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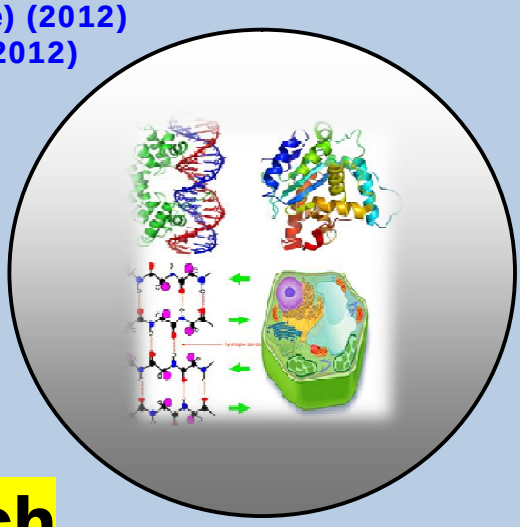

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RESEARCH PAPER
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Larval and Nectar Host Plants of Butterflies at Visakhapatnam, A.P., India

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ABSTRACT

A study was conducted to evaluate the butterfly fauna their larval and nectar host plants of butterflies at Visakhapatnam, Andhra Pradesh were described. At Visakhapatnam, 43 butterfly species distributed among 8 families. These butterflies utilized 74 plant species as their larval host plants. Among the 43 butterfly species Euploea core core could utilize 8 host plant species, Neptis hylas 7; Junonia lemonias and Eurema hecabe simulata 6 each; Elymnias caudata, Acraea terpsicore, Junonia hierta and Princeps demoleus utilized 5 each. The larvae of 30 butterfly species utilized 1 – 4 plant species. The larvae of the remaining 5 species Everes lacturnus syntala, Barbo cinnara, Euthalia nais, Colotis danae & Colotis eucharis eucharis could not be found to feed on any of the host plants available at Visakhapatnam. 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, Papilio. poltyes polytes, Princeps demoleus were seen to feed on mud in addition to foraging on different flowers. The remaining 35 species were found taking nectar at the flowers of one or the other 54 plant species
Keywords: Butterflies, Larval host plants, Oviposition, Nectar host plants.

INTRODUCTION

Most of the tropical plant species have evolved relationships with a variety of animals ranging from tiny trips and midges to bees and large bats & butterflies, to shuttle pollen between trees. The genetic variability resulting from cross – pollination is of crucial importance in natural selection. Apart from the evolutionary roles played by the insect - plant interactions, the insects themselves comprise a remarkable array of beneficial resources to humans & nature.

Among the insects the lovely and grateful butterflies provide economic & ecological benefits to the human society. Having multihued colours on their wings, they enhance the earth's beauty incontestably and add immense aesthetic value to the ambient environment. They accomplish pollination, a keystone ecological process in natural sustainability throughout the world. Their caterpillars are largely herbivorous and form the primary consumers in the ecosystems. The larvae are typically host specific. Adults require adequate nectar resources. Nectar provides energy for flight, which is vital to find mates and to disperse the species. Hence butterflies are the best rapid indicators of habitat quality, and also they are the sensitive indicators of climate change. This study describes the Larval and Nectar host plants of butterflies at Visakhapatnam, Andhra Pradesh.

MATERIAL AND METHODS

Visakhapatnam is located on the east coast of India in the state of Andhra Pradesh between 20^0 31' – 19^0 54' N latitude & 76^0 46' – 84^0 46' E longitude. It is the second largest city of Andhra Pradesh. The Eastern Ghats and blue waters of Bay of Bengal give the city a magical touch. In the rainy season a luxuriant growth of a variety of herbs and shrubs gives somewhat compactness to the vegetation with the onset of winter. The seasonal annuals that come up during the rainy season dry up and disappear. Some may reappear when cyclonic rains provide enough moisture and thrive through summer. During the summer the deciduous trees begin to shed their foliage and prepare to flower. The whole area is subjected to human disturbance giving rise to secondary growth of vegetation. The butterflies normally appear in their largest numbers when there is plenty of green vegetation that serves as both foliar & floral hosts. Regular field trips were made at 10 day intervals to record their composition, and to identify the flowering periods of the adult host plants. 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. The names adopted were the latest valid ones.

Collection and identification of butterflies

Representative samples of butterflies were collected during field survey using the methods described by De Rhe - Philipe (1931). They were collected by stalking or by chasing the fast flying species or by gently sweeping low flying species. The collection was made before 1000h under conditions of warm weather. They were identified and released. The unidentified specimens were killed by pressing the thorax and preserved in the envelops in a settling condition with fully opened wings. In order to prevent the spoilage of specimens Naphthalene was used. Measurement of each butterfly species is taken from end to end of the wings at expanded position. After noting the wing size and other characters such as colour , markings on the wings of the butterflies they were compared and identified by referring to Talbot (1939, 1947), Wynter-Blyth (1957), D'Abrera (1982, 1985, 1986), Larsen (1987, 1988), Gay *et al.* (1992), Gunathilagaraj *et al.* (1998) and Kunte (2000). For nomenclature Varshney (1980, 1985), Gunathilagaraj *et al.* (1998) and Kunte (2000) were referred. As familiarity increased visual recognition of various species was possible. It has been verified for its validity from Zoological Survey of India, Kolkata.

RESULTS AND DISCUSSION

Seasonality of butterflies

During the above said visits the composition, relative abundance, seasonality, foraging and oviposition activity of the butterfly species were monitored. Since the butterflies were day active during 0830 – 1500 h, they were observed at different patches of wilderness for an hour during 1000 – 1100 h at Visakhapatnam. Along with this, observations were also made on the foraging and oviposition activity of the adult butterflies and the plants utilized for nectar and ovipositing.

Of the 43 butterfly species that occur at Visakhapatnam more than half of the total butterfly species are encountered in wet season (56%) because the frequent rains in this period promote luxuriant growth of vegetation. Furthermore, a number of plant species providing food source to adult butterflies are also available in peak bloom in this season. Thus the plant species such as *Cassia occidentalis, Cleome viscosa, Duranta erecta, Santalum album, Sapindas emarginatus, Tectona grandis* and *Zizyphus oenoplia* providing nectar to adults are available in peak bloom in this season. However equally good numbers of plant species are in flowering during dry season and the plant species specially trees such as *Polyalthia longifolia, Wrightia tinctoria, Anacardium occidentale, Peltophorum pterocarpum,* and *Syzygium cumini* provided nectar for the butterfly species and hence 44% of the total butterflies were encountered in this season. As rainfall conditions are complicated and differ from region to region in South India, butterfly distribution may similarly differ from region to region and from year to year. These observations agree well with what Goodden (1974) has written about the temporal distribution of butterflies in the tropics.

Composition of butterfly species

India is described as a butterfly paradise (Venkatramani 1986). There are over 20,000 species of butterflies in the world, of which over 1,500 occur in India (Smetacek 1993). Visakhapatnam where the present study was carried out is in India which is covered by the sub region 'Peninsular India'. South India has a rich beautiful, diverse and scientifically very interesting butterfly fauna. The number of species is over 300 distributed in nine families (cf. Wynter-Blyth 1957). Of this total, 43 species were found to exist at Visakhapatnam, 8 species against 19 of Papilionidae; 8 against 34 of Pieridae; 12 against 51 of Nymphalidae; 7 against 89 of Lycaenidae; 3 against 11 of Danaidae; 3 against 31 of Satyridae; 1 against 74 of Hesperiidae; 1 against 2 of Acraeidae. It is thus evident that in this region Hesperiidae and Acraeidae are poorly represented compared to other families.

Ovpositing activity and host plant preference of butterflies

The host finding and egg laying are the crucial events in the life of butterflies since the hatching larvae are often relatively immobile and depend on the choice of the food plant by the gravid female (Thompson and Pellmyr 1991 and the references therein; Renwick and Chew 1994. Critical and comprehensive reviews are available on the knowledge accumulated on host selection and egg-laying such as number of eggs laid, egg size, rate of oviposition, cluster size (Labine 1968; Thompson and Pellmyr 1991; Renwick and Chew 1994). Several workers contributed much to the development of ideas in the area of host plant selection and oviposition (Chew and Robbins 1984; Singer 1984; Wiklund 1974a, b; 1975; 1977; 1984; Nylin 1988; Janz *et al.* 1994).

Several authors have speculated that ovipositing females select those plants for oviposition that is most suitable for larval growth and survival (Wiklund 1974a, 1984; Chew 1975; Gilbert and Singer 1975; Smiley 1978; Rausher 1979; 1980; Rausher and Papaj 1983; Damman and Feeny 1988; Watanabe 1976; 1981; 1993). Nectar sources also influence the selection of oviposition host plant species in habitats where these species are spatially separated (Murphy *et al.* 1984). Some studies (Ritsuo *et al.* 1990) showed that not all the taxonomically related plant species are preferred for oviposition, because they may contain chemical factors, which deter oviposition. Some butterfly species lay their eggs in clusters but a great majority of butterflies deposit their eggs singly (Labine 1968; Owen 1971; Stamp 1980; and the references therein; Kunte 2000; Atluri *et al*. 2004). The females exhibit higher frequency of wing strokes & search for host plants during oviposition. After identifying the right host plant they touch the leaves with their four legs and then fly off from one plant to another until it conforms. Then the female alights on the leaf, holds the leaf with the torcel claws then bends the tip of the abdomen and deposit the egg and fly off. Lycaenides walk over young branchlets of the host plant and oviposit at the axils of young leaves.

Oviposition habits

At Visakhapatnam female butterfly species laid eggs on specific hosts. During oviposition the adults used to test the rightness of the environment for laying eggs by tapping the leaves with fore legs. A similar behaviour was also reported with *Papilio mechaon* (Wiklund 1974a) and *Heliconius* Sp. (Benson *et al.* 1975). Ilse (1955) and Fox (1966) showed that this behaviour acts as a chemical test of the properties of the leaf with the help of foreleg chemoreceptors. Most butterfly species oviposited on young shoots, flower buds and terminal foliages. Such plant structures are rich in nitrogenous compounds, and served to meet the nitrogenous requirement of larvae because the adults contribute nothing in many cases (Cottrell 1984) and the older leaves evidently being unpalatable or even toxic. Kitching (1981) recognized three categories of butterflies on the basis of their egg-laying habit, most authors considered only two categories: (1) the cluster or batch layers, and (2) those laying eggs singly. Analysis of the egg laying habits displayed by different butterflies encountered at Visakhapatnam indicated the predominance of single egg laying habit than the cluster or batch laying habit. Thus *Pareronia valeria anais* showed batch laying habit and, *Acraea terpsicore,* and *Anaphaeis aurota* showed cluster egg laying habit. These two categories of egg laying habits were also observed by butterflies in different geographical regions with the predominance of single egg laying habit than the cluster or batch laying habit (Chew and Robbins 1984; Thompson and Pellmyr 1991). In other parts of India also there is the predominance of single egg laying habit (Kunte 2000), and 66 of the 67 Papilionid butterfly species lay their eggs singly (Table 1 of Stamp 1980).

The present study revealed that the larvae prefer to feed mostly young leaves. Of the 43 butterfly species recorded the larvae of seven butterfly species are supported by Fabaceae and followed by Acanthaceae (6) and Verbenaceae (5). Six families viz. Annonaceae, Asclepiadaceae, Capparidaceae, Malvaceae, Rhamnaceae and Rutaceae supported the larvae of three butterfly species each. The family Poaceae which supported the larvae of major butterfly species in Africa and Australia (Ackery 1991) supported only two butterfly species at Visakhapatnam.

Among the 28 plant families the Fabaceae members are fed by the larvae of *Hypolimnas bolina*, *Neptis hylas, Jamides celno, Zizeeria karsandra, Catopsilia pomona, C. pyranthe,* and *Eurema hecabe*. The Acanthaceae members supported the larvae of *Hypolimnas misippus, Junonia almana, J. hierta, J. iphita, J. lemonias,* and *J. orithya*. The Verbenaceae members supported *Junonia hierta, J. orithya, J. almana, J. lemonias*, and *Zizeeria karsandra*, and the remaining families supported the larvae of either one or two butterfly species. Some of the larval host plants utilized in the present study by some butterfly species are not recorded elsewhere in India (Table). Such plant species include *Ficus benjamina* and *F. microcarpa* for *Euploea core*, *Pergularia daemia* for *Danaus chrysippus, Dipteracanthus aculata* for *Junonia hierta, Dipteracanthus aculata* and *Ruellia tuberosa* for *Junonia iphita* and *J. lemonias, Evolvulus alsinoides* for *J. orithya, Triumfetta pentandra* for *Neptis hylas*, *Zizyphus oenoplia* for *Castalius rosimon*, *Ixora arborea* for *Rathinda amor, Citrus aurantium* for *Papilio polytes* and *Princeps demoleus* and *Cassia occidentalis* for *Catopsilia Pomona* in addition to the already recorded larval host plants. The findings of Talsma *et al.* (2008) showed that in the field the size of the plant appeared to be a more important stimulus with bigger plants receiving more oviposition than smaller plants regardless of their secondary chemistry. Our present study also revealed that among the larval host plants about 50% are the tree species utilized by the butterflies. Of the seven species of Papilionidae five species *Graphium agamemnon, G. doson. Papilio polymnestor, P. polytes, Princeps demoleus* fed on only tree species. The members of Lycaenidae and Pieridae also fed on tree species but along with the other habit types.

Larval host plants utilized at Visakhapatnam

In the present study 74 plant species are utilized by larvae as their host plants. Table gives list of host plants utilized for oviposition by each of the butterfly species during the study period.

Majority of the plant species are utilized by 1 or 2 butterfly species as their larval hosts. *Rostellularia procumbens* served as a larval host plant for all the 5 species of *Junonia* - *Junonia almana, J. hierta, J. iphita, J. lemonias* & *J. orithya* available at the study sites. *Phyla nodiflora, Barleria prionitis, Dipteracanthus aculata, Ruellia tuberosa* and *Evolvulus alsinoides* are also fed by only *Junonia* larvae. *Zizyphus mauritiana* is fed by *Castalius rosimon rosimon, Spindasis vulcanus vulcanus* and *Princeps demoleus* larvae. *Cassia siamea* is also fed by the larvae of three butterfly species *Catopsilia pomona*, *C. pyrathe* and *Eurema hecabe simulata*.

Among the 43 butterfly species *Euploea core core* could utilize 8 host plant species, *Neptis hylas* 7; *Junonia lemonias* and *Eurema hecabe simulata* 6 each; *Elymnias caudata*, *Acraea terpsicore*, *Junonia hierta* and *Princeps demoleus* utilized 5 each; *Spindasis vulcanus vulcanus*, *Zizeeria karsandra*, *Papilio polytes*, *Catopsilia pomona & C. Pyranthe* utilized each 4 species, *Hypolimnas misippus*, *Junonia iphita*, *J. orithya*, *Jamides celeno aelianus* and *Graphium agamemnon menides* could utilize each 3 species; *Danaus chrysippus chrysippus, Tirumala limniace leopardus*, *Melanitis leda ismene*, *Ariadne merione merione*, *Euthalia garuda, Hypolimnas bolina, Junonia almana, Castalius rosimon rosimon, Rathinda amor* each 2 species. *Phalantha phalantha phalantha*, *Graphium doson, Pachliopta hector,*

Anaphaeis aurota, Pareronia valeria anais, Papilio polymnestor, P. crino, Mycalesis visala subdita, Pachliopta aristolochiae, Leptosia nina nina, Lampides boeticus each 1 species.

The larvae of the remaining 5 species *Everes lacturnus syntala, Barbo cinnara, Euthalia nais, Colotis danae & Colotis eucharis eucharis* could not be found to feed on any of the host plants available at Visakhapatnam.

Nectar host plants of adult butterfly

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, Papilio poltyes 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. The 54 plant species belonging to 29 families are visited by 35 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.

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, Zizeerria 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 lactunnus syntala, Spindasis vulcanus vulcanus* each 1 plant species.

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. At Visakhapatnam except Satyridae all the families utilized flowers for nectar feeding.

Adult feeding habits provided by early naturalists have been expanded only slightly by recent studies (Gilbert and Singer 1975). Many adult butterfly species visit flowers for nectar but some such as *Heliconius* feed on pollen also. Certain species feed on honey dew, frog hopper secretions, rotting fruits, urine, perspiration, dung, sap oozing from wounds of plants and carrion.

The nectar of flowers is the only source of carbohydrate for the adult butterflies and this will contribute to longevity, fecundity and flight energetic.

Table 1. List of larval host plants of butterflies at Visakhapatnam.

S.No.	Butterfly species	Larval host plants
	DANAIDAE	
1.	*Danaus chrysippus*	*Calotropis gigantea* (Asclepi) (S) ***Pergularia daemia*** (Asclepi) (C)
2.	*Tirumala limniace*	*Calotropis gigantea* (Asclepi) (S) *Tylophora indica* (Asclepi) (C)
3.	*Euploea core*	*Nerium indicum* (Apocyna) (S) *Adenium odorum* (Apocyna) (S) *Hemidesmus indicus* (Asclepi) (C) *Tylophora indica* (Asclepi) (C) *Ficus benghalensis* (Morace) (T) ***F. benjamina*** (Morace) (T) *F. religiosa* (Morace) (T) *F. microcarpa* (Morace) (T)
	SATYRIDAE	
4.	*Elymnias caudata*	*Areca catechu* (Areca) (T) *Bambusa arundinacea* (Poaceae)(S) *Cocos nucifera* (Areca) (T) *Musa paradisiaca* (Musaceae)(T)
5.	*Melanitis leda*	*Bambusa arundinacea* (Poaceae) (S) *Ficus religiosa* (Morace) (T)
6.	*Mycalesis visala*	*Grasses* (Poaceae)
	NYMPHALIDAE	
7.	*Ariadne merione*	*Ricinus communis* (Euphor)(T) *Tragia involucrata* (Euphor) (C)
8.	*Euthalia garuda*	*Mangifera indica* (Anacar)(T) *Anacardium occidentale* (Anacar) (T)
9.	*Euthalia nais*	--------
10	*Hypolimnas bolina*	*Erythrina variegata* (Legumi) (T) *Sida cordata* (Malva) (H)
11.	*H. misippus*	*Asystasia gangetica* Acantha) (C) *Sida cordifolia* (Malva) (S)
12.	*Junonia almana*	*Rostellularia procumbens* (Acantha) (H) *Phyla nodiflora* (Verbena) (H)
13.	*J. hierta*	*Barleria prionitis* (Acantha) (S) ***Dipteracanthus prostrates*** (Acantha) (S) *Rostellularia procumbens* (Acantha) (H) *Ruellia tuberosa* (Acantha) (H) *Phyla n odiflora* (Verbena) (H)

14.	*J. iphita*	*Rostellularia procumbens* (Acantha) (H) ***Dipteracanthus prostrates*** (Acantha) (S) ***Ruellia tuberose*** (Acantha) (H)
15.	*J. lemonias*	*Asystasia gangetica* (Acantha) (C) *Barleria prionitis* (Acantha) (C) ***Dipteracanthus prostrates*** Acantha) (S) *Phyla nodiflora* (Verbena) (H) *Rostellularia procumbens* Acantha) (S) ***Ruellia tuberose*** Acantha) (S)
16.	*Lorithya*	*Rostellularia procumbens* (Acantha) (H) ***Evolvulus alsinoides*** (Convolvula) (H) *Phyla nodiflora* (Verbena) (H)
17.	*Neptis hylas*	*Ceiba pentandra* (Bomabaca) (T) *Canavalia gladiata* (Legumino) (C) *Pongamia pinnata* (Legumino) (T) *Thespesia populnea* (Malvace) (T) ***Triumfetta pentandra*** (Tiliace) () *Helicteres isora* (Sterculi) (T) *Grewia tiliaefolia* (Tiliace) (T)
18.	*Phalanta phalantha*	*Flacourtia indica*
	ACRAEIDAE	
19.	*Acraea terpsicore*	*Mangifera indica* (Anacar) (T) *Hibiscus cannabinus* (Malvace) (S) *Musa paradisiaca* (Musaceae) (T) *Passiflora foetida* (Passiflo) (C) *Hybanthus enneaspermus* (Violace) (H)
	LYCAENIDAE	
20.	*Castalius rosimon*	*Ziziphus mauritiana* (Rhamnace) (T) ***Z. oenoplia*** Rhamnace) (S)
21.	*Everes lacturnus*	--------
22.	*Jamides celeno*	*Abrus precatorius* (Legumino) (C) *Cajanus cajan* (Legumino) (S) *Pongamia pinnata* (Legumino) (T)
23.	*Lampides boeticus*	*Crotalaria laburnifolia* (Legumino) (S)
24.	*Rathinda amor*	***Ixora arborea*** (Rubia) (T) *Ixora coccinia* (Rubia) (S)
25.	*Spindasis vulcanus*	*Canthium parviflorum* (Rubia) (S) *Ziziphus mauritiana* (Rhmana) (T) *Psidium guajava* (Myrtace) (T) *Allophyllus cobbe* (Sapinda) (T)
26.	*Zizeeria karsandra*	*Amaranthus viridis* (Amarantha) (H) *Zornia diphylla* (Legumino) (H) *Lantana camara* (Verbena) (S) *Tribulus terrestris* (Zygophylla) (H)
	PAPILIONIDAE	
27.	*Graphium agamemnon*	*Annona reticulata* (Annona) (T) *A. squamosa* (Annona) (T)

		Polyalthia cerasoides (Annona) (T) *P. longofolia* (Annona) (T)
28.	*G. dason*	*Polyalthia longifolia* (Annona) (T)
29.	*Pachliopta aristolochiae*	*Aristolochia indica* (Aristolochi) (C)
30.	*P. hector*	*Aristolochia indica* (Aristolochi) (C)
31.	*Papilio crino*	*Chloroxylon swietenia* (Meliaceae) (T)
32.	*Papilio polymnestor*	*Atalantia monophylla* (Rutaceae) (T)
33.	*P. polytes*	*Annona squamosa* (Annona) (T) *Aegle marmelos* (Rutaceae) (T) ***Citrus grantium*** (Rutaceae) *Murrya koenigii* (Rutaceae) (T)
34.	*Princeps demoleus*	*Aegle marmelos* (Rutaceae) (T) ***Citrus grantium*** (Rutaceae) *Chloroxylon swietenia* (Meliace) (T) *Murrya koenigii* (Rutaceae) (T) *Ziziphus mauritiana* (Rhamnac) (T)
	PIERIDAE	
35.	*Anaphaeis aurota*	*Capparis zeylanica* (Capparida) (C)
36.	*Catopsilia pomona*	*Bauhinia racemosa* (Legumino) (T) ***Cassia occidentalis*** (Legumino) (S) *C. fistula* (Legumino) (T) *C. siamea* (Legumino) (T)
37.	*C. pyranthe*	*Bauhinia racemosa* (Legumino) (T) *Cassia occidentalis* (Legumino) (S) *C. fistula* (Legumino) (T) *C. siamea* (Legumino) (T)
38.	*Colotis danae*	--------
39.	*C. eucharis*	--------
40.	*Eurema hecabe*	*Caesalpinia coriaria* (Legumino) (T) *Cassia occidentalis* (Legumino) (S) *C. siamea* (Legumino) (T) *Mimoasa pudica* (Legumino) (S) *Samanea saman* (Legumino) (T) *Peltophorum pterocarpum* (Legumino) (T)
41.	*Leptosia nina*	*Capparis zeylanica* (Capparida) (C)
42.	*Pareronia valeria*	*Capparis zeylanica* (Capparida) (C)
	HESPERIIDAE	
43.	*Borbo cinnara*	-------

Plant species serving as both larval and adult hosts

Proctor and Yeo (1972) mentioned that in the case of Lepidoptera, the same plant species serve as the host for both larvae and adults. Meera Bai (1987) reported both adults and larvae of *Colotis eucharis* and *Colotis. danae* feed on the flowers and leaves of *Cadaba fruticosa* and also those of *Anaphaeis aurota* on *Capparis spinosa*. The present study also revealed the utilization of host plants both by the adults and larvae. Such species include *Nerium odorum* fed both by adults and larvae of *Euploea core* and those of *Ricinus communis* by *Ariadne merione, Calotropis gigantea* by *Danaus chrysippus*, *Rostellularia procumbens* by *Junonia almana*, *Phyla nodiflora* by *Junonia almana* and *Junonia orithya*, *Zizyphus oenoplia* by *Castalius rosimon* and *Tribulus terrestris* by *Zizeeria karsandra*.

CONCLUSIONS

With diminishing opportunities to protect large tracts of native habitat, efforts to preserve biodiversity in fragmented landscapes and to understand ecological processes in these systems are becoming increasingly important (Saunders *et al.* 1991, Robinson *et al.* 1992, Lawrence *et al.* 1997, Gascon *et al.* 1999). Recent studies recognized that human altered landscapes may present significant opportunities to conserve at least a portion of present biodiversity that might otherwise be lost under prevailing patterns of land use change (Pimentel *et al.* 1992, Daily *et al*. 2001, Ricketts 2001). At Visakhapatnam as a result of urbanization and industrialization the vacant places and sub urban areas with beautiful patches of vegetation are disappearing and the depending species including the butterflies are getting depleted. In addition to spurt in general housing activity, of late many government lands are being utilized by the government for constructing houses for economically backward people thus destroying the mating locations and also the food sources of butterflies. In India a butterfly specialist group constituted to work out the modalities for the conservation of the butterflies proposed 'butterfly farming' to preserve these beautiful creatures. Hence, butterfly gardening is a unique activity that helps in maintaining natural populations of various butterflies within the lands that might become available for such activities. Usually locations near natural forests are likely to result in the recolonization of more number of species compared to locations in urban areas. In the present study the polyphagous species such as *Euploea core, Elymnias caudata, Melanitis leda, Hypolimnas bolina, Hypolimnas misippus, Junonia almana, Junonia hierta, Junoni. lemonias, Junonia orithya, Neptis hylas, Acraea terpsicore, Spindasis vulcanus, Papilio polytes, Princeps demoleus* and *Zizeeria karsandra* are the best suited for butterfly gardening programs due to their adaptability to a variety of host plants, however certain monophagous species like *Mycalesis visala, Ariadne merione, Phalanta phalantha, Graphium doson, Pachliopta aristolochiae, Pachliopta hector, Papilio polymnestor, Anaphaeis aurota, Leptosia nina, Pareronia valeria,* and *Papilio crino* may be reared in captivity and release them in wild so that the declining populations can be restocked and maintained. Such management helps to preserve and increase the diversity and richness of these insects which in turn maintain the genetic diversity of plants that utilize these butterflies as pollinators.

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