects on invertebrate community [38], mating in geometrid moth [39]. Noting the disturbances in the garden, steps were taken to decrease the disturbing factors. Branches of big trees just next to the garden have been loped to decrease bird perching and increase sunlight. Lighting has been reduced at the garden site. Currently, more butterflies are being sighted after care was taken to reduce anthropogenic disturbances.

In the present study, considering both phases 1 and 2, a total of 43 species were observed in the campus. 39 species were sighted in the relocated garden (Table 1). 12 species (including introduced species) of different families of butterflies were new records for the newly established butterfly garden. The introduced species like Blue Tiger, Common Rose, Tawny Coster have successfully completed their life cycles in the new habitat. Adults of the species like Common Jay were seen before the establishment of the garden.

Earlier, we could not locate where the eggs were laid nor could we see caterpillars. After establishment of the garden, we were able to see where these species laid eggs regularly on their host plants *Polyalthia longifolia* many of which were freshly planted. The details of butterfly of different families were given in Table 1. Previous recording of the butterfly species diversity in the study area revealed the presence of 31 butterfly species, dominated by Nymphalidae (39%) over Lycaenidae (26%), Pieridae (16%), Papilionidae (9%) and Hesperidae (10%) (Figure 5).

Most butterflies recorded in the relocated habitat belong to the Nymphalidae with seven new records to the campus but two species Striped Tiger (*D. genutia*) and Common Leopard (*P. phalantha*) which were recorded previously were never seen in the newly established habitat during the study period. Six Papilionidae species were recorded with 3 new records. Six Lycaenidae species were recorded but 2 species including Monkey Puzzle (*R. amor*; seen rarely previously) and Common Pierrot (*C. rosimon*) sighted previously was never seen during the study period. With 2 new records, 7 Pieridae species were recorded. 3 species of Hesperidae seen earlier were also found (Figure 6 and 7).

Table 2. List of host and nectar plants planted in the butterfly garden and butterflies attracted to them.

Name of the plant	Type of the plant	Name of the butterfly dependent on the food plant
<i>Crotalaria sp.</i>	Nectar	Blue Tiger and other butterflies
<i>Murraya koenigi</i>	Host	Lime Butterfly and Common Mormon
<i>Calotropis sp.</i>	Nectar and host	Milkweed butterflies like Plain Tiger
<i>Ixora sp.</i>	Nectar and host	Monkey Puzzle
<i>Lantana camara</i>	Nectar	For most of the butterflies...
<i>Passiflora foetida</i>	Nectar and host	Tawny Coster
<i>Nerium odorum</i>	Nectar and host	Common crow
<i>Catharanthus sp.</i>	Nectar	
<i>Heliotropium indicum</i>	Nectar	
<i>Wattaka kavolubilis</i>	Nectar and host	Blue Tiger
<i>Cassia sophera, Cassia fistula</i>	Host	Mottled Emigrant, Common Emigrants, Common Grass Yellow
<i>Cassia auriculata</i>	Host	Larval host plant of Emigrants and Common Grass Yellow
<i>Cassia sp., Cassia tora, Cassia alata</i>	Host	Common Emigrant
<i>Aristolochia sp.</i>	Host	Common Rose
<i>Stachyterpheta jamaicensis</i>	Nectar	
<i>Wedelia sp.</i>	Nectar	

<i>Cleome sp.</i>	Host	Psyche
<i>Citrus sp</i>	Host	Lime Butterfly and Common Mormon
<i>Ricinus sp.</i>	Host	Castor
<i>Neolamarckia cadamba</i>	Nectar and host	Commander
<i>Tridax sp.</i>	Nectar	
<i>Vernonia sp.</i>	Nectar	
<i>Blumea lacera</i>	Nectar	
<i>Phoenix sp.</i>	Host	Palm Fly
<i>Taberne sp.</i>	Nectar	
<i>Polyalthia sp.</i>	Host	Tailed Jay, Common Jay
<i>Petunia sp.</i>	Nectar	
<i>Ruellia tuberosa</i>	Nectar	
<i>Bauhinia sp.</i>	Host	Chestnut -Streaked Sailor
<i>Sida rhombifolia</i>	Nectar and host	Lemon Pansy, Grey Pansy, Lime Blue, Common Pierrot, Indian Skipper
<i>Sida acuta</i>	Nectar and host	Lemon Pansy, Grey Pansy, Lime Blue, Common Pierrot, Indian Skipper
<i>Balsam sp.</i>	Nectar	
<i>Hibiscus sp.</i>	Nectar	
<i>Clitoria ternatea</i>	Nectar	
<i>Phyla nodiflora</i>	Nectar and host	Lemon Pansy, Grey Pansy and Peacock Pansy Pansypansy
<i>Euphorbia hirta</i>	Nectar	

Mukherjee et al. [29] have studied butterfly species diversity by random sampling in rural, suburban and urban localities of Kolkata. They have shown that suburban areas had maximum species (96 numbers), which was dominated by Lycaenidae, followed by rural (81 numbers) and urban area (53 numbers). It has been documented that urban areas can sustain a number of butterfly species [29,34].

The present study was carried out in a small set up garden, which is the smaller part of urban area and overall 43 numbers of butterfly species were observed. Butterflies belonging to Nymphalidae were found to be maximum (44%) followed by Pieridae (16%), Lycaenidae

(19%), Papilionidae (14%) and least was Hesperiiidae (7%). In a study by Ghosh and Mukherjee [34], in Serampore (a suburban area of Kolkata), 38 species of butterfly belonging to 30 genera and five families were recorded and enlisted. Nymphalidae showed the maximum species richness, comprising of 15 species (39%), followed by Lycaenidae (6 species, 16%), Pieridae (6 species, 16%), Hesperiiidae (6 species, 16%) and Papilionidae (5 species, 13%). This study was conducted over a short time. Nevertheless, diversity seen in our local urban area is quite comparable to that seen in this suburban area. Different landscape and composition of host plants may account for the difference in relative percentage of different families of butterflies.

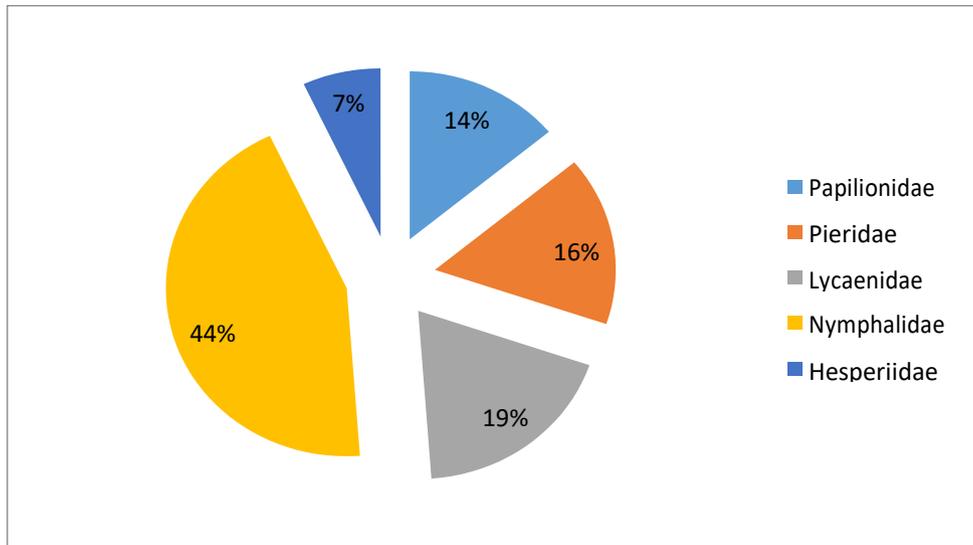


Figure 4. Family wise distribution of throughout the study period

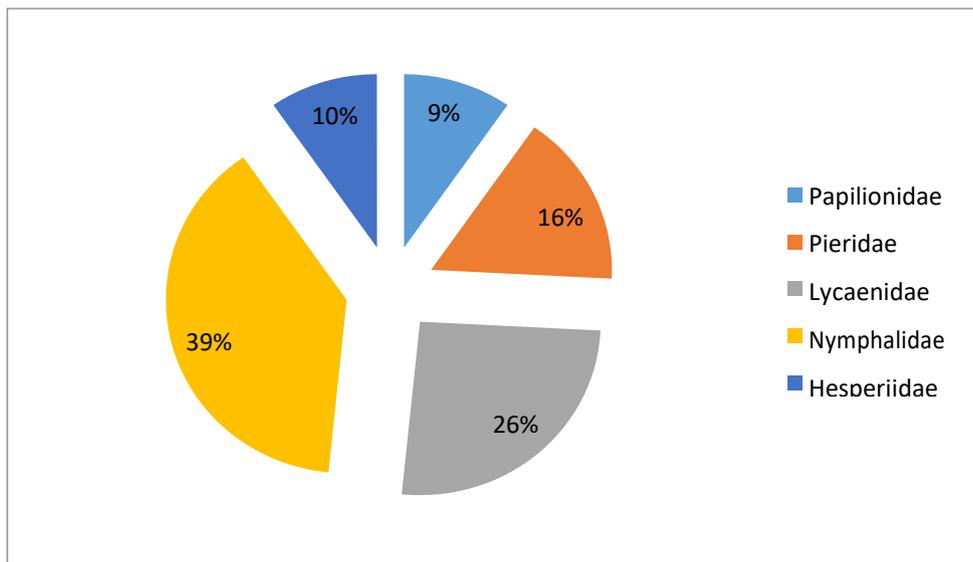


Figure 5. Previously seen family wise distribution of butterflies in the garden.

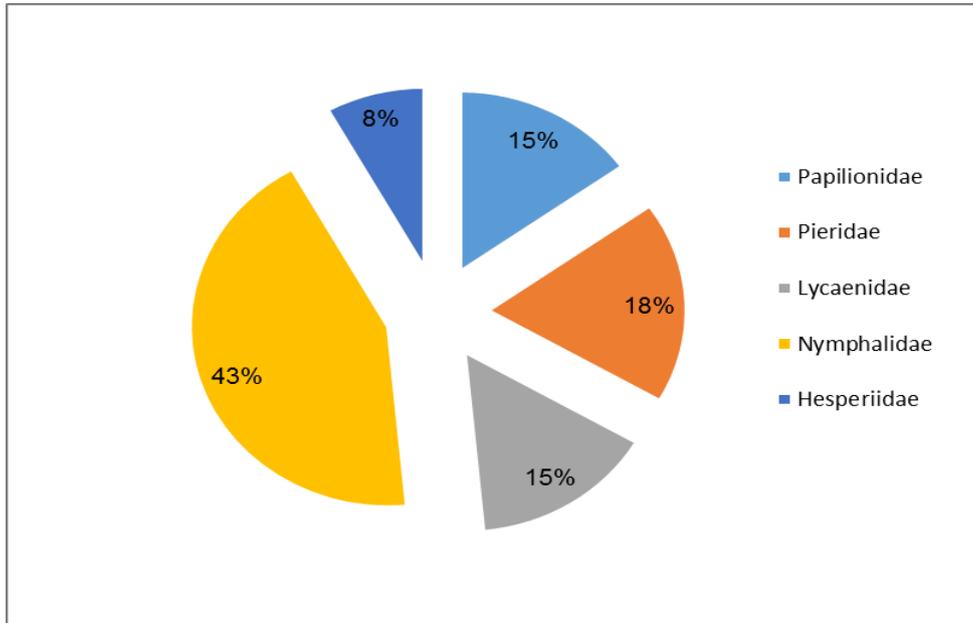


Figure 6. Recently seen family wise distribution of butterflies in the garden.

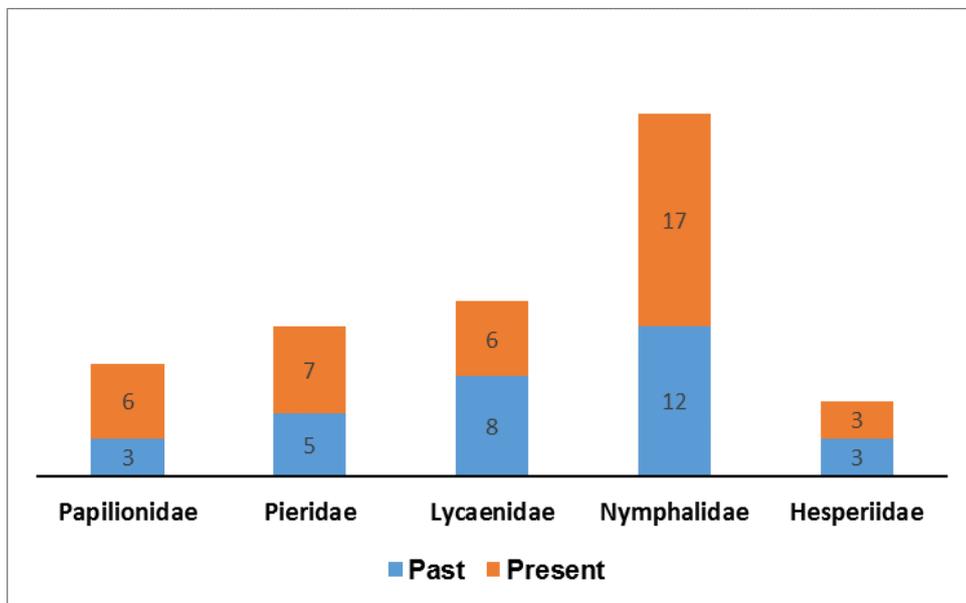


Figure 7. Change in family wise species richness of butterflies recently in the garden during study period.

It has already been established that birds are major predator of butterflies. There was luxuriant growth of plants and trees in the new garden during the year especially after monsoon. Abundance of butterflies was seen. This caused increase in bird population. There was perceptible decline of caterpillars. In analyzing the decline, a few things are evident. The predator pressure is foremost.

The trees surrounding the garden support many birds mainly crows (*Corvus splendens*), sparrows (*Passer domesticus*), Bulbul (*Pycnonotus cafer*), Common Maina (*Acridotheres tristis*), tailor bird (*Orthotomus sutorius*) etc. The caterpillars serve a ready concentrated food source. The number of caterpillars decreased even after sighting a sizeable number over a period of observation. A study on Butterfly abundance at DAE campus, South India, birds have been found to be preying actively on palatable species of butterflies and be an important governing factor of butterfly population [31], which supported the present study for predation as a demerit for butterfly diversity in an urban area. This predation can be mitigated through special measures for future research.

Therefore, butterfly gardening is a unique approach for eco-restoration phenomenon, where both monophagous or polyphagous butterfly species visit within a short strip of land. Conservation is facilitated with suitable measures taken to mitigate anthropogenic stresses, human interference and predation.

4. CONCLUSIONS

Many butterflies have been seen in the relocated garden, some choosing it as their home for completing their life cycle. To this end, it can be said that the butterfly garden established in an urban surrounding has to some extent restored the habitat and offset effects of anthropogenic disturbance.

Space is a limiting factor. Host plants of butterflies whose adults were sighted but who did not find enough plants to lay eggs need to be planted. If more area in surrounding areas can be made available, it is hoped more butterflies will choose this relocated garden as their home. Care has to be taken to decrease effects of street lighting, bird predators and human disturbance.

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