Floral morphology and behavior of butterflies at flowers

Meerabai guddeti[1], Teaching Assistant

Department of Botany, Rayalaseema University, Kurnool – 518004. A.P., India.
guddetimeerabai@gmail.com

Abstract: The study is aimed at studying the behavior of butterflies at various kinds of flowers they visited. The flowers visited by butterflies are subdivided into 7 categories in relation to the position of essential organs to the other floral parts. The manner of landing of butterflies on various morphologically different flowers and their wing positions on flowers was observed. The results are discussed as (a). Pattern of alighting and (b). Wing positions during forage which varies from species to species depending on the flower structure. The results revealed that they are polylectic and there is a resource partioning by congeneric species of butterflies. It suggests that the feeding specialization may vary depending on resource availability and the degree of competitive pressures.

[Meerabai G. **Floral morphology and behavior of butterflies at flowers.** *N Y Sci J* 2013;6(10):96-99]. (ISSN: 1554-0200). http://www.sciencepub.net/newyork. 15

Key Words: Behavior, manner of landing, pattern of alighting, wing positions

1. Introduction:

Gilbert and Singer (1976) wrote that the broad outlines of adult feeding habits in butterflies as provided by early naturalists have been expanded only slightly by recent studies. Many adult butterflies visit flowers for nectar, some such as *Heliconius* feed on pollen too. The nectar of flowers is the only source of carbohydrate for the adult butterflies and this will contribute to longevity, fecundity and flight energetics. Swihart (1971) stated that the butterflies are diurnal in their activity and visit many flowers that open in the morning using innate and imprinted "search images". Most species have innate color preference and show fidelity to color variations. Ilse (1932) suggested that detailed features of the flowers, such as the "dissection" of the corolla may also form an important identifying character. Neff et al. (1977) stated that the butterflies they studied are polyphagic in their floral host utilization pattern. Gilbert and Singer (1975) concluded "all indications are that adults are as species, less specific and more opportunistic in feeding than are their larval counterparts". Courtney et al. (1983) found large loads of pollen being carried by butterfly mouthparts, and demonstrated that these insects play an unsuspected role in long – distance pollination. They further noted long intervals between butterflies picking up pollen and transferring them to another plant. Heithaus (1974), Moldenke (1975, 1979) and Frankie et al.(1983) stated that the plant – pollinator relationships are very vital to the organization, continued functioning and integrity of the respective communities of which they are a part. Thus, there is every need to acquire more knowledge about the role of butterflies as vectors of pollen and their behavior at flowers while they land on flowers. Hence the present study is aimed at studying the behavior of butterflies at various kinds of flowers. To understand the behavioral problems associated with a study of floral evolution it may be well to consider several specific investigations of floral mechanisms and their implications.

2. Materials and methods:

Taking into consideration the position of essential organs relative to the other floral parts, the flowers visited by butterflies are subdivided into 7 categories as (A) Flowers zygomorphic with the essential organs placed adjacent to or laying on the lower corolla lip(s), (B) Flowers zygomorphic with the essential organs oriented towards the upper lip, (C) Flowers open with the essential organs centrally positioned, (D) Flowers open with exposed numerous stamens, (E) Flowers tubular with the essential organs inserted, (F) Flowers tubular with the essential organs exerted and (G) Flowers with the essential organs rather elongated and oriented horizontally.

On several fine weather days, 30 butterfly species foraging on flowers are observed and recorded to know the manner of landing of butterflies on various morphologically different flowers and their wing positions on flowers.

3. Results and Discussion:

The results are discussed under two heads - (a) pattern of alighting and (b) wing positions during forage.

(a).Pattern of alighting: The position butterflies take on the flowers and the probability of gaining contact with the essential organs of the flowers varies from species to species depending on the flower structure.

In group 'A' flowers represented by *Cleome viscosa, Pongamia glabra, Peltophorum* *pterocarpum* and *Moringa oleifera,* the butterflies landed on the exerted essential organs and inserted their proboscides into the nectorial disc. In this case, contact definitely took place between the essential organs and the body parts such as legs and head.

In group 'B' flowers *Ocimum basilicum, Hyptis suaveolens* and *Adathoda vasica* where the essential organs are situated under the shade of upper corolla lip, the butterflies landed on the lower lip of corolla and inserted their proboscides into the small tube. In this case, the head region while being pushed into the tube, and the margins of intact vertical wings contacted the essential organs.

In group 'C' flowers represented by *Sida cardifolia*, *S. acuta, Tribulus terrestris*, *Zizyphus mauritiana, Z.oenoplea, Scutia myrtina, Santalum album, Muntingia calabura, Antigonon leptopus, Jatropha gossypifolia, Hibiscus rosasynensis, Murraya konigii, Jatropha podagrica* and *Euphorbia* splendens butterflies landed on the fully expanded petals and walked around the essential organs to sip nectar secreted around them. Then the proboscis and head gained contact with the essential organs. In Santalum album and Murraya konigii which are also open flowers, but arranged in cymes, the butterflies landed and walked on the inflorescence to cover all the flowers. During this process the legs, proboscis and abdomen contacted the essential organs.

In group 'D' flowers represented by *Capparis spinosa, Albizzia lebbeck, Enterolobium saman, Syzygium jambolanum* and *Alangium lamarkii* where the long numerous stamens are exposed, the butterfly alighted on stamens and inserted its proboscis and head into the nectar which is situated at the base of the essential organs. Almost all the body parts such as legs, head, proboscis, abdomen and wings came into contact with the essential organs.

In group 'E' flowers represented by *Asystasia gangetica, Pedalium murex, Hamelia patens, Ixora arborea, Rauwolfia serpentina, Catharanthus roseus, Carissa carandus, C.spinarum, Lantana camara, Duranta repens, Stachytorpheta indica, Tectona grandis, Citheroxylon subserratum, Vitex negundo, Premna latifolia, Anacardium occidentale, Bougainvillea spectabilis, Helianthus debilis* and *Tithonia rotundifolia* where the essential organs are placed within/below the level of corolla tube, the butterflies landed on the flat rim and inserted their proboscis into the corolla tube. Then the proboscis touched the essential organs.

In group 'F' flowers where the essential organs are exerted, flowers arranged in singles as in *Randia brandisii, Merremia tridentate, Borreria hispida, Nerium odorum,* the butterfly alighted on the flat rim and inserted its proboscis through the mouth of corolla tube. Then the proboscis and head came into contact with the essential organs. In the head and umbellate type of inflorescences such as *Tridax, Eupatorium, Sapindus, Caesalpinia coriaria* the butterflies walked over the inflorescence to cover all the opened flowers. Then the legs, proboscis and head brushed against the essential organs. In *Wrightia tinctoria* the butterfly holded the tube with their legs and inserted proboscis through the small slits between the hood like staminal tube. Sometimes the proboscis which is inserted through the slit may stuck up and cannot be taken out freely. Then the butterfly tries to take out proboscis with force, thereby causing movement of anthers,
which in turn results in pollen deposition on the stigma which is placed below the hood like staminal tube.

In group 'G' flowers represented by *Cadaba fruiticosa, Caesalpinia pulcherrima, Clerodendron phlomides* and *C.infortunatum*, the butterfly alighted on these elongated parts and inserted its proboscis into the nectorial tube of *Cadaba, Caesalpinia* and corolla tube of *Clerodendron.*

(b). Position of wings during forage: Butterflies when they forage on flowers, keep their wings in various positions as 1. Wings fluttering, 2. Wings spreading, 3. Wings upright and half opened and 4. Wings upright and adpressed.

Based on their feeding behavior, the insects are categorized into specialists or oligolectic which feed on particular plant species or on the members of particular plant family, and generalists or polylectic which show no specific preference in selecting their food either at family or species level. Semi specialists visit only a restricted subset of species (Moldenke, 1979). No butterfly species of the present study was found to restrict its visits to a single plant species. In other words they are polylectic. However, certain butterfly species more or less preferred limited number of plant species while in peak bloom. These results lend support to Gilbert & Singer (1976) and Schemeske (1976) who demonstrated resource partitioning by congeneric species of butterflies and also to Subba Reddi & Reddi (1984) who pointed out that feeding specialization may vary depending on resource availability and the degree of competitive pressures. As expressed by Baker & Baker (1973), it is likely that a butterfly visiting only one plant species may not pick up a balanced supply of various amino acids necessary for protein – building. Moreover, as Michener (1979) commented, most flowering plant species in the tropics are not in bloom for as long as the flight period of most insects, so that oligolecty is impracticable (Table 1).

Table 1. The number of plants visited and number of plants which pollen adhered on different body parts of butterflies

S.No.	Name of the Butterfly	No .of plants visited	Proboscis	Antennae	Head	Legs	Wings
1.	Danaus limniace	7	7	3	5	5	-
2.	D.chrysippus	30	26	6	18	14	5
3.	Euploea core	16	14	4	5	7	-
4.	Euthalia garuda	3	3	-	3	3	3
5.	Hypolimnas misippus	7	7	2	3	3	4
6.	H.bolina	5	5	3	3	4	3
7.	Precis almana	6	6	2	3	3	-
8.	.P.lemonias	15	14	5	8	10	-
9.	P.hierta	11	11	5	5	5	5
10.	Phalanta phalantha	16	15	4	7	7	6
11.	Acraea violae	12	12	6	6	6	8
12.	Castalius rosimon	13	10	3	6	8	5
13.	Euchrysops cnejus	7	4	1	3	4	-
14.	Jamides celeno	3	2	-	1	2	-
15.	.Atrophaneura hector	19	16	-	3	3	-
16.	A.aristolochiae	30	24	3	10	5	3
17.	Papilio polytes Romulus	23	21	3	5	8	8
18.	P.demoleus	15	14	-	4	3	6
19.	Graphium agamemnon	13	12	1	4	2	3
20.	Cepora nerissa	11	11	1	2	4	3
21.	Anaphaeis aurota	9	6	2	3	2	-
22.	Colotis eucharis	11	10	1	5	5	2
23.	C.danae	9	8	1	4	1	1
24.	Valeria valeria anais	2	1	-	1	-	-
25.	Catopsilia crocale	11	11	-	4	2	-
26.	C.crocale pomona	8	7	-	2	1	-
27.	C.pyranthe	15	11	6	14	9	6
28.	.Eurema hecabe	18	16	3	6	6	-
29.	Pelopidas mathias	11	10	2	6	4	-
30.	Borbo cinnara	22	20	2	11	8	-

In conclusion, this study supports the costly information hypothesis which says that the insects should be flower constant if the average reward of a flower species is above a certain threshold, but should increasingly invest into sampling alternatives as the reward goes down.

4.References:

1. Baker HG, Baker I. Some anthecological aspects of the evolution of nectar producing flowers, particularly amino acid production in nectar. In: V.H.Heywood (ed.), Taxonomy and Ecology. 1973. Academic press, London – New York, PP.243 – 264.
2. Courtney S P, Hill CJ, Westerman A. Pollen carried for long periods by butterflies. Oikos, 1983. 38: 260 – 263.
3. Frankie GW, Haber WA, Opler PA, Bawa KS. Characteristics and organization of the large bee pollination system in the Costa Rican dry forest. In: C.E.Jones and R.J.Little (eds.) Handbook of Experimental pollination biology. 1983. Van Nostrand Reinhold Co., New York.
4. Gilbert L E, Singer M C. Butterfly Ecology. Annu. Rev. Ecol. Syst. 1976. 6: 365 – 397.
5. Heithaus E R. The role of Plant – pollinator interactions in determining community structure. Ann.Mo.Bot.Gard. 1974. 61: 675 – 691.5.Ilse D.

Zur "Formwahrnehmung" der Tagfalter.I. Spontaue Bevorzugung Von
6. Formmerkmalen durch vanessen. Zeitschrift fur vergleichende physiologie, 1932. 17: 537 – 556.
7. Michener C D. The biogeography of the bees. Ann.Mo.Bot.Gard. 1979. 66: 276 – 347.
8. Moldenke A R. Niche specialization and species diversity along an altitudinal transect in California. Oecologia (Berl.) 1975. 21: 219 – 242.
9. Moldenke A R. Pollination ecology within the Sierra Navada. Phytologia. 1979. 42: 223 – 282.
10. Neff J L, Simpson B B, Moldenke A R. Flowers – flower visitor system. In: G.H.Oriens and O.T.Solbrig (eds.), Convergent Evolution in Warm Deserts. Stroudsburg, Dowden, Hutchinson and Ross Inc., 1977. PP. 204 – 224.
11. Schemeske D W. Pollination specificity in *Lantana camara* and *L.trifolia* (Verbenaceae) Biotropica 1976. 8: 260 -264.
12. Subba Reddi C, Reddi E U B. Bee – flower interaction and pollination potential. Proc. Indian Acad.Sci. (Animal Science). 1984. 93: 373 – 390.
13. Swihart S L. Colour discrimination by the butterfly *Heliconius charitonius* Linn, Anim. Behav. 1971. 19: 156 - 164.