

NECTAR RESOURCE USE BY BUTTERFLIES IN A DRY DECIDUOUS FOREST IN EASTERN GHATS, INDIA

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Introduction

Insects visit flowers to obtain food, usually in the form of pollen or nectar. The plants obtain the services of pollinators in carrying pollen from one flower to another (Proctor *et al.*, 1996). Butterflies are often considered as opportunistic foragers that visit a wide variety of available flowers. However, their choice of flower is not random and they exhibit distinct flower preference which can differ between species (Jennersten, 1984). The choice of plants as nectar sources by butterflies depends on various factors including innate colour preference, corolla depth, clustering of flowers from which nectar can be extracted (Porter *et al.*, 1992; Corbet, 2000). The floral scent is an important cue signal for butterflies initially to identify and subsequently to recognize and distinguish among rewarding plants. Hence, in order to understand the butterfly-flower interactions, the present study was undertaken.

Study Area

A systematic study was carried out to find out the food resources of butterflies in Sathyamangalam Wildlife Sanctuary (10° 29' 15" to 11° 43' 1" N latitudes and 76° 50'

46" to 77° 27' 22" E longitudes) from April 2007 to July 2008. The erstwhile Sathyamangalam Forest Division has been declared as Wildlife Sanctuary on 3rd November, 2008. The study area has rich flora and wildlife with an elevation of 940 m. The major vegetation type of the study area is tropical dry deciduous forests. The dry deciduous forest is dominated with plants such as *Anogeissus latifolia*, *Terminalia bellirica*, *Tectona grandis*, *Gmelina arborea*, *Acacia leucopholea* and scattered bushes of *Lantana camara*. The streams and rivers that cut across the forests support riverine vegetation.

Methods

To find out the food resources of butterflies, in the blooming season, 27 plant species were observed for 648 hrs at the rate of 24 hours per species to record the flower visiting insect species, their foraging behaviour, length of the visits and number of flowers visited in unit time. The observations were carried out between 0700 and 1800 hrs. Butterfly species were collected and identified by using *The Book of Indian Butterflies* (Kehimkar, 2008), *Some South Indian Butterflies* (Gunathilagaraj *et al.*, 1998) and *Common Butterflies of India* (Gay *et al.*, 1992).

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Butterfly attracting flowers were grouped into three size classes, namely small (< 1 cm), medium (1-3 cm) and large (> 3 cm) and four colour categories namely, red, white, green and yellow. Other food resources of butterflies were also recorded while walking through the forest patches.

Results

Butterfly diversity : A total of 86 species of butterflies belonging to five families were recorded (Appendix 1). One species belonging to Hesperidae could not be identified. The family Nymphalidae dominated with 35 species followed by Pieridae and Lycaenidae (14 each) and Papilionidae and Hesperidae (11 each) respectively. Five endemic species namely, Common Silver Line (*Spindasis vulcanus*), Common Banded Peacock (*Papilio buddha*), Crimson Rose (*Pachliopta hector*), Blue Mormon (*Papilio polymnestor*) and Southern Birdwing (*Troides minos*) were also recorded.

Nectar resources : Out of the 86 butterfly species recorded, only 49 species used nectar and other species obtained their food from non-floral resources such as mud, wet soils and cow dung. Floral nectar of 21 plant species formed food. Six plant species namely *Anogeissus latifolia*, *Syzygium cumini*, *Terminalia arjuna*, *Phyllanthus emblica*, *Feronia elephantum* and *Chionanthus paniculatus* were not visited by butterflies (Table 1). The food plants comprised 18 tree species, 2 shrubs and one herb. Highest number of butterfly species was recorded in *Lantana camara* (27), followed by *Canthium dicoccum* (13), and *Ligustrum perrottetii* (11) respectively.

Majority of the butterflies visited flowers in the study area that had white

flowers (57.14%). This was followed by red (19.04%), green (14.28%) and yellow (9.52%) respectively. However, maximum number butterfly species was attracted to red flowers (n=36). With regard to the size of butterfly visited flowers, the small sized (< 1cm) flowers attracted maximum species (n=48) followed by medium sized (n=18), and large sized flowers (n=5). Foraging timings and behaviour varied among different species. Most of the species are generally active in the forenoon. The Common Banded Awl (*Hasora chromus*) forages throughout the day. The Lemon Pansy spent long durations for gathering nectar and visited many flowers. The Danaid Eggyfly (*Hypolimnas misippus*), Chocolate Pansy (*Precis iphita*) and Plain Tiger (*Danaus chrysippus*) also spent longer duration to siphon the nectar in a single tree (*Zizyphus rugosa*), but covered only a few flowers. The Tailed Jay (*Graphium agamemnon*), Common Blue Bottle (*Graphium sarpedon*) and other swallow tail butterflies occasionally visited flowers and spent only 1-2 sec in a single flower and flew away.

Non-floral food resources : A total of 14 species probed the mud, wet soils near the stream bank and cow dung to obtain the minerals. Species such as, The Pioneer (*Anaphaeis aurota*), Three Spot Grass Yellow (*Eurema blanda*) and Chocolate Pansy (*Precis iphita*) were inclined to feed on both wet soil and cow dung.

Discussion and Conclusion

Most butterflies have specific habitat and food requirements. Although adult butterflies are sensitive to their choice of flowers for feeding, most species never visit some flowers (Feltwell, 1986). All the butterflies are not flower visitors; only the

Table 1

*Butterfly attracting plant species (flowers) in the dry deciduous forest in
Sathyamangalam Wildlife Sanctuary, Tamil Nadu, India*

Sl. No.	Plant species	Family	Flower		# of species attracted
			Size	Colour	
1	<i>Lantana camara</i> (Shrub)	Verbenaceae	Small	Purple	27
2	<i>Canthium dicoccum</i>	Rubiaceae	Small	White	13
3	<i>Ligustrum perrottetii</i>	Oleaceae	Small	White	11
4	<i>Leucas aspera</i> (Herb)	Lamiaceae	Medium	white	11
5	<i>Vitex altissima</i>	Verbenaceae	Small	Red	9
6	<i>Tarenna asiatica</i> (Shrub)	Rubiaceae	Small	White	8
7	<i>Premna tomentosa</i>	Verbenaceae	Small	White	7
8	<i>Melia dubia</i>	Meliaceae	Small	White	6
9	<i>Santalum album</i>	Santalaceae	Small	Red	6
10	<i>Capparis grandis</i>	Capparidaceae	Medium	White	6
11	<i>Zizyphus rugosa</i>	Rhamnaceae	Small	Green	5
12	<i>Tamarindus indicus</i>	Caesalpiniaceae	Small	Yellow	5
13	<i>Diospyros montana</i>	Ebenaceae	Medium	Green	5
14	<i>Ixora arborea</i>	Rubiaceae	Medium	White	5
15	<i>Zizyphus mauritiana</i>	Rhamnaceae	Small	Green	4
16	<i>Terminalia bellirica</i>	Combretaceae	Small	White	3
17	<i>Gmelina arborea</i>	Verbenaceae	Large	Yellow	2
18	<i>Butea monosperma</i>	Fabaceae	Large	Red	2
19	<i>Pongamia pinnata</i>	Fabaceae	Small	White	2
20	<i>Buchanania lanzan</i>	Anacardiaceae	Small	White	2
21	<i>Dolichandron atrovirens</i>	Bignoniaceae	Large	White	1
22	<i>Chionanthus paniculatus</i>	Oleaceae	Small	White	0
23	<i>Feronia elephantum</i>	Rutaceae	Small	Red	0
24	<i>Phyllanthus emblica</i>	Euphorbiaceae	Small	White	0
25	<i>Terminalia arjuna</i>	Combretaceae	Small	White	0
26	<i>Syzygium cumini</i>	Myrtaceae	Small	White	0
27	<i>Anogeissus latifolia</i>	Combretaceae	Small	Yellow	0

highly evolved species, whose mouth-parts are represented by a long, thin proboscis, is adapted for feeding on liquid diet such as nectar (Wynter-Blyth, 1957). It is to be

noted here that six plant species were not visited by butterflies in the study area.

Cruden (1976) related the length of

foraging visits to the amount of accumulated nectar. When little nectar is available, the visits are short and many flowers are visited by the butterfly. When relatively large amounts of nectar accumulate, the butterflies need to spend more time to extract the nectar and hence fewer flowers are visited. In the present study, few species of butterflies spent less time on certain plant species and longer duration on other flower species which could be due to the varying quantity of nectar.

Although butterflies have been regarded as opportunistic nectar feeders, some species e.g., *Maniola jurtina* (Shreeve, 1992), show preferences to flowers with particular nectar concentrations (Watt *et al.*, 1974; Pivnick and McNeil, 1985), colour and pattern (Faegri and van der Pijl, 1979; Watt *et al.*, 1974; Jennersten, 1984) and flower structure e.g., corolla length (Kingsolver and Daniel, 1979; May, 1985). Butterfly morphology (e.g., proboscis length, wing loading) also forms an important feature of flower choice (Porter *et al.* 1992; Corbet, 2000). According to Faegri and Vander Pijl (1979) colour and form of a plant play an important role in butterfly foraging.

Jennersten (1984) studied the flower visitation and pollination efficiency of some North European butterflies in Sweden and reported butterflies being attracted to blue and red colours. Most butterfly species have innate colour preference and show high fidelity to colour variations; in some cases these may be modified by experience or training (Reddi and Bai, 1984).

Shahabuddin (1997) recorded butterfly visitors to 20 plant species in Palni hills, Western Ghats. A comparison of flower visitors to 5 plant species that are common to both locations shows lot of differences in terms of number of species visited, which could be related to the local environmental conditions.

The nature of vegetation is the important factor that determines the survival of herbivores in a particular habitat. Being highly sensitive to changes in environment, butterflies are easily affected by even relatively minor perturbations in the habitat. Maintaining a healthy habitat is very important to sustain these herbivores. Hence, to attract butterflies, butterfly attracting plant species listed here may be included in the afforestation programs.

Appendix 1

*Butterfly species recorded in Sathyamangalam Wildlife Sanctuary, Tamil Nadu, India
(From April 2007 to July 2008)*

Sl. No.	Family/ Common Name	Zoological Name	Legal status
1	2	3	4

I. Nymphalidae

1	Tawny Coster	<i>Acraea violae</i>	
2	Dark Blue Tiger	<i>Tirumala septentrionis</i>	

Contd...

1	2	3	4
3	Plain Tiger	<i>Danaus chrysippus</i>	
4	Common Crow*, **, ***	<i>Euploea core</i>	Sch- IV
5	Glassy Blue Tiger	<i>Parantica aglea</i>	
6	Striped Tiger	<i>Danaus genutia</i>	
7	Common Fourring	<i>Ypthima huebneri</i>	
8	Nilgiri Fourring	<i>Ypthima chenui</i>	
9	Rustic **	<i>Cupha erymanthis</i>	
10	Chocolate Pansy*, **	<i>Precis iphita</i>	
11	Danaid Eggfly***	<i>Hypolimnas misippus</i>	Sch- I
12	Lemon Pansy**	<i>Junonia lemonias</i>	
13	Common Sailer	<i>Neptis hylas</i>	
14	Common Leopard*, **	<i>Phalanta phalantha</i>	
15	Blue Pansy	<i>Junonia orithiya</i>	
16	Yellow Pansy	<i>Junonia hierta</i>	
17	Common Lascar	<i>Pantoporia hordonia</i>	
18	Common Castor	<i>Ariadne merione</i>	
19	Angled Castor	<i>Ariadne ariadne</i>	
20	Common Evening Brown	<i>Melanites leda</i>	
21	Common Nawab	<i>Polyura athamas</i>	
22	Common Tree brown	<i>Lethe rohria</i>	
23	Red-Disc Bush brown	<i>Mycalis oculus</i>	
24	Nigger	<i>Orsotrioena medus</i>	
25	Common Fourring	<i>Ypthima huebneri</i>	
26	Common Sergeant	<i>Athyma perius</i>	
27	Common Baron***	<i>Euthalia aconthea</i>	Sch-II
28	Joker	<i>Byblia ilithyia</i>	
29	Grey Pansy	<i>Junonia atlites</i>	
30	Peacock Pansy	<i>Junonia almana</i>	
31	Great Eggfly	<i>Hypolimnas bolina</i>	
32	Common Bushbrown	<i>Mycalis perseus</i>	
33	Common Five-ring	<i>Ypthima baldus</i>	
34	White Four-ring**	<i>Ypthima ceylonica</i>	
35	Club Beak*	<i>Libythea myrrha</i>	
II. Lycaenidae			
36	Transparent 6-Lineblue	<i>Nacaduba kurava</i>	
37	Lime Blue	<i>Chilades lajus</i>	

Contd...

1	2	3	4
38	Pea Blue	<i>Lampides boeticus</i>	
39	Common Cerulean**	<i>Jamides celeno</i>	
40	Banded Blue Pierrot*, **	<i>Discolampa ethion</i>	
41	Common Silverline	<i>Spindasis vulcanus</i>	
42	Slate Flash	<i>Rapala manea</i>	
43	Indian Red Flash	<i>Rapala iarbus</i>	
44	Plum Judy	<i>Abisara echerius</i>	
45	Monkey Puzzle	<i>Rathinda amor</i>	
46	Yam Fly	<i>Loxura atymnus</i>	
47	Common Pierrot***	<i>Castalius rosimon</i>	Sch-I
48	Red Pierrot	<i>Talica nyseus</i>	
49	Silverstreak Blue	<i>Iraota timoleon</i>	
III. Papilionidae			
50	Common Blue Bottle*	<i>Graphium sarpedon</i>	
51	Common Banded Peacock	<i>Papilio buddha</i>	
52	Common rose	<i>Pachliopta hector</i>	
53	Tailed Jay	<i>Graphium agamemnon</i>	
54	Crimson Rose***	<i>Pachliopta hector</i>	Sch- I
55	Common Mormon*	<i>Papilio polytes</i>	
56	Red Helen*	<i>Papilio helenus</i>	
57	Blue Mormon*	<i>Papilio polymnestor</i>	
58	Lime Butterfly*	<i>Papilio demoleus</i>	
59	Southern Birdwing	<i>Troides minos</i>	
IV. Pieridae			
60	Small Orange Tip	<i>Colotis etrida</i>	
61	Common Gull	<i>Cepora nerissa</i>	
62	Large Salmon Arab***	<i>Colotis fausta</i>	Sch-II
63	Small Salmon Arab	<i>Colotis amata</i>	
64	Common Wanderer	<i>Peroronia valeria</i>	
65	White Orange Tip	<i>Ixias marianne</i>	
66	Common Jezebel	<i>Delias eucharis</i>	
67	Common Grass Yellow	<i>Eurema hecabe</i>	
68	Three Spot Grass Yellow*, **	<i>Eurema blanda</i>	
69	Crimson Tip	<i>Colotis danae</i>	
70	Pioneer*, **	<i>Anaphaeis aurota</i>	

Contd...

1	2	3	4
71	Yellow Orange Tip	<i>Ixias pyrene</i>	
72	Lemon Emigrant	<i>Catopsilia crocale</i>	
73	Great Orange Tip*	<i>Hebomia glaucippe</i>	
74	Common Emigrant*, **	<i>Catopsilia pomona</i>	
V. Hesperidae			
75	Golden Angle	<i>Caprona ransonnetti</i>	
76	Chestnut Bob	<i>Iambrix salsala</i>	
77	Paintbrush Swift	<i>Baoris farri</i>	
78	Brown Awl	<i>Badamia exclamationis</i>	
79	Malabar Spotted Flat	<i>Calaenorrhinus ambareesa</i>	
80	Common Banded Awl**	<i>Hasora chromus</i>	
81	Indian Skipper	<i>Spialia galba</i>	
82	Common Dartlet	<i>Oriens goloides</i>	
83	Tamil Grass Dart***	<i>Taractrocera ceramas</i>	Sch-II
84	Small Banded Swift	<i>Pelopidas mathias</i>	
85	Rice Swift	<i>Borbo cinnara</i>	
86	Unidentified	-	

*Mud-puddling species, **Major flower visiting species, *** WPA, 1972

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SUMMARY

This paper discusses the butterfly-flower interrelationships in a dry deciduous forest in Sathyamangalam Wildlife Sanctuary, Tamil Nadu, Eastern Ghats. A total of 86 species of butterflies belonging to five families were recorded in the study area. Butterfly foraging observations were recorded on 27 plant species belonging to 17 families. A total of 49 species of butterflies foraged on floral nectar of 21 plant species. Maximum number of flower-visiting butterfly species (n=17) belonged to Nymphalidae. Small-sized flowers (<1cm) attracted

maximum number of butterfly species (n=48). Among the various flower colours, red were visited by maximum number of species (n=36). Mud-puddling behaviour of butterflies is also discussed.

Key words : Butterflies, Nectar feeding, Mud-puddling, Sathyamangalam Wildlife Sanctuary, Tamil Nadu, Eastern Ghats.

पूर्वी घाट प्रदेश, भारत के शुष्क पर्णपाती वन में तितलियों द्वारा मकरन्द संसाधन का उपयोग

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सारांश

इस अभिपत्र में सत्यमंगलम वन्य प्राणि अभयारण्य, तमिलनाडु, पूर्वी घाट प्रदेश के शुष्क पर्णपाती वन में तितलियों पुष्पों के पारचारिक संबंधों का विवेचन किया गया है। अधीत क्षेत्र में कुल मिलाकर पांच वंशों की तितलियों की 86 जातियां पाई जाती हैं। तितलियों द्वारा चारा ग्रहण करने के पर्यवेक्षण 17 कुलो की 27 पादप जातियों पर से आलेखित किए गए। कुल मिलाकर तितलियों की 49 जातियों ने 21 पादप जातियों से अपना पुष्प मकरन्द चारा प्राप्त किया। पुष्पों पर आने वाली तितलियों की अधिकतम संख्या (n=17) अप्सरातितील (निम्फैलिडी) वंश की थी। छोटे आकार वाले पुष्प (< 1 सेमी) ने तितलियों की अधिकतम संख्या (n=48) को आकृष्ट किया। पुष्पों के विभिन्न रंगों में से लाल रंग वाले पुष्पों पर अधिकतम तितली जातियां मंडराई। तितलियों के पंक मज्जन व्यवहार का विवेचन भी किया गया है।

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