

## Pattern of visit by butterflies in different time frames on *Lantana camara* Linnaeus in urban landscapes of Kolkata

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Submitted : 16.01.2017

Accepted : 09.03.2017

Published : 30.04.2017

### Abstract

Plant insect interaction is a healthy phenomenon in the nature. In the urbanised area, butterfly and flowering plant interaction indicates the status of environment of such area. *Lantana camara* Linnaeus is an invasive plant with a great negative impact to the nature but the butterfly association with this plant also has a great impact for holding biodiversity. A work was conducted to study the association of butterflies with *Lantana camara* Linnaeus in different time frame viz. 6-8 am, 8-10am, 10am-12pm, 12-2pm, 2-4pm and 4-6pm. A total number of 24 species of butterflies belonging to 4 sub families has been reported from this plant. Among these six time frames 8-10am holds significantly highest butterfly visitors ( $\chi^2=11.96296$ ,  $df=5$ ,  $p=0.035312$ ). Visitations of different butterfly families also have been studied and study shows different pattern of visit for different family in each time frame.

Key words : Butterfly, *Lantana camara* Linnaeus, Visitation pattern, Urban ecosystem.

### INTRODUCTION

Butterfly association with the flowering plants is a worthy phenomenon in nature. In the urban landscapes, such as cities, towns, spaces for plants and trees are common to endure the scenic beauty of landscapes and enhance the air quality of the environment (Mukherjee et.al, 2015)<sup>[1]</sup>. With time as urbanisation follows, some invasive plant species colonised and established themselves in natural component of the urban condition and *Lantana camara* L. is one of such invasive plant. This plant was native to tropical and subtropical America but now it has well spread into more than 60 countries around the world, especially in tropical Asia, Africa and Australia. This plant has a negative impact on the ecosystem, agriculture, livestock and human health. *Lantana camara* L. plant is reported as one of the important invasive weed in many countries and India is one of them. (Kritasampan et.al., 2016)<sup>[2]</sup>.

With the view of the pollinators, butterflies are marked as one pollinator of *Lantana camara* L., (Priyanka and Joshi, 2013)<sup>[3]</sup> (Forester, 2010)<sup>[4]</sup>. The association of butterflies with this plant species is a healthy incident for nature. A study on butterfly diversity on Kolkata metropolitan region was done by Biswas et. al. (2016)<sup>[5]</sup> in which a total number of 132 species has been reported. Mukherjee et.al. (2015)<sup>[1]</sup> studied the impact of butterfly on *Lantana camara* L. in urban landscapes of Kolkata and they have recorded a total number of 25 butterfly species from their work. A study was also conducted on the flower visiting arthropods on this plant by Kritasampan et.al.(2016)<sup>[2]</sup>.

This present study was conducted in some urban areas of Kolkata Metropolitan Region, from which communication reports total number of 24 species of butterflies belonging to 4 families from *Lantana camara* L. A study on different time specific visitation has also been conducted to observe the visitation pattern of butterfly on this plant in and around urban landscape.

### MATERIAL AND METHODS

#### STUDY AREA

The study was conducted by selecting three different study sites in the Kolkata Metropolitan Region, focusing on the urbanisation. Kolkata Metropolitan Region (KMR) is an urban agglomeration of city of Kolkata in the state West Bengal, India. This is the largest agglomeration in eastern India. The study area includes three regions of KMR which are Khardah (22°43'18.30"N, 88°22'42.41"E), Titagarh (22°44'41.14"N, 88°22'27.20"E) and Madhyamgram (22°41'27.77"N, 88°27'51.86"E). (Figure : 1)

#### Sampling plots design:

To conduct the study, three transect paths of 500 meters were placed in three different study sites. Total numbers of five quadrates with area of (5m X 5m) were placed randomly on the transect path to study butterfly diversity. Total fifteen quadrates have been placed among all the study sites.

#### Sampling period and time:

The study was conducted in the period of four consecutive months (March to June) of the year 2016. Transects were monitored during different time intervals of daytime. The study was conducted during 6 am to 6 pm with the time frames of 2 hours intervals i.e. 6 to 8 am, 8 to 10 am, 10 am to 12 pm, 12 to 2 pm, 2 to 4 pm and 4 to 6 pm. The butterfly species were identified with the help of the book Butterflies of India by Issac Kehimkar<sup>[6]</sup> and photographed with Nikon D7000 camera.

#### Study Description:

The plant *Lantana camara* L. is a wild invasive plant species. This deciduous shrub with an average height of 2m (6ft.) taxonomically belongs to the class Magnoliopsida, Order Lamiales, Family Verbenaceae (Priyanka and Joshi, 2013)<sup>[3]</sup>. This plant is a woody shrub, with prickly stem, opposite, ovate, subacute leaves with truncated base and both sides are crenate, serrate and scabrid. Flowers of this plant undergo change in colour with ages. Younger flowers have pink buds and yellow

flowers. In case of aged flowers, the colour is orange, magenta and scarlet. (Mukherjee et.al. , 2015)<sup>[1]</sup>.

### Data analysis

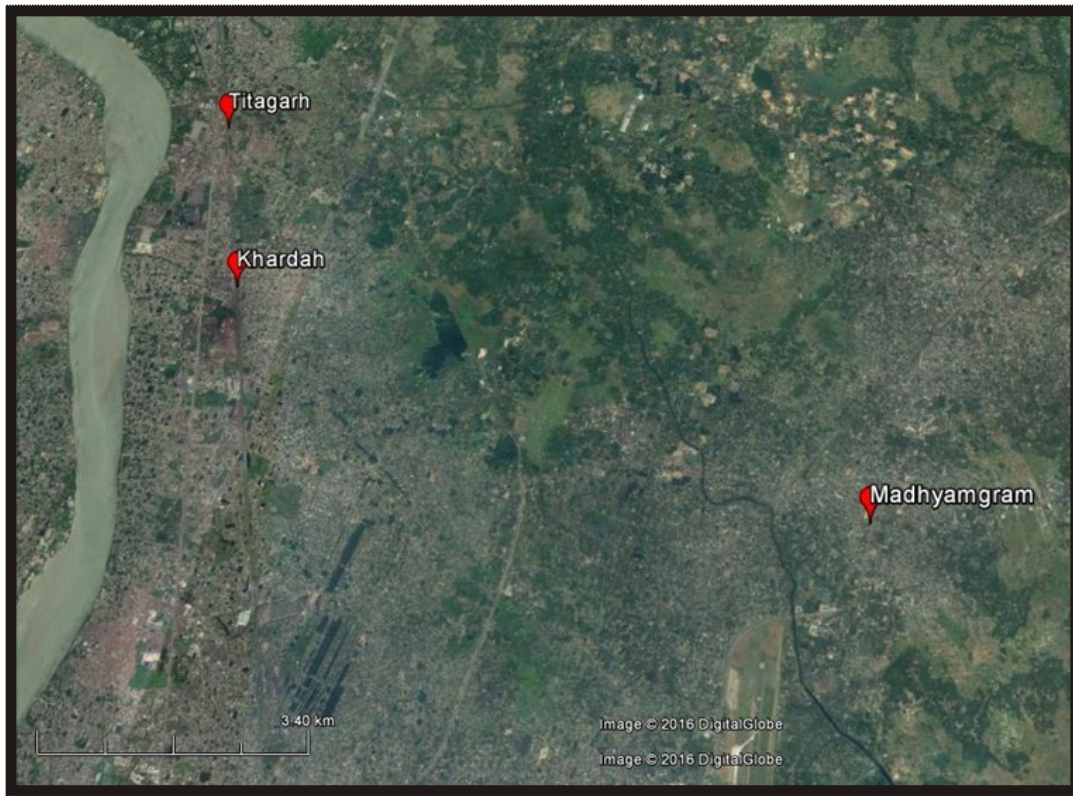
The butterfly species were identified with the help of above mentioned book and the recorded as necessary. To measure its significance, the recorded data was analysed by using Chi square test with the help of Microsoft Excel, Windows 2007.

### RESULTS

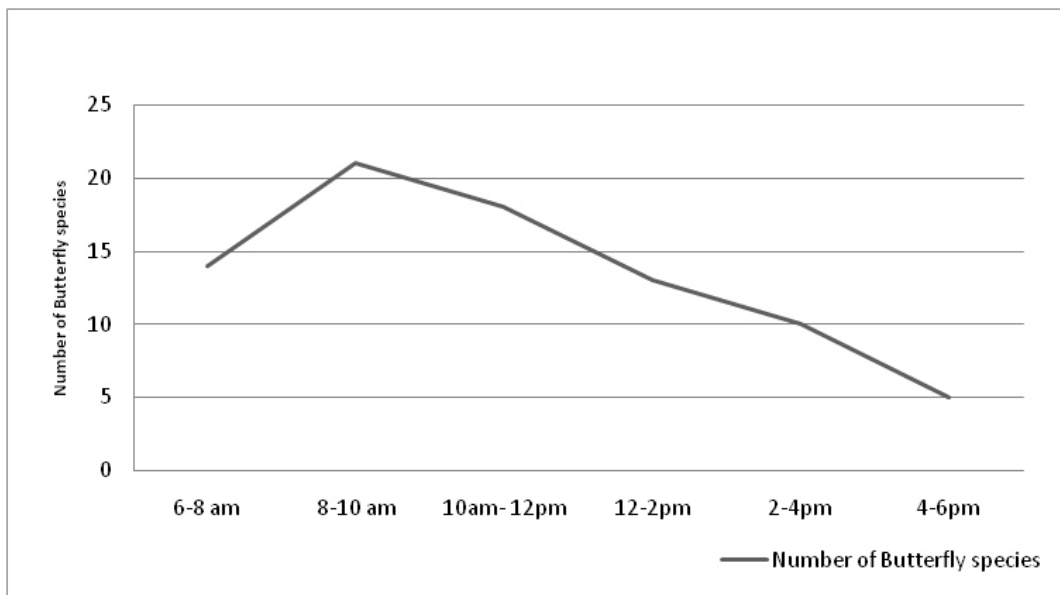
Among the 24 butterfly species belonging to 4 families recorded as visitors of *Lantana camara*L. (Table : I). Maximum number of butterflies were recorded under family Nymphalidae (10 species, 41.6%) followed by Pieridae (6 species, 25%), Papilionidae (5 species, 20.8% ) and Lycaenidae (3 species, 12.5%). With the respect of the study from different time intervals, Table I demonstrates that the highest numbers of

**Table 1:** List of butterfly species recorded from *Lantana camara* L. and their visitation on different time intervals.

Sl. No.	Scientific name	Butterfly species visit in each time frame					
		6-8 am	8-10 am	10-12 pm	12pm-2 pm	2-4 pm	4-6 pm
1.	<i>Papiliopolytes</i> Linnaeus, 1758	+	+	+	-	-	+
2.	<i>Papiliooclytia</i> (Linnaeus, 1758)	-	+	+	+	+	-
3.	<i>Papiliodemoleus</i> Linnaeus, 1758	-	-	-	+	+	+
4.	<i>Graphium</i> Agamemnon (Linnaeus,1758)	+	-	+	+	+	-
5.	<i>Graphiumdoson</i> (Felder, 1864)	-	+	-	+	-	-
6.	<i>Delias eucharis</i> (Drury, 1773)	-	+	+	-	-	-
7.	<i>Appiasolferna</i> Swinhoe, 1890	+	+	+	-	-	-
8.	<i>Euremahecabe</i> (Linnaeus, 1758)	+	+	+	+	+	-
9.	<i>Catopsilia Pomona</i> (Fabricius, 1775)	-	+	-	+	+	-
10.	<i>Leptosianina</i> (Fabricius, 1793)	-	+	+	+	+	-
11.	<i>Pareroniahippia</i> (Fabricius, 1787)	-	+	+	+	-	-
12.	<i>Junoniaatlites</i> (Linnaeus, 1763)	+	+	+	+	+	-
13.	<i>Danausgenutia</i> (Cramer, 1779)	+	+	+	-	-	-
14.	<i>Danauschrysippus</i> (Linnaeus, 1758)	+	+	+	-	-	+
15.	<i>Euploea core</i> (Cramer ,1780)	+	+	+	+	+	+
16.	<i>Tirumala limniace</i> (Cramer, 1775)	-	-	-	+	+	+
17.	<i>Acraea violae</i> (Fabricius,1775)	+	+	-	-	-	-
18.	<i>Hypolimnasbolina</i> (Linnaeus, 1758)	-	+	+	-	-	-
19.	<i>Ariadne merione</i> (Cramer, 1779)	+	+	+	+	+	-
20.	<i>Ypthimahuebneri</i> Kirby, 1871	+	+	+	-	-	-
21.	<i>Junoniaalmana</i> (Linnaeus, 1758)	-	+	+	+	-	-
22.	<i>Castaliusrosimon</i> (Fabricius, 1775)	+	+	+	-	-	-
23.	<i>Tarucusnara</i> Kollar, 1848	+	+	-	-	-	-
24.	<i>Zizulahlax</i> (Fabricius, 1775)	+	+	+	-	-	-
	<b>Total number of species</b>	14	21	18	13	10	5



**Fig. 1:** Map of the studied surveyed area (Created by Google Earth software)



**Fig. 2:** Graphical representation of butterfly visitation status on *Lantana camara* L. in different time frames.

butterfly species were recorded in the time frame of 8 - 10 am (21 species, 87.5%), followed by 10am - 12pm (18 species, 75%), 6 to 8 am (14 species, 58.3%), 12 to 2 pm (13 species, 54.1%), 2 to 4 pm (10 species, 41.6%) and least number of species had been found in the time frame of 4 to 6 pm (5 species, 20.8%). The chi square test indicates a significant peak value on the number of butterfly species in the time frame between 8 am to 10 am during the study period. With the respect of the pattern of visit of butterflies from different families, the observation is clearly showcasing the number of butterflies from different family with

their inclination and declination order in different studied time frames.

## DISCUSSION

In the world of insect, Lepidoptera especially butterfly can be marked as bio indicator to narrate the environmental condition of an ecosystem. Study of butterfly species specific diversity also indicates the vegetation status of the area with the anthropogenic value associate with it. *Lantana camera*L., has a great negative impact on natural ecosystems, agricultural productivity, livestock

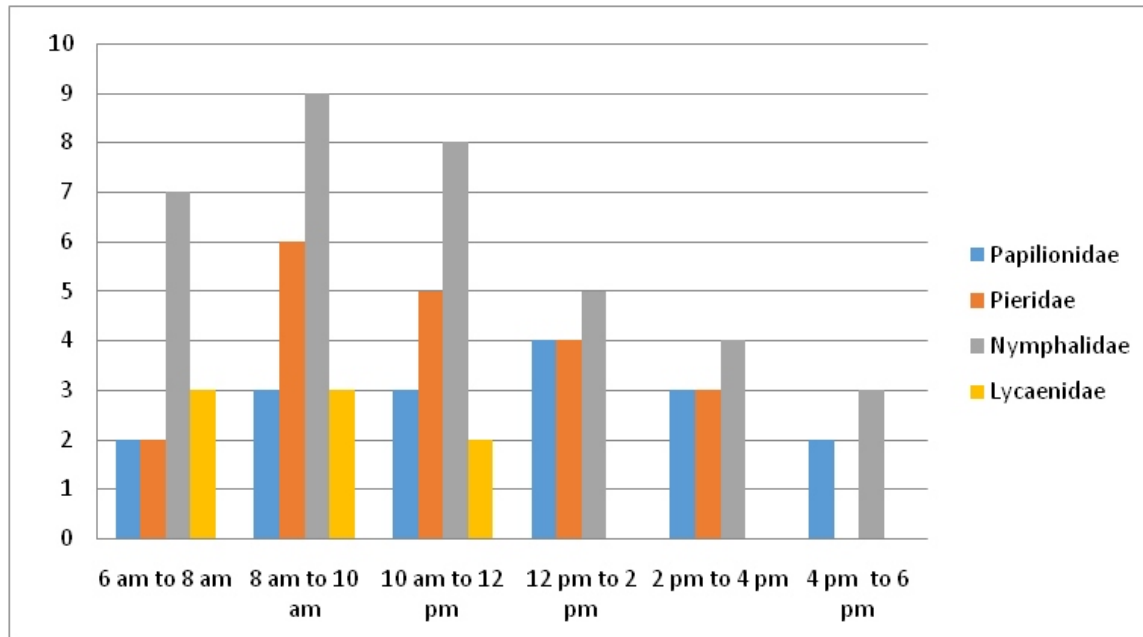


Fig. 3: Graphical representation of different families of butterfly on *Lantana camara* L. in different time frames.

and also human health (Kritsampan *et.al.*, 2016)<sup>[2]</sup>. But due to the effective reproductive character and pollination by insects it seems to have an importance for holding a great insect biodiversity. *Lantana camara* L. is associated with butterfly pollination due to its flower structure which has long narrow corolla tube and nectar accumulation with grouped in inflorescences (Carrion-Tacuri *et.al.*, 2014)<sup>[7]</sup>. Therefore, enriched butterfly diversity can be observed as visitors of *L. camara* L.

In this present communication, data reveals that the highest number of butterfly species visited between 8.00 to 10.00 am (Table I) (Figure 2). By the help of statistical analysis (Chi Square) data shows a significant peak at  $p < 0.05$  level ( $\chi^2=11.96296$ ,  $df=5$ ,  $p=0.035312$ ) in butterfly species number in that particular time interval. This occurred may be due to, as butterflies are cold blooded species and they cannot generate enough energy with the help of their own metabolism, therefore the heat which they need to fly they cannot produce and for that reason they have to completely rely on the heat absorbed from the Sun (Peiris, P.U.S., 2016)<sup>[8]</sup>. So, the morning temperature may be suitable for them to gain the energy level and visitation increased that time. Butterflies are most active in the time period of 9 am and noon (Butterflies of Sri Lanka, 2010)<sup>[9]</sup>. But when the temperature gets too hot they will reposition their wing to avoid the higher exposure of Sun. Therefore in the hotter part of daytime the reduction of butterfly species numbers will occur (Peiris, P.U.S., 2016)<sup>[8]</sup>. Maybe this is the reason, after the sudden and drastic first peak at 8.00 to 10.00 am time interval, the number of butterfly species declined slightly up to 12.00 pm but a fall was shown between 12.00 to 2.00 pm. That occurred may be due to the Sun comes in the overhead position that time. Butterfly species number moderately degrade from the next respective time intervals e.g. 2 to 6 pm.

In the respect of different families of butterfly, butterfly species family Nymphalidae and Papilionidae have visited during every time intervals. Butterflies from family Pieridae have a visitation period from 6 am to 4 pm but after 4 pm, data shows no

visitation of butterflies from this family. In case of family Lycaenidae the visitation occur during 6am to 12 pm. after 12 pm no visitation has been recorded of butterflies from this family (Figure 3).

The study describes that *Lantana camara* L. holds an enrich butterfly diversity throughout the day. So, the association of butterfly with this plant indicates probably a good ecosystem in such urbanised areas

## CONCLUSION

Though this plant has negative impacts, this plant can be marked as a useful key for holding great butterfly diversity. As the butterflies have been marked as a pollinator and remarkable visitor of this plant, therefore this invasive plant shows a good biodiversity impact on the aspect of insect diversity. Excluding this view, *Lantana camara* L. also has a number of uses in the anthropogenic aspects such as various medicinal uses, produce Biofuel, using as raw material to produce paper pulp, baskets, temporary shelter etc. (Priyanka and Joshi, 2013)<sup>[3]</sup>. In these urbanised areas of Kolkata altogether 24 butterfly species have recorded from this plant, which means this plant may be has a potentiality to be used as a surrogate plant for the conservation of butterfly in urban areas.

## ACKNOWLEDGEMENT

Authors are thankful to Principal of Bidhannagar College for giving us the necessary support. Thanks are also due to Head of the Zoology department of Bidhannagar College for his extended support. Authors are also grateful to Dr. Bulganin Mitra for his help and necessary support during the entire study.

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