

Nectar host plants of butterflies, their flowering period and flower colour at Visakhapatnam

■ D. SANDHYA DEEPIKA, J.B. ATLURI AND K. LAXMI SOWMYA

SUMMARY

This paper is intended to be a study concerning with nectar host plants of butterflies at Visakhapatnam, Andhra Pradesh is described. At Visakhapatnam a total of 43 butterfly species spread over eight families was recorded. They are distributed among 8 families. Of the 43 species of butterflies recorded at Visakhapatnam, 5 species *Elymnias caudata*, *Mycalesis visala subdita*, *Melanitis leda ismene*, *Euthalia garuda*, and *Neptis hylas* seldom foraged on the nectars of flowers. They are found to feed on over ripe or rotten fruits, sap oozing from wounds and tree trunks. Among the remaining species *Papilio polymnestor*, *P. poltyes polytes*, *Princeps demoleus* were seen to feed on mud in addition to foraging on different flowers and three species, *Euthalia nais*, *Papilio crino*, *Colotis danae* could not found to feed on any flower during the study period. The remaining 35 species were found taking nectar at the flowers of one or the other 54 plant species. The mutualistic relationship between plants and insects is widely explained. Plants have evolved floral structures for the production of nectar which is collected by insects that in the process pollinate the flowers. Also the flowering period and colour of the flower is described.

Key Words : Butterflies, Nectar host plants, Flower colour, Flowering period

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Natural ecosystem and their ingredients support all life on earth. To keep such natural ecosystems functional, biodiversity has to be maintained. Among the various elements of biodiversity plants and insects form the dominant groups. During the course of evolution delicate balance has been established in the ecological functioning of plants and insects in the biosphere. The mutualistic relationship between plants and insects is widely explained. Many adult butterfly species visit flowers for nectar but some such as *Heliconius* feed on pollen also. The nectar of flowers is the only source of carbohydrate for the adult butterflies and this will contribute

to longevity, fecundity and flight energetic. Watt *et al.* (1974) suggested that nectar may be an important source of water to the anthophilous animals than of sugar at least for certain periods. For flower localization and identification of visual cues are the main signals and colour vision is an important factor (Silberglie, 1977). MC Lean and Cook (1956) suggested that the flowers which are regularly visited by butterflies are red and violet. The spontaneous preference for colour was demonstrated by Ilse and Vaidya (1956) on *Papilio demoleus*. Each species had a peak flowering period with which varies from plant to plant. Deep flowers with nectar inaccessible to shorter tongued bees are expected to provide a refuge free from competition from honey bees (Corbet *et al.*, 1995; Sugden *et al.*, 1996). Comba *et al.* (1999) described nectar production and insect visits in 24 British plant species. The present study describes the nectar host plants of butterflies and their flowering periods at Visakhapatnam, Andhra Pradesh.

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MATERIAL AND METHODS

The study was made at two sites at Visakhapatnam.

- Andhra University campus which enjoys both wild and cultivated flora.
- Kanbalakonda wild life sanctuary with semi protected forest area.

The Andhra University campus is spread over 0.5sq.km and is in proximity to the cost line. The vacant land is getting depleted due to the construction activity to accommodate several new courses. But still the campus supports beautiful patches of vegetation with some ever green species. Luxuriant growth is observed during rainy season. The seasonal annuals that come up during the rainy season dry up with the onset of winter giving rather open view to the vegetation.

Kanbalakonda wild life sanctuary is situated in the Eastern Ghats on the outskirts of Visakhapatnam city. It extends to an area of 7,139 hectares consisting of gentle to steep slopes. Kambalakonda Eco – tourism part spreading an area of 80 hectares was carved out. The sanctuary harbors very rare and endemic flora with variety of fauna.

The butterflies normally appear in their largest numbers when there is plenty of green vegetation that serves as both foliar and floral hosts. Regular field trips were made at 10day intervals to record the composition, prevalence and flowering periods of plant species. Taxonomic identification of the plants was done by the reference to the flora of Visakhapatnam by Venkateswarlu *et al.* (1972) as well as comparison with the authenticated herbarium specimens available in the Botany Department, Andhra University.

RESULTS AND DISCUSSION

The experimental findings obtained from the present study have been discussed in following heads:

Nectar host plants of butterflies and their flowering period:

Of the 43 species of butterflies recorded at Visakhapatnam, 5 species *Elymnias caudata*, *Mycalis visala subdita*, *Melanitis leda ismene*, *Euthalia garuda*, and *Neptis hylas* seldom foraged on the nectars of flowers. They were found to feed on over ripe or rotten fruits, sap oozing from wounds and tree trunks. Among the remaining species *Papilio polymnestor*, *Papilio polytes polytes*, *Princeps demoleus* were seen to feed on mud in addition to foraging on different flowers. Three species, *Euthalia nais*, *Papilio crino*, *Colotis danae* could not found to feed on any flower during the study period. The remaining 35 species were found taking nectar at the flowers of one or the other 54 plant species (Table 1).

Of the 35 butterfly species visiting flowers *Catopsilia pyranthe* visited 16 plant species, *Pachliopta aristolochiae aristolochiae* and *Danaus chrysippus* each visited 15 plant species and *Euploea core core*, and *Pachliopta hector* each - 13; *Papilio polytes polytes* and *Eurema hecabe simulata* each

11; *Graphium agamemnon menides*, *Junonia lemonias* and *Princeps demoleus*, *Phalanta phalantha phalantha* 10 each; *Borbo cinnara*, *Junonia hierta*, *Anaphaeis aurota* and *Hypolimnas misippus*, *Junonia almana* – 7 each; *Castalius rosimon rosimon*, *Junonia iphita* - 6; *Leptosia nina nina*, *Zizeeria karsandra*, *Anaphaeis aurota* each 5, *Hypolimnas bolina*, *Acraea terpsicore*, *Tirumala limniace leopardus*, *Pareronia valeria*, *Papilio polymnestor*, *Junonia orithya*, *Colotis eucharis*, *Graphium doson* – 4 each; *Catopsilia pomona* and *Rathinda amor* 3; *Jamides celeno aelianus*, *Junonia almana* each 2 and *Ariadne merione merione* and *Everes lactunus syntala*, *Spindasis vulcanus vulcanus* each 1 plant species.

The nectar host plants present in Andhra University campus but absent at Kambalakonda include *Rostellularia procumbens*, *Asystasia gangetica*, *Anacardium occidentale*, *Wrightia tinctoria*, *Catharanthus roseus*, *Nerium indicum*, *Tridax procumbens*, *Tagetes patula*, *Caesalpinia coriaria*, *Caesalpinia Pulcherrima*, *Cleome viscosa*, *Jatropha gossypifolia*, *Sida acuta*, *Hibiscus rosa-sinensis*, *Moringa pterigosperma*, *Bougainvillia spectabilis*, *Petalium murex*, *Antigonon leptopus*, *Ixora arborea*, *Santalum album*, *Sapindus emarginatus*, *Waltheria indica*, *Muntingia calabura* and *Duranta erecta*.

The nectar plants present in Kambalakonda but absent in Andhra University campus are *Blepharis maderaspatensis*, *Carissa carandus*, *Leucas aspera*, *Sida cordata*, and *Stachytarpetta jamaicensis*.

Each species had a peak flowering, the period of which varied from plant to plant at the study sites. *Rostellularia procumbens*, *Asystasia gangetica*, *Catharanthus roseus*, *Nerium indicum*, *Calotropis gigantea*, *Tridax procumbens*, *Vernonia cinerea*, *Caesalpinia pulcherrima*, *Cleome viscosa*, *Euphorbia hirta*, *Moringa pterigosperma*, *Bougainvillia spectabilis*, *Hamelia patens*, *Ixora arborea*, *Muntingia calabura*, *Lantana camara*, *Phyla nodiflora* and *Hybanthus enneaspermus* flowered in uniform frequency all through the year.

The remaining plant species showed flowering in a particular period of the year. Thus *Blepharis maderaspatensis* flowered during November-March; *Anacardium occidentale*: January-March, *Wrightia tinctoria*: March-June, *Carissa carandus*: January-November, *Tagetes patula*: December-March, *Caesalpinia coriaria*: October-January, *Peltophorum pterocarpum*: April-July, *Terminalia catappa*: March-April, *Evolvus alsinoides*: September-February, *Jatropha gossypifolia*: September, *Pongamia pinnata*: February-July, *Sida cordata*: August-May, *Sida acuta*: August-December, *Hibiscus rosa-sinensis*: October-December, *Azadirachta indica*: March-April, *Syzigium cumini*: March-July, *Petalium murex*: June-December, *Antigonon leptopus*: August-April, *Zizyphus oenoplia*: September-October, *Spermacoce hispida*: August-March, *Santalum album*: June-August., *Sapindus*

Table 1 : List of nectar host plants and their flower colour

| Sr. No. | Butterfly species | Adult host plants | Flower colour |
|-----------------|--------------------------|--|---|
| Danaidae | | | |
| 1. | <i>Danaus chrysippus</i> | <i>Antigonon leptopus</i> <i>Azadirachta indica</i> <i>Caesalpinia coriaria</i> <i>C. pulcherrima</i> <i>Calotropis gigantea</i> <i>Cleome viscosa</i> <i>Duranta repens</i> <i>Euphorbia hierta</i> <i>Lantana camara</i> <i>Moringa oleifera</i> <i>Sapindus emarginatus</i> <i>Spermacoce hispida</i> <i>Syzygium cumini</i> <i>Tridax procumbens</i> <i>Wrightia tinctoria</i> | Pink White Yellow Yellow White Yellow Violet Yellow Pink and Orange White Yellow Pink White Yellow White |
| 2. | <i>Tirumala limniace</i> | <i>Antigonon leptopus</i> <i>Cathranthus roseus</i> <i>Lantana camara</i> <i>Sapindus emarginatus</i> | Pink Pink Pink and Orange Yellow |
| 3. | <i>Euploea core</i> | <i>Anacardium occidentale</i> <i>Antigonon leptopus</i> <i>Azadirachta indica</i> <i>Caesalpinia coriaria</i> <i>Carsissa carandas</i> <i>Ixora arborea</i> <i>Lantana camara</i> <i>Nerium odorum</i> <i>Santalum album</i> <i>Sapindus emarginatus</i> <i>Syzygium cumini</i> <i>Terminalia catappa</i> <i>Ziziphus oenoplia</i> | Yellow Pink White Yellow White Pink and Orange Pink/Red/White Brownish purple Yellow White Whitish yellow Pale green |
| Satyridae | | | |
| Nymphalidae | | | |
| 4. | <i>Ariadne merione</i> | <i>Ricinus communis</i> It fed on the sap oozing from wounds in tree trunks overripe and damaged fruits and spoiled flowers | Green |
| 5. | <i>Hypolimnas bolina</i> | <i>Antigonon leptopus</i> <i>Lantana camara</i> <i>Santalum album</i> <i>Syzygium cumini</i> | Pink Pink and Orange Brownish purple White |
| 6. | <i>H. misippus</i> | <i>Anacardium occidentale</i> <i>Antigonon leptopus</i> <i>Hyptis suaveolens</i> <i>Lantana camara</i> <i>Santalum album</i> <i>Sapindus emarginatus</i> <i>Tagetes patula</i> | Yellow Pink Pink Pink and Orange Brownish purple Yellow Yellow and Orange |

Table 1 contd....

Contd.... Table 1

| | | | |
|------------|---------------------------|--|---|
| 7. | <i>Junonia almana</i> | <i>Antigonon leptopus</i> <i>Calotropis gigantea</i> <i>Duranta repens</i> <i>Lantana camara</i> <i>Phyla nodiflora</i> <i>Rostellularia procumbens</i> <i>Tridax procumbens</i> | Pink White Violet Pink and Orange Pink Pink Yellow |
| 8. | <i>J. hierta</i> | <i>Antigonon leptopus</i> <i>Caesalpinia coriaria</i> <i>C. pulcherrima</i> <i>Duranta repens</i> <i>Lantana camara</i> <i>Santalum album</i> <i>Tridax procumbens</i> | Pink Yellow Yellow Violet Pink and Orange Brownish purple Yellow |
| 9. | <i>J. iphita</i> | <i>Anacardium occidentale</i> <i>Antigonon letopus</i> <i>Catheranthus roseus</i> <i>Duranta repens</i> <i>Lantana camara</i> <i>Santalum album</i> | Yellow Pink Pink Violet Pink and Orange Brownish purple |
| 10. | <i>J. lemonias</i> | <i>Anacardium occidentale</i> <i>Antigonon leptopus</i> <i>Duranta repens</i> <i>Lantana camara</i> <i>Santalum album</i> <i>Spermacoce hispida</i> <i>Stachytarpheta jamaicensis</i> <i>Tectona grandis</i> <i>Tridax prcumbens</i> <i>Ziziphus oenoplia</i> | Yellow Pink Violet Pink and Orange Brownish purple Pink Blue White Yellow Pale green |
| 11. | <i>J. orithya</i> | <i>Antigonon leptopus</i> <i>Lantana camara</i> <i>Phyla nodoflora</i> <i>Spermacoce hispida</i> | Pink Pink and Orange Pink Pink |
| 12. | <i>Phalanta phalantha</i> | <i>Antigonon leptopus</i> <i>Caesalpinia coriaria</i> <i>Carissa carandas</i> <i>Duranta repens</i> <i>Lantana camara</i> <i>Santalum album</i> <i>Sapindus emarginatus</i> <i>Tectona grandis</i> <i>Tidax procumbens</i> <i>Waltheria indica</i> | Pink Yellow White Violet Pink and Orange Brownish purple Yellow White Yellow Yellow |
| Acraeidae | | | |
| 13. | <i>Acraea terpsicore</i> | <i>Duranta repens</i> <i>Lantana camara</i> <i>Spermacoce hispida</i> <i>Tridax procumbens</i> | Violet Pink and Orange Pink Yellow |
| Lycaenidae | | | |
| 14. | <i>Castalius rosimon</i> | <i>Antigonon leptopus</i> <i>Cleome viscosa</i> <i>Rostellularia procumbens</i> <i>Spermacoce hispida</i> <i>Tridax procumbens</i> <i>Ziziphus oenoplia</i> | Pink Yellow Pink Pink Yellow Pale green |

Table 1 contd..

| Contd... Table 1 | | | | Contd... Table 1 | | | |
|------------------|---------------------------------|----------------------------------|-----------------|------------------|-----------------------------------|-----------------------------------|-----------------|
| 15. | <i>Everes lacturnus</i> | <i>Spermacoce hispida</i> | Pink | | <i>Lantana camara</i> | Pink and Orange | |
| 16. | <i>Jamides celeno</i> | <i>Antigonon leptopus</i> | Pink | | <i>Munthia calabura</i> | White | |
| | | <i>Jatropha gossypifolia</i> | Red | | <i>Nerium indica</i> | Pink/Red/White | |
| 17. | <i>Rathinda amor</i> | <i>Antigonon leptopus</i> | Pink | | <i>Sida acuta</i> | Yellow | |
| | | <i>Lantana camara</i> | Pink and Orange | | <i>S. cordifolia</i> | Yellow | |
| | | <i>Tridax procumbens</i> | Yellow | | <i>Stachytarpheta jamaicensis</i> | Blue | |
| 18. | <i>Spindasis vulcanus</i> | <i>Antigonon leptopus</i> | Pink | | <i>Wrightia tinctoria</i> | White | |
| | | | | | <i>Ziziphus oenoplia</i> | Pale green | |
| 19. | <i>Lampides boeticus</i> | <i>Sida cordata</i> | Yellow | 25. | <i>Papilio polymnestor</i> | <i>Antigonon leptopus</i> | Pink |
| | | <i>S. cordifolia</i> | Yellow | | | <i>Catharanthus roseus</i> | Pink |
| | | <i>Spermacoce hispida</i> | Pink | | | <i>Hibiscus rosa-sinensis</i> | Red |
| | | <i>Vernonia cinerea</i> | Pink | | | <i>Tecoma stans</i> | Yellow |
| 20. | <i>Zizeeria karsandra</i> | <i>Boerhavia diffusa</i> | Pink | 26. | <i>P. polytes</i> | <i>Antigonon leptopus</i> | Pink |
| | | <i>Rostellularia procumbens</i> | Pink | | | <i>Asystasia gangetica</i> | White |
| | | <i>Tephrosia purpurea</i> | Violet | | | <i>Bougainvillea spectabilis</i> | Red |
| | | <i>Tribulus terrestris</i> | Yellow | | | <i>Caesalpinia coriaria</i> | Yellow |
| | | <i>Vernonia cinerea</i> | Pink | | | <i>C. pulcherrima</i> | Yellow |
| | Papilionidae | | | | | <i>Duranta repens</i> | Violet |
| 21. | <i>Graphium agamemnon</i> | <i>Anacardium occidentale</i> | Yellow | | | <i>Hemelia patens</i> | Orange |
| | | <i>Antigonon leptopus</i> | Pink | | | <i>Lantana camara</i> | Pink and Orange |
| | | <i>Bougainvillea spectabilis</i> | Red | | | <i>Munthia calabura</i> | White |
| | | <i>Caesalpinia pulcherrima</i> | Yellow | | | <i>Sida cordifolia</i> | Yellow |
| | | <i>Catharanthus roseus</i> | Pink | | | <i>Wrightia tinctoria</i> | White |
| | | <i>Duranta repens</i> | Violet | 27. | <i>Princeps demoleus</i> | <i>Antigonon leptopus</i> | Pink |
| | | <i>Lantana camara</i> | Pink and Orange | | | <i>Asystasia gangetica</i> | White |
| | | <i>Sida cordifolia</i> | Yellow | | | <i>Caesalpinia coriaria</i> | Yellow |
| | | <i>Tectona grandis</i> | White | | | <i>Carissa carandas</i> | White |
| | | <i>Vitex nigunda</i> | Violet | | | <i>Catharanthus roseus</i> | Pink |
| 22. | <i>G. doson</i> | <i>Antigonon leptopus</i> | Pink | | | <i>Hemelia patens</i> | Orange |
| | | <i>Lantana camara</i> | Pink and Orange | | | <i>Lantana camara</i> | Pink and Orange |
| | | <i>Sida cordifolia</i> | Yellow | | | <i>Nerium indicum</i> | Pink/Red/White |
| | | <i>Peltophorum pterocarpum</i> | Yellow | | | <i>Pedaliium murex</i> | Yellow |
| | | | | | | <i>Spermacoce hispida</i> | Pink |
| 23. | <i>Pachliopta aristolochiae</i> | <i>Antigonon leptopus</i> | Pink | | Pieridae | | |
| | | <i>Bougainvillea spectabilis</i> | Red | 28. | <i>Anaphaeis aurota</i> | <i>Antigonon leptopus</i> | Pink |
| | | <i>Catharanthus roseus</i> | Pink | | | <i>Azadirachta indica</i> | White |
| | | <i>Caesalpinia coriaria</i> | Yellow | | | <i>Lantana camara</i> | Pink and Orange |
| | | <i>C. pulcherrima</i> | Yellow | | | <i>Stachytarpheta jamaicensis</i> | Blue |
| | | <i>Duranta repens</i> | Violet | | | <i>Tridax procumbens</i> | Yellow |
| | | <i>Hemelia patens</i> | Orange | 29. | <i>Catopsilia pomona</i> | <i>Duranta repens</i> | Violet |
| | | <i>Lantana camara</i> | Pink and Orange | | | <i>Lantana camara</i> | Pink and Orange |
| | | <i>Munthia calabura</i> | White | | | <i>Nerium indicum</i> | Pink/Red/White |
| | | <i>Sida acuta</i> | Yellow | 30. | <i>C. pyranthe</i> | <i>Anacardium occidentale</i> | Yellow |
| | | <i>S. cordifolia</i> | Yellow | | | <i>Antigonon leptopus</i> | Pink |
| | | <i>Tridax procumbens</i> | Yellow | | | <i>Caesalpinia coriaria</i> | Yellow |
| | | <i>Waltheria indica</i> | Yellow | | | <i>C. pulcherrima</i> | Yellow |
| | | <i>Wrightia tinctoria</i> | White | | | <i>Catharanthus roseus</i> | Pink |
| | | <i>Ziziphus oenoplia</i> | Pale green | | | <i>Cleome viscosa</i> | Yellow |
| 24. | <i>P. hector</i> | <i>Catharanthus roseus</i> | Pink | | | <i>Hemelia patens</i> | Orange |
| | | <i>Caesalpinia pulcherrima</i> | Yellow | | | <i>Lantana camara</i> | Pink and Orange |
| | | <i>Carissa carandas</i> | White | | | <i>Nerium indicum</i> | Pink/Red/White |
| | | <i>Duranta repens</i> | Violet | | | | |
| | | <i>Hibiscus rosa-sinensis</i> | Red | | | | |

Table 1 contd...

Table 1 contd...

Contd.... Table 1

| | | |
|-----|-----------------------------------|-----------------|
| | <i>Pongamia pinnata</i> | White |
| | <i>Sida acuta</i> | Yellow |
| | <i>S. cordifolia</i> | Yellow |
| | <i>Spermacoce hispida</i> | Pink |
| | <i>Syzigium jambolanum</i> | Greenish white |
| | <i>Tridax procumbens</i> | Yellow |
| 31. | <i>Colotis eucharis</i> | |
| | <i>Lantana camara</i> | Pink and Orange |
| | <i>Leucas aspera</i> | White |
| | <i>Spermacoce hispida</i> | Pink |
| | <i>Stachytarpheta jamaicensis</i> | Blue |
| 32. | <i>Eurema hecabe</i> | |
| | <i>Antigonon leptopus</i> | Pink |
| | <i>Carissa carandas</i> | White |
| | <i>Duranta repens</i> | Violet |
| | <i>Lantana camara</i> | Pink and Orange |
| | <i>Petalium murex</i> | Yellow |
| | <i>Sida cordifolia</i> | Yellow |
| | <i>Spermacoce hispida</i> | Pink |
| | <i>Stachytarpheta jamaicensis</i> | Blue |
| | <i>Tridax procumbens</i> | Yellow |
| | <i>Vitex negundo</i> | Violet |
| | <i>Ziziphus oenoplia</i> | Pale green |
| 33. | <i>Leptosia nina</i> | |
| | <i>Blepharis madaeraspatensis</i> | White |
| | <i>Evolvulus alsinoides</i> | Blue |
| | <i>Hybanthus enneaspermus</i> | Pink |
| | <i>Sida cordata</i> | Yellow |
| | <i>Vernonia cinerea</i> | Pink |
| 34. | <i>Pareronia valeria</i> | |
| | <i>Asystasia gangetica</i> | White |
| | <i>Bougainvillea spectabilis</i> | Red |
| | <i>Catharanthus roseus</i> | Pink |
| | <i>Ixora arborea</i> | White |
| | Hesperiidae | |
| 35. | <i>Borbo cinnara</i> | |
| | <i>Antigonon leptopus</i> | Pink |
| | <i>Asystasia gangetica</i> | White |
| | <i>Caesalpinia coriaria</i> | Yellow |
| | <i>Duranta repens</i> | Violet |
| | <i>Lantana camara</i> | Pink and Orange |
| | <i>Tectona grandis</i> | White |
| | <i>Tridax procumbens</i> | Yellow |

emarginatus: October-December, *Waltheria indica*: March and September, *Duranta repens*: March-December, *Tectona grandis*: August-November, *Stachytarpheta Jamaicensis*: September-December, *Vitex negundo*: October-December, *Hyptis suaveolens*: September-January and *Leucas aspera* during June-February.

The 54 plant species belonging to 29 families are visited by 38 butterflies. Among these families the plants belonging to Polygonaceae fed by 22 butterfly species followed by Verbenaceae, Rubiaceae and Asteraceae each 15, Apocyanaceae 14, Fabaceae 12 and Malvaceae 10. The remaining plant families supported less than 10 butterfly

species.

Special observations on *Antigonon* which grows abundantly almost throughout the year showed the visitation of majority of the abundant butterflies present in Andhra University campus. Among them *Catopsilia pyranthe*, *Borbo cinnara*, *Junonia lemonias*, and *Danaus chrysippus* were found in abundance in this order.

Butterflies feed at mud puddles, dung and carrion and such behaviour is termed puddling. 'Puddling intensity differs within species, among sex and age classes, the participants are usually male and often young (Collenette, 1934; Adler 1982; Adler and Pearson, 1982; Berger and Lederhouse, 1985; Boggs and Jackson, 1991; Launer *et al.*, 1993; Sculley and Boggs, 1996). It may involve aggregations of individuals feeding at a location which is used repeatedly. Puddling may be the result of scarce nutrient (sodium) in the adult diet or competitive exclusion of males or young individuals from a richer resource (flowers) by females of older individuals. Such behaviour is observed atleast in *Papilio* (Arms *et al.*, 1974). The puddling substrates contain substances other than sodium which could be nutritionally important to puddling insects. The puddling substrate varies in soluble sodium content, with mud having the lowest concentrations and carnivore dung having the highest (Boggs and Dau, 2004). Females of species that mate several times were rarely seen puddling themselves where as females of species that mate only once were more often seen puddling when old, presumably because their male-derived sodium reserves had been depleted. The Nymphalid genus *Asterocampa* do not visit flowers, but feed on decaying materials such as rotten fruit, fermenting tree sap, animal excrement and carcasses. Adults of *Asterocampa celtis* were observed to feed on wet mud and fruits of mulberries and cherries (Langlois and Langlois, 1964).

Butterfly visits vs. flower colour:

The colour of the flower which plays an important role in attracting insects was recorded for each of the taxon visited by butterflies.

Of the 43 butterfly species recognized at study sites, 5 species are not found to visit any flower. The remaining 38 butterfly species visited flowers of different colours: Pink, yellow, white, blue, red, pale green, orange and violet. The number of plant species possessing yellow colour were 18, white 15, pink 10, red 4, orange and violet each 3 blue 2 and pale green 1. Among these plants the plants with the flower colour Yellow and Pink attracted more number of butterflies *i.e.* 34 and 28, respectively. The next attracting colour being orange (25), white (19) followed by violet (15) and red (11). Pale green and brownish purple flowers were visited by (7), blue (6) butterfly species each.

The frequency of visits made by different butterflies to different colour flowers varied. *Danaus chrysippus chrysippus*, *Tirumala limniace leopardus*, *Euploea core core*,

Hypolimnas misippus, *Junonia hierta*, *Junonia lemonias*, *Phalanta phalantha phalantha*, *Acraea terpsicore*, *Castalius rosimon rosimon*, *Rathinda amor*, *Zizeeria karsandra*, *Graphium agamemnon menides*, *Graphium doson*, *Pachliopta aristolochiae aristolochiae*, *Pachliopta hector*, *Papilio polytes polytes*, *Princeps demoleus*, *Anaphaeis aurota*, *Catopsilia pyranthe*, *Eurema hecabe simulata*, *Borbo cinnara* and *Lampides boeticus* made frequent visits to yellow and pink flowers.

The other flower colour combinations favoured by the species include: *Ariadne meroine meroine* – green, *Hypolimnas bolina*-pink and white; *Junonia almanac* – pink and violet; *Junonia iphita*, and *Junonia Orithya* - pink and orange, *Catopsilia pomona*- pink, red, white, violet and orange; *Pareronia valeria anais*-pink, white and red; *Jamides celeno aelianus* and *Papilio polymenstor* – pink and red; *Colotis eucharis eucharis* – pink, blue and white; *Junonia orithya*, *Zizeeria Karsandra*, *Everes lactunus syntala* and *Spindasis vulcanus vulcanus* – pink only; *Leptosia nina nina* – yellow, pink, blue and white.

Butterflies exhibit distinct flower preferences that can differ between species (Jennersten, 1984, Murphy *et al.*, 1984, Erhardt and Thomas, 1991). The choice of plants as nectar sources by butterflies depends on various factors, such as colour, corolla depth, clustering of flowers, floral scent and nectar quality, quantity and concentration. The visual character *i.e.* colour is very important as guiding visitors to the angiosperm flowers (Lunau and Maier, 1995, Chittka *et al.*, 2001). Hence, colour vision is an important component of intra and interspecific interactions in butterflies (Crane, 1955, Silberglied, 1984) as well as in the recognition and use of floral food sources. The visible spectrum to butterflies extends from the ultraviolet through the red is the broadest known in the animal kingdom (Silberglied, 1984). When a particular floral colour is recognized and preferred by the visitors they frequently visit flowering plants (Kevan and Baker, 1983; Barth, 1991; Schoonhoven *et al.*, 1998). Most flower visitors innately prefer a particular colour and use them as cues for flower recognition and selection (Dronamraju, 1960; Levin, 1972). At Visakhapatnam except Satyridae all the families utilized flowers for nectar feeding. The remaining families predominantly foraged on the flowers with pink and yellow colours. The other flower colours used in the next order of preference are white followed by red, orange, violet, blue and pale green. Baker *et al.* (1983) stated that the butterfly flowers range from white to yellow and pink and even red but are not blue. But the present study reports that two plant species *Stachytarpheta jamaicensis* and *Evolvulus alsinoides* which produced blue coloured flowers were visited by many butterflies such as *Pachliopta hector*, *Anaphaeis aurota*, *Colotis eucharis*, *Eurema hecabe*, *Junonia lemonias* and *Leptosia nina*. This finding is in agreement with Ilse (1928), Ilse and Vaidya (1956), Swihart and Swihart (1970), Scherer and Kolb (1987a,b) who stated that blue is commonly

preferred by many butterfly species, while purple is preferred by several Papilionoids and Pierids and yellow is preferred by several Pierids and Nymphalids. Scherer and Kolb (1987a,b) reported when searching for food *Agalis urticae*, *Pararge aegeria*, and *Pieris brassicae* to prefer one particular colour irrespective of brightness. In *Papilio xuthus* a difference is also observed between the sexes with regard to colour preference (Kinoshita *et al.*, 1999). Omura and Honda (2005) while studying the factors that stimulate flower visiting using the adult butterfly *Vanessa indica* showed a colour preference for yellow and blue. Their results also demonstrated that *Vanessa indica* depends primarily on colour during flower visitation. Weiss (1997) investigated the importance of innate preferences and learned associations in choice of flower colours for *Battus philenor* and showed innate colour preferences for yellow and to a lesser extent blue and purple. The species was also able to learn within 10 flower visits to associate floral colour with the presence of nectar rewards in yellow or magenta *Lantana camara* flowers. Most individuals readily shifted their foraging behavior when the colour of the rewarding flower was changed.

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