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Address for Correspondence
Butterfly Research Centre, Bhimtal, Uttarakhand 263 136, India. Phone: +91 8938896403.
Email: butterflyresearchcentre@gmail.com

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Cover Photo of *Spialia zebra* by Mukesh Panwar

TABLE OF CONTENTS

NEEM FLOWERS (*AZADIRACHTA INDICA*) AS AN ABUNDANT SOURCE OF NECTAR FOR BUTTERFLIES IN AN URBAN LANDSCAPE IN DELHI, INDIA

RAJESH CHAUDHARY

Department of Biomedical Science, Acharya Narendra Dev College, Govindpuri, Kalkaji, New Delhi-19.

rajeshchaudhary@andc.du.ac.in

Reviewer: Peter Smetacek

Abstract

Most butterflies feed on floral nectar. The ability of butterflies to access nectar deep within a flower depends on the length of their proboscis. Adequate nutrition is known to maintain the reproductive potential of butterflies. In an urban context, lacking adequate parks and gardens, there is always a need of flowers that can provide nectar to butterflies. In this situation, avenue trees, bearing flowers with nectar accessible to a wide range of butterflies, could help maintain a reasonably diverse butterfly population. The Neem tree, *Azadirachta indica,* is planted along roads and in parks in urban areas of Delhi. Its small flowers were found to attract several species of butterflies belonging to all five major families present in Delhi. It is suggested that trees such as *Azadirachta indica* and other nectar trees, if planted as avenue trees, may help in the conservation of butterflies in an urban landscape.

Key words: Flowering tree, Food plant, Butterfly, Urban Landscape

Introduction

Butterflies are liquid-feeding insects; they acquire food by sucking through their long tubular proboscis (Krenn, 2010). Adult butterflies can be broadly categorised into two feeding guilds: nectar feeding (feeding on floral nectar) and non-nectar feeding (acquiring nutrition from decaying fruit, sap, honey dew, etc.). The feeding habits are associated with certain modifications in the microstructure of the proboscis, particularly at the tip (Krenn *et al*., 2001, Molleman *et al*., 2005; Krenn, 2010; Lehnert, *et al*., 2016). A vast majority of butterflies feed on floral nectar (Krenn, 2010). The profitability of feeding on floral nectar depends in part on the depth of the corolla-tube (or the depth at which nectar is seated in flowers); the amount of nectar, proboscis length and wing load (Corbet, 2000; Tiple *et al*., 2009). The shorter proboscis of small butterflies limits them from using flowers with deep seated nectar (May, 1992). Butterflies with a longer proboscis however, can harvest nectar from a broad range of flowers, including flowers with short as well as those with long corolla tubes (May, 1992; Corbet, 2000; Kunte, 2007; Sultana *et al*., 2017). Nutrition is known to maintain high fecundity in female butterflies and increase their body weight and fat storage (Hill *et al*., 1989; O'Brien *et al*., 2004; Mevi-Schutz *et al*., 2005; Geister *et al*., 2008; Karlsson *et al*., 2009). Butterflies obtain nectar from a range of flowers. The role of tree flowers as a source of nectar has not been appreciated by many researchers. Tree flowers however, can be an important source of nectar for butterflies living in or close to forested as well as urban landscapes. Here, I present an account of butterfly species which can benefit from feeding on the flowers of *Azadirachta indica* (A. Juss; Family: Meliaceae) commonly known as 'Neem tree'. The tree commonly grows in urban and rural areas in most parts of India and a few researchers have indicated

Neem flowers as a source of nectar for butterflies (Palot et. al. 2005, Vikas, 2011). The present observations were made in urbanized parts of Delhi, where *A. indica* trees are scattered along roads and in gardens. The results have been discussed in the context of the role *A. indica* plays in supporting butterfly populations in urban areas.

Material and Methods

The observations were made on *Azadirachta indica* growing as avenue trees in the residential area of Rohini in North-West Delhi. Three trees were observed to assess the period and duration of flowering. To determine the number of species of butterflies visiting the tree, the crown of one of the trees was observed from the fourth floor balcony (at a height of approximately 10 m) of a residential building. Observations began soon after flowers appeared on most of the branches (3rd week of April, 2020) and continued until senescence of flowers on most of the twigs and appearance of fruits (3rd week of May, 2020). The tree was observed for 25 days. On any given day, the first observation was made between 10:00 am and 10:30 am, the second between 12:00 pm and 12:15 pm and the third and last between 3:00 pm and 3:30 pm. During each of the three events the tree was observed for 10 minutes. During this time (i.e. 10:00 am to 4:00 pm) the entire tree crown was illuminated by sunlight. The decision regarding at which time of the day observations should be made was based on two days of trial observations before the actual study was started. During the trial the tree was observed for 10 minutes for every 1-1.5 hours between 9:00 am and 4:00 pm. It was found that the maximum butterfly activity on the canopy was concentrated between 10:00 am and 1:00 pm followed by a dip between 1:00 pm and 3:00 pm, possibly due to high temperature. A slight rise in activity was again seen from 3:00 pm to 4:30 pm. Butterflies were identified from a distance of 2-3 meter. Smaller butterflies such as Lycaenids or those landing far from the location of the observer were photographed using Digital SLR camera (Nikon) fitted with an 80-400 mm zoom telephoto lens. Identification of butterflies up to species level was done based on Kehimkar (2016) and Smetacek (2016).

Results and Discussion

A. indica has various beneficial properties and therefore, it has been grown in India for ages (Kumar *et al*., 2013). It has been planted along roads and in parks in Delhi. In this part of India, the peak blooming period of *A. indica* is during the months of April and May (Kumar *et al*., 1999; Vikas, 2011) and the same has been observed in the present study as well. A tree in full bloom is laden with white or pale yellow flowers (about 8-11 mm wide and 6-5 mm long) arranged in drooping panicles clustered at the end of twigs (Figures 1 & 2). The flowers emit a sweet fragrance which probably helps attracting visitors or pollinators. The peak time of visitation was observed to be between 10:00 am and 12:00 noon. This has also been reported in a previous study undertaken on reproductive biology of *A. indica* (Vikas, 2011). A total of 24 species of butterflies belonging to 22 genera of five families (viz. Pieridae, Papilionidae, Lycaenidae, Nymphalidae and Hesperiidae) were observed feeding on the flowers of *A. indica* (Table 1 & Figure 3). Three species were only identified to genus level. Of all the butterfly species visiting *A. indica* flowers (Table 1), individuals of *Belenois aurota* were most numerous. *B. aurota* is a migratory butterfly which is abundant in Delhi from March till early May (Larsen, 2002). Those species which were observed only once during the entire period of observation (Table 1) are extremely rare in Delhi (such as *Delias eucharis*); or not commonly sighted in the study area (such as *Acraea violae*, *Ixias pyrene* and *Colotis amata*). However, some butterflies commonly sighted in the area during the period of study, such as *Papilio demoleus* and *Ariadne merione*, rarely visited *A. indica*

flowers. This may indicate some level of preference of different species butterflies for *A. indica* flowers. It is evident from Table 1, that nectar present in flowers of *A. indica* is accessible to both butterflies with longer as well as shorter proboscis. The flowers were observed to be foraged upon by some of the smallest butterflies of Delhi such as *Zizeeria* sp., *Zizula hylax* and *Luthrodes pandava* with proboscis length as small as 4.4 mm (Tiple *et al*., 2009). It therefore appears that all the butterfly species of Delhi possess a suitable length of proboscis for probing Neem flowers for nectar. Further, though a single flower only contains a small amount of nectar, clustering of flowers makes foraging advantageous even to larger numbers of butterflies (Vikas, 2011; Corbet, 2000).

Flowers of trees planted along roads are a source of nectar for butterflies in urban areas jam-packed with buildings with little or no space left for gardens and parks. In this setting, flowering trees can be important refuelling stations for migrating butterflies flying several meters above the ground to avoid vehicular disturbance and other obstructions at ground level. Blooming of *A. indica* coincides with the period of the year when butterflies are abundant in Delhi. Further, the tree retains flowers for over one month providing food to a wide range of butterflies. Thus, trees such as *A. indica* and other flowering trees with a range of different flower types, especially those known to attract butterflies and flowering in the main butterfly flying and migrating periods, can play an important role in maintaining butterfly populations in urban landscapes.

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Table 1: Genera and species of butterflies visiting *Azadirachta indica* flowers. Symbol (#) represents butterfly species that visited flowers more often, and symbol (*) represents species of butterflies that were sighted only once on the flowers during the entire period of observation.

S.N.	Family	Species Recorded
1	Pieridae	Pioneer *Belenois aurota* (Fabricius, 1793) #
2		*Catopsilia* sp. (Huebner, 1819)
3		Large Cabbage White *Pieris brassicae* (Linnaeus, 1758)
5		Indian Cabbage White *Pieris canidia* (Linnaeus, 1768)
6		Common Gull *Cepora nerissa* (Fabricius, 1775)

7		Small Salmon Arab *Colotis amata* (Fabricius, 1775) *
8		Yellow Orange Tip *Ixias pyrene* (Linnaeus, 1764) *
9		*Eurema* sp. (Huebner, 1819)
10		Common Jezabel *Delias eucharis* (Drury, 1773) *
11	Papilionidae	Common Jay *Graphium doson* (C. & R. Felder, 1864) #
12		Lime Butterfly *Papilio demoleus* (Linnaeus, 1758) *
13	Lycaenidae	Plains Cupid *Luthrodes pandava* (Horsfield, 1829) #
14		Pea Blue *Lampides boeticus* (Linnaeus, 1767) #
15		Zebra Blue *Leptotes plinius* (Fabricius, 1793) #
16		*Zizeeria* Chapman, 1910 sp.
17		Tiny Grass Blue *Zizula hylax* (Fabricius, 1775)
18	Nymphalidae	Plain Tiger *Danaus chrysippus* (Linnaeus, 1758) #
19		Common Tiger *Danaus genutia* (Cramer, 1779)
20		Blue Tiger *Tirumala limniace* (Cramer, 1775)
21		Common Castor *Ariadne merione* (Cramer, 1777) *
22		Painted Lady *Vanessa cardui* (Linnaeus, 1758)
23		Tawny Coster *Acraea violae* (Fabricius, 1793) *
24		Blue Pansy *Junonia orithya* (Linnaeus, 1758)
25	Hesperiidae	Common Banded Awl *Hasora chromus* (Cramer, 1780)

Fig.1: Flowering branch of *Azadirachta indica* showing inflorescence.

Fig.2: Close-up of a single *Azadirachta indica* flower.

Fig.3: *Pieris canidia*

Fig.4: *Cepora nerissa*

Fig.5: *Belenois aurota*

Fig.6: *Pieris brassicae*

Fig.7: *Graphium doson*

Fig.8: *Lampides boeticus*

Fig.9: *Zizeeria* sp

Fig.10: *Luthrodes pandava*

Fig.11: *Leptotes plinius*

Fig.12: *Zizula hylax*

Fig.13: *Vanessa cardui*

Fig.14: *Acraea violae*

Fig.15: *Danaus genutia*

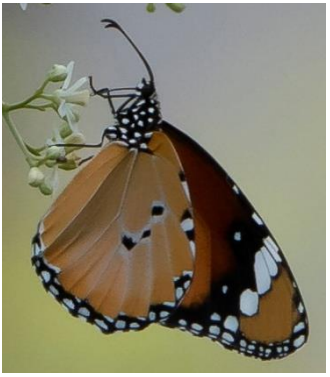

Fig.16: *Danaus chrysippus*