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Eco-ethology study of butterfly species found in set up garden in an urban area, Kolkata, India

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Abstract
The objective of the present study was to identify the habitat preferences (ecology), nectar-plant as well as host-plant interaction and different behavioural (ethology) activities in the unmanaged and set up garden within the campus (southern side) of Lady Brabourne College, Kolkata, India. The set up garden was constructed in an effort to offset the damage caused to their habitat due to heavy construction activity/anthropogenic disturbances in the campus. The study was conducted of an area of about 30m X 14m size through focal-animal sampling method and studied in two phases as in the first phase, survey of butterflies' habitat and behavioural activities within an unmanaged garden in the campus prior to construction activity (May 2012 to October, 2012) and in the second phase, setting up a garden in another site of same campus with plantation of host plants preferred by butterfly species between October, 2012 to June, 2015. Specific behaviour pattern like resting, hovering, basking, flight, courtship flight, chasing, mud puddling, mating and also nectaring preferences of local butterflies for local plants was studied. The results showed that Plains Cupid spent maximum time on basking (21%), other species 10 % to 13% or less time. The Blue Tiger, Castor, and Common Jezebel showed nectaring (8-10%) and others species 3-7%. Resting (10-15%) was seen by Common Grass Yellow and other species viz. Plains Cupid, Forget-Me-Not, Peacock Pansy, Gram Blue and Common Mormon were not found in resting. Blue Tiger, Mottled Emigrant, Lime Butterfly, Common Jezebel, Psyche spent maximum time (9-15%) on hovering. No hovering activity was observed in Plains Cupid, Forget-Me-Not, Common Evening Brown. On courtship, Plains Cupid shows maximum activity. Common Evening Brown spent most time sitting in cool shady place sitting on garbage, ripped fruit etc. Mottled Emigrant (19.5%), Blue Tiger (18%), Common Castor (11%), Striped Albatross (6%) were observed to mudpuddle. This study indicates preference of weeds as nectar source by the different families of butterflies. In conclusion, this study emphasizes the importance of saving some land in a garden for the so-called weeds. The normal ethology indicates their adaptation in the new habitat and success of effort for restoration of sustainable ecosystem in the urban area.

Keywords: Butterfly garden, Host plant preferences, butterfly species, urban area, human interference, eco-ethology

1. Introduction
The basic habitat ecology of butterfly species in forests, gardens, parks etc. is governed by nectar as well as host-plant preferences of butterfly in which flowers for attraction, nectar content, pollination as well as leaf of particular plant species supporting egg-laying, play a role and also serve as food for larvae [1]. According to Kuussaari *et al.,* [2], butterfly species increased as per availability of plant species in the semi-urban and urban area. It has been reported the native plant species support food for leaf-eating caterpillars and nectar sipping adult butterflies but the butterfly species are eliminated when the plant species in the area is replaced by exotic invasive species [3].
Butterflies do not feed indiscriminately from any flower they find. They show preference for nectar flowers with specific chemical composition [4]. But, very little information is available on feeding habits and food resources of adult butterflies compared to that of the larvae [5]. Butterflies often disperse to areas in patches, with an abundance of nectar flowers [6]. Despite the importance of nectar for butterfly ecology, nectar flower use by individual species is often poorly known, particularly in specific localities. Nectar flower use can vary by region and can depend on the availability of flower and on relative nectar quality [6, 7]. Nectar resource use has been studied in wild life sanctuary at Gujarat [8]. Highest number of butterflies was recorded in *Lantana camara.* This study was conducted on available plant resources in the sanctuary. To understand butterfly-flower interaction in urban scenario, in a new habitat, it is important to know the nectar plant preferences of the local butterflies.

The information would help in better planning and planting of plants in the garden.

Butterfly gardens can be set up in most locations by introducing butterfly host plants. The area can be large or small. Information pertaining to the life history patterns, host range and habitat associations of various butterflies is essential prior to designing the garden. The butterfly species choose their host plant to increase population of larvae. Sharma and Sharma [8], have mentioned that major butterflies are choosy and each species show its own particular requirements in relation to habitats, temperature, relative humidity, larval food plants and adult food sources. It has also been recorded that 190 butterfly species feed on 149 flowering plant species across forests and urban parks in Singapore [9].

However, butterfly diversity is directly dependent on particular plant species for availability of nectar [10, 11, 12]. On the other hand, host plants and their parts are also useful as food for different butterfly species [13, 14]. In the South Asian scenario, a choice of feeding as well as egg laying preferences onto the particular plant species by butterflies have been reported [4, 14, 15]. Like other macroinvertebrates, butterfly is an important fauna and known as a valuable pollinator. These pollinators are indicator of good environmental health [16, 17, 18, 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 [2, 15, 21]. Even though information regarding species specific habitat preference and different ethological activities of butterflies are available [14, 22, 23] data is scanty with respect to eco-ethology of different species in a setup garden in an urban area. Diversity of nectar host plants and abundance of butterflies have a direct relationship has been documented by Solman Raju [24] and Krauss *et al* [25].

It was documented that as per availability of suitable nectar as well as host plant in their habitat they behave in a different manner such as basking, resting, foraging, pollinating, nectaring, mudpuddling, hovering, courtship-flight and mating [8, 23, 26, 27]. In general, behavioural (ethological) response in animal is an adaptive feature in relation to particular habitat and indication of natural selection [28]. Butterflies are small macroinvertebrates and cold blooded animal in the terrestrial ecosystem. They choose specific habitats for their nutritional requirements. They need sunlight to increase their body temperatures for flight mechanism. They select basking substrates and precisely orientate their wings with respect to the sun to receive the warmth of sunlight to start their activity [29]. Some bask by spreading their wings flat. Butterflies with dark surface raise temperature sooner. On the other hand, butterflies with light colouration as white and yellow, reflect more light. They have darker bands or spots to aid in rise of temperature. However, on very warm days or if body temperature is sufficiently elevated they rest in cool, shady places [5].

The present study was conducted to know the behavior (ethology) of butterflies with special reference to their nectar and host-plant preference in a restored habitat in the campus area of Lady Brabourne College situated in a densely populated urban area of central East Kolkata, India.

2. Materials and Methods

2.1 Study site

The study site was selected in the campus of Lady Brabourne College located in the central east side of Kolkata, West Bengal, India with a latitude of 22º32´40.8´´N and longitude of 88º22´05´´E with an elevation of 7m MSL (as per GPS survey and locations of the point determined by Prismatic compass calculation) [30]. The campus building is surrounded by garden with a large public maidan or field, and a nursery on the Eastern region and constructed buildings on all other sides. The sprawling campus had good vegetation with different herbs, shrubs and trees. The western side of the campus building had wild plants growing along with cultivated plant species. The present study was conducted in a butterfly garden created on the south side of the campus to compensate for the habitat loss in the area due to construction and building activity.

2.2 Study period

The study period was divided into two phases. In the first phase, survey of butterflies' habitat and behavioural activities within an unmanaged garden in the campus (Lady Brabourne College, Kolkata) was carried out prior to construction activity (May 2012 to October, 2012) and in the second phase, setting up a garden in another site of same campus with plantation of host plants preferred by butterfly species was done and observed for butterfly visits, host-plant preference and ethological activities (between October, 2012 to June, 2015).

2.3 Field survey for eco-ethology

A status survey of butterfly species was done in the college campus and in the adjoining areas before setting up the garden. A checklist of butterflies in relation to host-plant preferences with special reference to nectar plants and larval food plants was prepared [30]. Different behavioural activities of butterflies were studied using focal-animal sampling method [31, 32]. Time allocation was calculated as man hour. Behavioral allocation in man hours of different activities in different species of butterflies was done over a period of 5 months (Two hours in the morning and Two hours in the evening with intermittent gaps). Focal-animal sampling refers to any sampling method in which (i) all occurrences of specified (inter)actions of an individual, or specified group of individuals, are recorded during each sample period, and (ii) The length of time each focal individual spent in various activities, was recorded. The sample, which was once chosen as focal individual was followed to whatever extent possible during each of his study period.

In this present study, the focal individual was butterflies of different family. Each individual was observed for 5 minutes. During this sample period, all the different activities by the focal individual were recorded. Field observation was recorded for two hours each in morning and afternoon session. A time-budget of behaviours like foraging, nectaring, flower-visiting (flight), basking (thermoregulation), mud puddling (drinking at wet soil patches), resting, courtship flight, was recorded.

3. Results

3.1 Weeds and cultivated plant species for butterfly preferences in set up garden

The present study results indicate that butterfly species can be increased through setting up a garden in an urban area, if these species got suitable nectar and host-plants. Fig 1A – S depicts different species of butterflies found in the set up garden during the study period. Butterfly species diversity and their nectar plant preferences have been studied in the butterfly garden set up in an urban area. To create the butterfly garden weeds and cultivated plant species were planted as well as grown from seeds.

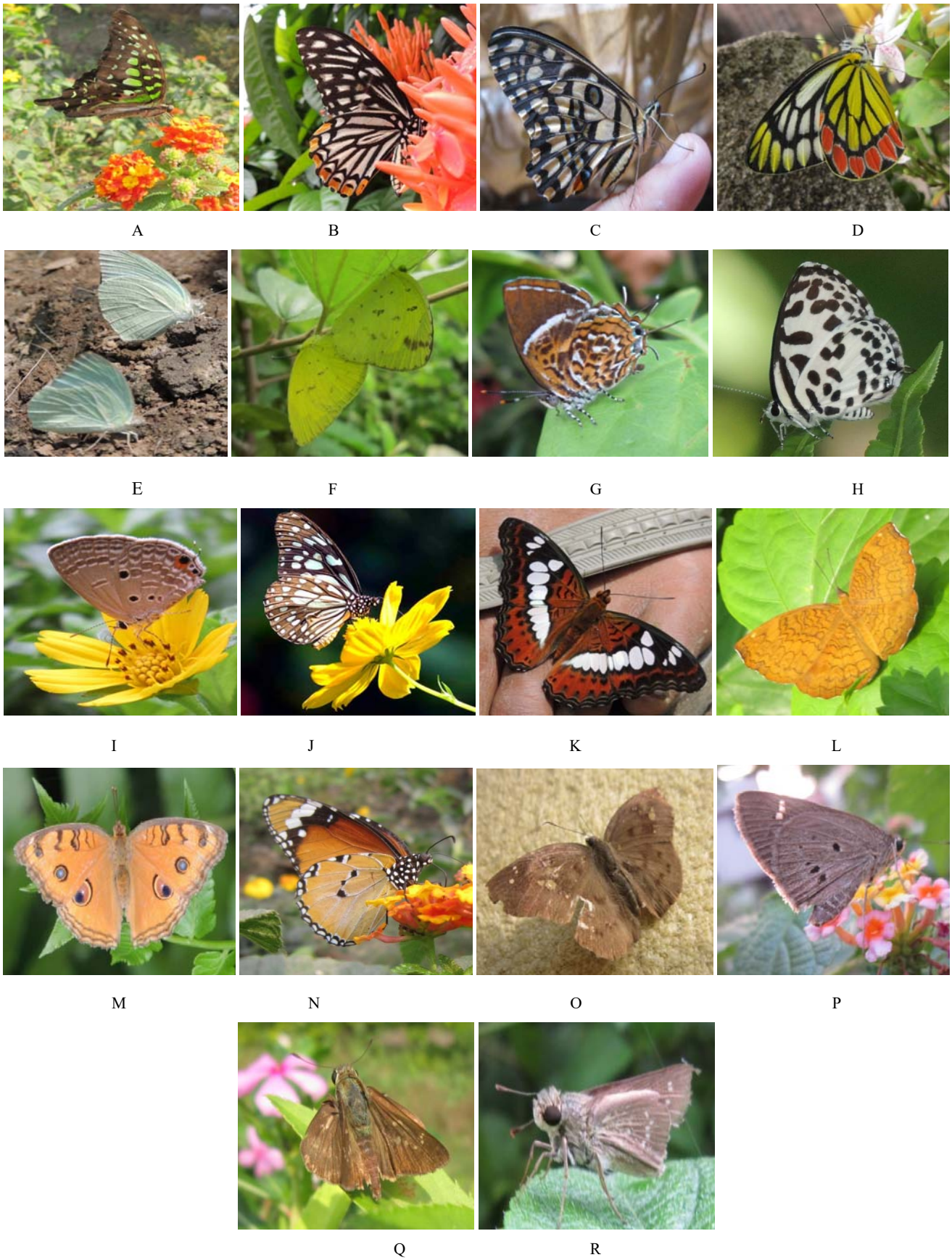


Fig 1: Some of the species of butterfly belonging to different families observed in the garden during the study period [A = Tailed Jay (Papilionidae); B = Common Mime (Papilionidae); C = Lime Butterfly (Papilionidae); D = Common Jezebel (Pieridae); E = Common Emigrant (Pieridae); F = Three Spot Grass Yellow (Pieridae); G = Monkey Puzzle (Lycaenidae); H = Common Pierrot (Lycaenidae); I = Plains Cupid (Lycaenidae); J = Blue Tiger (Nymphalidae); K = Common Baron (Nymphalidae); L = Commander (Nymphalidae); M = Common Castor (Nymphalidae); N = Peacock Pansy (Nymphalidae); O = PlainTiger (Nymphalidae); P = Common Snow Flat (Hesperiidae); Q = Skipper (Hesperiidae); R = Small Branded Swift (Hesperiidae); S = Rice Swift (Hesperiidae)]

The list of weeds and cultivated plant species is tabulated in Table 1. Naturally growing suitable weed plants present previously were left undisturbed.

Table1: List of the butterfly attracting plant species in the set up garden

Weeds			Cultivated		
Plant species	**Local Name**	**Family**	**Plant species**	**Local Name**	**Family**
Lantana camara	Putush	Verbenaceae	*Cosmos sulphureus*	Cosmos	Asteraceae
Calotropis gigantea	Akanda	Apocynaceae	*Wedelia chinensis*	Bhringaraj	Asteraceae
Crotalaria sp.	Atasi	Fabaceae	*Ixora chinensis*	Rongon	Rubiaceae
Mikenia micrantha	Mile-a minute plant	Asteraceae	*Alstonia scholaris*	Chhatim	Apocynaceae
Vernonia cinara	Chhoto kukshim	Asteraceae	*Tagetes errecta*	Ganda	Asteraceae
Tridax procambens	Tridhara	Asteraceae	*Neolamarckia cadamba*	Kadam	Rubiaceae
Sida acuta	Peet berela	Malvaceae	*Catharanthus roseus*	Nayantara	Apocynaceae
Leonurus sibricus	Roktodron	Lamiaceae	*Delonix regia*	Krishna chura	Fabaceae
Syndrella nodiflora	Syndrella	Asteraceae	*Taberne Montana coronaria*	Togor	Apocynaceae
Stachyterpheta jamaicensis	Jar bansh	Verbenaceae	*Cestrum nocturnam*	Night blooming jasmine	Solanaceae
Blumea lacera	Kukur muta	Asteraceae	*Rosa sp.*	Rose	Rosaceae
Meliolotus albus	White sweet clover	Fabaceae			
Parthenium hysterophorus	Congress grass	Asteraceae			
Ruellia tuberosa	Popping pod	Acanthacea			

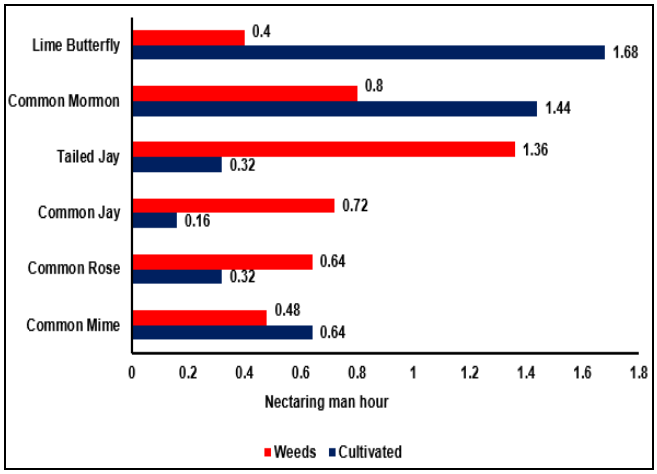
All the observed butterfly species under five families is tabulated in Table 2. 5 families of butterflies comprising of 45 species belonging to 35 genera were observed in the set up garden. Total of 28 species, (Papilionidae – 6, Lycaenidae – 4, Nymphalidae – 9, Pieridae – 7 and Hesperiidae – 2) were studied to explore their preference of weeds versus cultivated plants available in the garden (Table 2).

It was observed that weeds harbour most species of butterflies compared to cultivated ornamental plants. Fig 2, shows data recorded for butterfly family wise nectaring preferences in relation to weeds and cultivated plants. Among the 6 species of Papilionidae, Lime butterfly, Common Mormon, and Common Mime preferred cultivated plants over weeds (Fig 2A). In case of Lycaenidae (Fig 2B), 3 out of the 4 species observed preferred weeds. Lycaenids are polyphagous and have other food preference too. Fig 2C also shows that in Nymphalidae all species preferred weeds. Swift belonging to Hesperiidae also preferred weeds (Fig 2D). In family Pieridae (Fig 2E), all species showed preference of weeds over cultivated except Common Jezebel. It is commensurate with its known behaviour to prefer mainly tree tops and canopy except feeding on flowers when it comes down. However, during the observation time, it was not seen at lower heights. Overall, the date shows that out of the 29 butterfly species selected for studies, 23 species preferred weeds. This study indicates preference of weeds as nectar source by the different families of butterflies. Out of 25 plant species, 14 species, which are commonly known as weeds are preferred over the cultivated species.

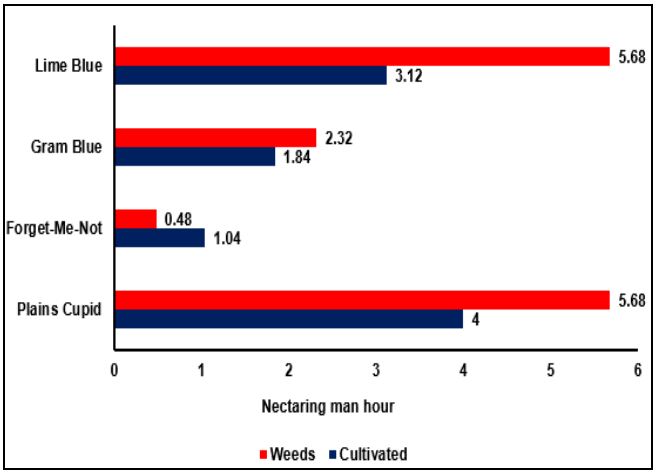
Table 2: Relative distribution of genera and species of different butterfly families recorded in the set up garden

Family of butterfly	Number of Genus	Number of species	Genus	Species (Common name)
Papilionidae	4	6	*Papilio* *Graphium* *Atrophaneura* *Chilasa*	*P. polytes* (Common Mormon), *P. demoleus* (Lime Butterfly) *G. doson* (Common Jay) *A. agamemnon* (Tailed Jay) *A. aristolochiae (Pachiliopta* (*aristolochiae,)(*Common Rose) *C. clytia* (Common Mime)
Pieridae	7	9	*Eurema* *Catopsilia* *Appias* *Cepora* *Delias* *Leptosia* *Pareronia*	*E. blanda* (Three-Spot Grass Yellow), *E. hecabe* (Common Grass Yellow) *C. Pomona* (Lemon Emigrant), *C. pyranthe* (Mottled Emigrant) *A. libythea* (Striped Albatross) *C.nerissa* (Common Gull) *D. eucharis* (Common Jezebel) *L. nina* (Psyche) *P. valeria* (Common Wanderer)
Lycaenidae	7	8	*Rathinda* *Castalius* *Catochrysops* *Lampides* *Pseudozizeeria* *Euchrysops* *Chilades*	*R. aamor* (Monkey Puzzle) *C. rosimon* (Common Pierrot) *C. starbo* (Forget-Me-Not) *L. boeticus* (Pea Blue) *P. maha* (Pale Grass Blue) *E. cnejus* (Gram Blue) *C. pandava* (Plains Cupid), *C. lajus* (Lime Blue)
Nymphalidae	13	18	*Tirumala* *Danaus* *Euploea* *Melanitis* *Elymnias* *Mycalesis* *Ypthima* *Phalanta* *Moduza*	*T. limniace* (Blue Tiger) *D. genutia* (Striped Tiger), *D. chrysippus* (Plain Tiger) *E. core* (Common Crow) *M. leda* (Common Evening Brown) *E. hypermenstra* (Common Palmfly) *M. perseus* (Common Bushbrown) *Y. baldas* (Common Five-Ring), *Y. huebneri* (Common Four-Ring) *P. phalantha* (Common Leopard) *M. procris* (Commander)

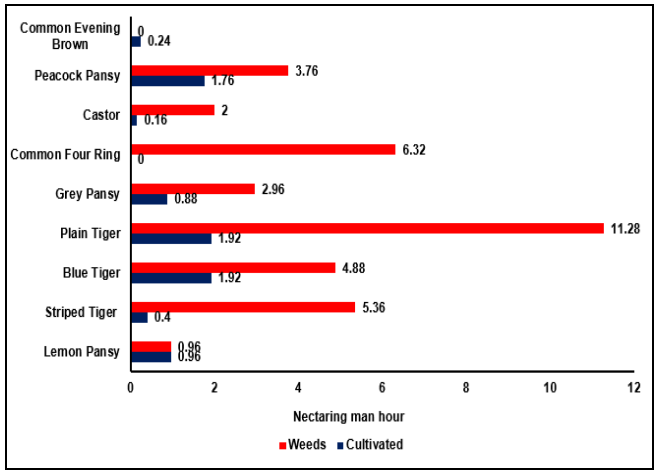
			Neptis *Acraea* *Junonia* *Euthalia*	*N. jumbah* (Chestnut-Streaked Sailer) *A. merione* (Common Castor), *A. violae* (Tawny Coster) *J. atlites* (Grey Pansy), *J. almana* (Peacock Pansy), *J. lemonias* (Lemon Pansy), *J. iphita* (Chocolate Pansy) *E. aconthea* (Common Baron)
Hesperiidae	4	4	*Spialia* *Borbo* *Pelopidas* *Taqiades*	*S. galba* (Indian Skipper) *B. cinnara* (Rice Swift) *P. mathias* (Small Banded Swift) *T. sp.*



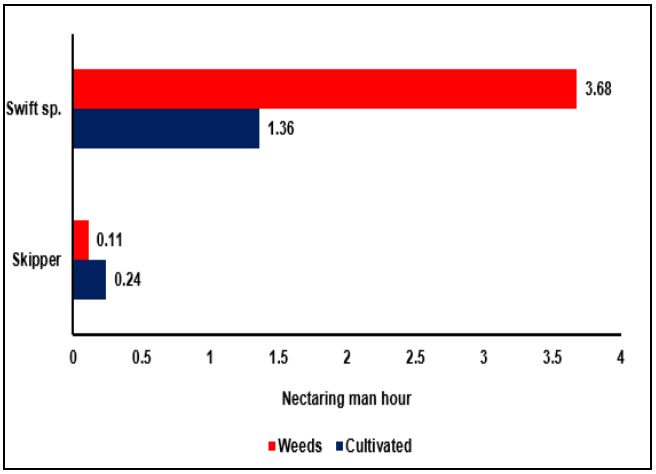
A. Papilionidae



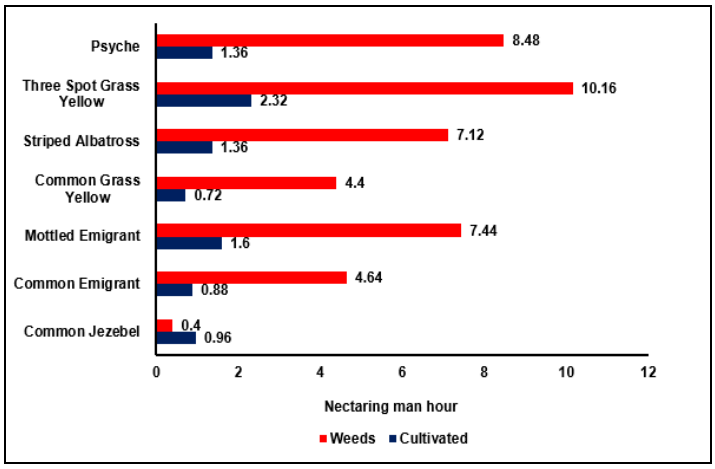
B. Lycaenidae



C. Nymphalidae



D. Hesperiidae



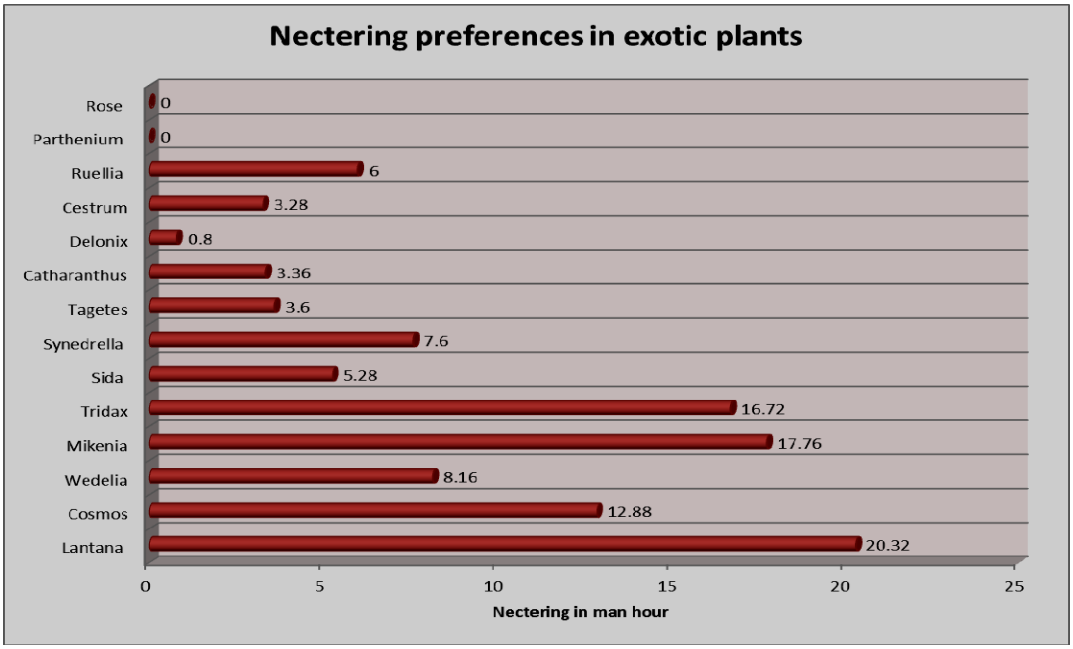
E. Pieridae

Fig 2 (A – E): Different butterfly species in relation to nectar plant preference (weeds and cultivated species) in the set up garden

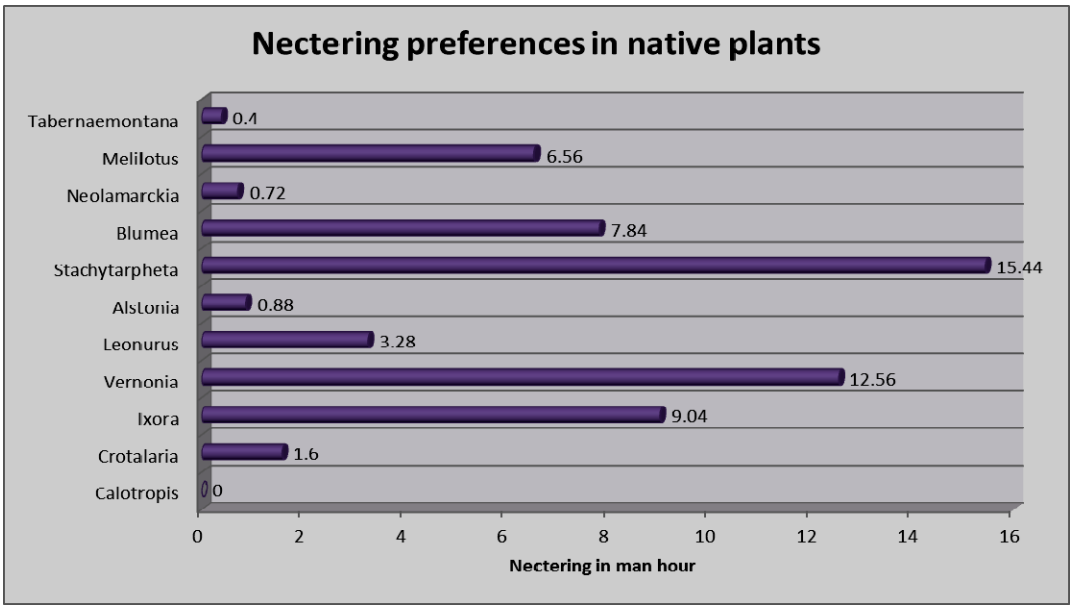
Plants in the garden were categorized as native and exotic (Table-3). Among exotic plants, *Lantana, Mikenia, Tridax, Cosmos, Wedelia, Syndrella* seem to be mostly preferred for nectaring by different families of butterflies. Among the native plants, *Stachyterpheta* was preferred by most families followed by *Vernonia, Ixora and Blumea, Melilotus* and *Leuneorus.* Family Pieridae and Hesperiidae mostly preferred *Tridax* (exotic) and *Stachyterpheta* (native), followed by *Vernonia and Melilotus. Mikenia* preferred maximum by family Nymphalidae, followed by Hesperiidae and Pieridae. Lantana is preferred maximum by Papilionidae and mostly by Pieridae and Nymphalidae family. Exotic species as *Cosmos, Wedelia* and native species viz. *Blumea, Melilotus, Stachyterpheta* and *Vernonia* were found to be preferred by the family Lycaenidae. Species like *Rosa*, *Delonix* were not much preferred by the butterfly species (Fig 3 A – B).

Table 3: List of exotic and native plants studied for nectaring preference

Exotic	Native
Lantana camara	*Calotropis gigantea*
Cosmos sulphureus	*Crotalaria juncea*
Wedelia chinensis	*Ixora chinensis*
Mikenia micrantha	*Vernonia cinerea*
Tridax procumbens	*Leonurus sibiricus*
Sida acuta	*Alstonia scholaris*
Synedrella nodiflora	*Stachytarpheta jamaicensis*
Tagetes sp.	*Blumea lacera*
Catharanthus roseus	*Neolamarckia cadamba*
Delonix regia	*Melilotus albus*
Cestrum nocturnam	*Tabernaemontana divaricata*
Ruellia tuberosa	
Parthenium hysterophorus	
Rosa sp.	



A



B

Fig 3 (A – B): Relative nectaring preferences of different species of exotic and native plants

3.2 Behavioural activities of butterfly species in set up garden

As a part of the study, different behavioural activities of these butterflies were carried out in the set up garden. Various activities such as basking, resting, flight, courtship flight, chasing, mating, mudpuddling etc. was studied for the different species found in the garden. Many species (49) of butterfly were observed during the study period. Many were short time visitors which came for nectaring, but did not stay as suitable host plants and other conditions were not available. 20 species which were regularly seen were chosen for behavioral study in the restored habitat of the newly established garden. Behavioral allocation in man hours (in sec / activity) of different activities in different species of butterflies was done over a period of 5 months. Fig. 4. is a comprehensive representation for several behavioural activities of different butterfly species during the study period. Differential average activities were recorded by different species of butterflies (in sec/activity). It was observed that Plains Cupid spent maximum time on basking (21%). Other species spent 10 % to 13% or less time. 8-10% of time was observed to be spent on nectaring by Blue Tiger, Castor, and Common Jezebel. Rest of the butterflies spent 3-7% time nectaring. 10-15% time was seen to be spent on resting by Common Grass Yellow. During the observation period, Plains Cupid, Forget-me-not, Peacock Pansy, Gram Blue and Common Mormon were not found resting. Blue Tiger, Mottled Emigrant, Lime butterfly, Common Jezebel, Psyche spent maximum time (9-15%) on hovering. No hovering activity was observed in Plains Cupid, Forget-me-not, Common Evening Brown. On courtship, Plains cupid shows max activity. Common Evening Brown spent most time sitting in cool shady place sitting on garbage, ripped fruit etc. Mottled Emigrant (19.5%), Blue Tiger (18%), Castor (11%), Striped Albatross (6%) were observed to mudpuddle.

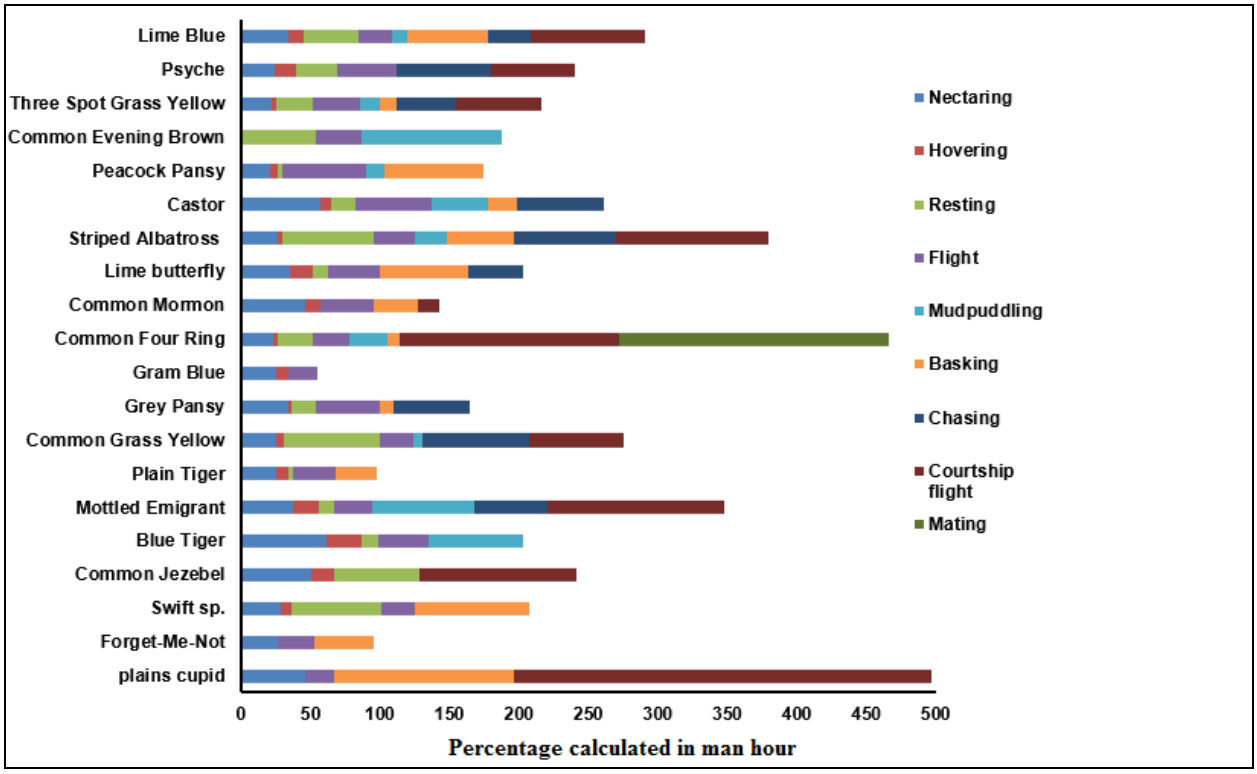


Fig 4: Differential average activities shown by different species of butterflies (in sec / activity)

4. Discussion

In the present study it was seen that in spite of the environmental stresses in an urban area, the butterfly diversity increases if a habitat with suitable nectar as well as host plant is found for a sustainable life. Similar observations of strong associations of butterflies with host-plants for the completion of their life cycle nectar plants use have been reported [33, 34, 35]. Apart from feeding on nectar as is familiar with butterflies, the diet of adults is varied. Alcohol, rotting fruits, vegetables as well as rotting animals, minerals from soil etc. are included in their food preferences. For many butterflies, drinking at wet soil patches is an important feeding activity, which also has a profound implication on reproduction [36]. Sharma *et al* [37] have documented that the plant species belonging to families Mimosaceae, Capparaceae, and Caesalpiniaceae contained most appropriate food for butterfly species belonging to the 4 different families of butterflies in Gir National Park, Gujarat, India. A study in Dhaka University garden, Bangladesh reports Compositae, Verbenacaeae, Asteraceae, Amaranthaceae, Labiateae, Viticeae and Apocynaceae harbour several butterfly species [38]. In the present study, it was found that the attracting plant species belonged to Verbenacaeae, Apocynaceae, Fabaceae Asteraceae, Malvaceae, Lamiaceae, Acanthaceae family.

Behavioral allocation in man hours (in sec / activity) of different activities in different species of butterflies was done over a period of 5 months. Foraging behaviours of insects were observed on different flowers such as *Lantana camara*, *Ixora* sp. etc. According to Begum *et al* [38] and Goulson and Cory [39], reported that flower colors and fragrance together employ strong signal for foraging. Moreover, *L. camara* is a suitable weed which supports several butterfly species [40].

Several reports have emphasized that choice of nectar feeding on particular flower and egg laying preferences onto the particular leaf of same or different plant species [4, 14, 15]. The butterfly species use leaf for egg-laying as well as feeding by

larvae. Basking was seen in non-flower habitat, like mud, rock, wastes, etc. in arctic butterflies [41]. Flight behaviour depends upon local weather condition of the season [42]. Basking behavior was observed in most of the species. Plains Cupid was observed to spend maximum time on basking.

Family Pieridae, Nymphalidae and Papilionidae have been generally seen mud puddling [8, 26]. Mud puddling behavior helps males for reproductive success due to sodium uptake from mud, wet soils etc. This activity serves sodium and amino acids to the female with the spermatophore transfer by males during mating as a nuptial gift. This also supports nutrition enhancement for the survival rate of the eggs [43, 44, 45]. In the present study, species belonging to Pieridae such as Mottled Emigrant (19.5%), Striped Albatross (6%) and Nymphalidae species such as Blue Tiger (18%), and Castor (11%), were observed to mudpuddle. These species of butterflies are thriving in this new habitat. The abundance apparently indicates their reproductive success.

Butterflies are seasonal in their occurrence. The months when adults are active are called as flight periods. The availability of the larval host plants is dependent on season, the plant in correct growth stage, appropriate temperature and humidity. Flight periods were also recorded. Butterflies occur seasonally being common for a few months and seen rarely or not at all in other months. Record of seasonal appearance of different species was kept from January to September (figure not shown). Blue Tiger was seen throughout and Plain Tiger seen all through except August, September. Further behaviour studies conducted in natural habitats will help in comparison and find if duration of flight time or time of the day and season shows any change. Comparison of how the availability of food plants in a localized area of the butterfly garden and in the expanse of large habitat have any effect on the various activities will need to be explored. In certain cities in South India, previously unreported butterflies are being recorded or previously uncommon butterflies are becoming common (for example the Common Palm Fly, Common Banded Peacock, Common Jay) [5]. Comparative study of flight periods in those and in original habitat will be an interesting data. We have also seen some butterflies like Danaid Egg fly, Common Leopard, Common Baron etc. for short time in the garden. It has to be observed if more visits are made by them in future. Availability of larval food plants will be most crucial for their sustenance. Otherwise they will remain as passing visitors searching for host plants. The present study conducted in college campus by setting up a butterfly garden also supports this notion. Though the area was a smaller one, through proper planning and planting of suitable plants it was successful in increasing the butterfly diversity [30].

Previous study documented that nectar, color and fragrance attract these pollinators and setting up a garden and/or park through urban designing may enhance butterfly diversity [4, 14, 21, 38]. Even though information regarding species-specific habitat study and different ethological activities of butterfly is available [8, 15, 22, 23, 26, 27], but data is lacking on the study of comprehensive eco-ethology of different butterfly species in a setup garden of urban area. It is well-known that both ornamental and more functional areas can be diversified for the benefit of arthropods and other animals [46]. However, space was found to be a limiting factor for increase in species diversity. Non availability of host plants prevented many species from laying eggs even they were observed nectaring [48, 49]. Effort is on to find space in surrounding area of the garden to plant suitable plants for their survival.

5. Conclusion

In conclusion, present eco-ethological observations of butterflies are an important aspect of study in the unmanaged and set up garden. The study throws light on nectar as well as host-plant preferences and the behavioural activities of several butterfly species. Generally, availability of food as well as host plants is most crucial for completing their life cycle. The present study observed many species for very short time, which indicates non availability of suitable conditions especially host plants. The present study in the set up garden at an urban area has shown that a suitable habitat with special reference to nectar (exotic as well as native) and host plant can be successful in supporting butterflies and other pollinators. Observed species exhibited several behavioural activities such as basking, nectaring, resting, chasing, hovering, flight, courtship flight and mud puddling, as a part of normal life cycle. They visit a variety of flowers in different seasons. Many of the flowering plants and weeds are used as nectar resource and thus support a rich diversity of butterflies and other pollinators. A butterfly garden helps to maintain the natural habitat for the pollinators. However, there are many environmental stresses still in urban area and a set up garden to some extent can restore and sustain the ecosystem for more butterfly species. Butterfly diversity study in Institutional estates has emphasized their importance in providing resources for butterflies. Large open areas on college campuses can be utilized for them to increase their abundance. In general, for beautification of urban areas, gardens and parks are built and emphasis is laid on ornamental plants. The present study emphasizes the importance of the so called weeds as an important part of the butterfly conservation effort.

It is suggested that to save these pollinators, space should be provided for weeds, where butterflies can visit and perform their activities and egg-laying. It will help conservation effort if during planning these are taken care of with less anthropogenic disturbances to enhance the diversity in an urban area.

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