



RESEARCH ARTICLE

Occurrence and distribution of Flying jewels in Visakhapatnam

*D. Sandhya Deepika., J.B. Atluri., Laxmi Sowmya .K

Andhra University, Department of Botany, Visakhapatnam, Andhra Pradesh, India.

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Corresponding Author

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D. Sandhya Deepika

Abstract

A study was conducted during 2007 & 2008 on the composition of butterflies encountered at Visakhapatnam. The study was carried out at two sites of Visakhapatnam they are 1. Andhra University campus 2. Kambalakonda eco-tourism Park. At Au campus 38 butterfly species and at Kambalakonda 41 butterfly species were observed. Five species, *Euthalia nais*, *Lampides boeticus*, *Papilio crino*, *Colotis danae*, *C. eucharis* that are encountered at Kambalakonda Eco-tourism Park are not found at Andhra University campus. 2 species *Mycalasis visala subdita* and *Junonia hierta* observed in Andhra University campus are not encountered at Kambalakonda. *Papilio crino* which is present in Kambalakonda Eco-tourism Park is found in 2008 only. A total of 43 species spread over 8 families were recorded. Of these 43 species, Papilionidae consists of 8 species; Pieridae 8 species; Nymphalidae 12 species; Lycaenidae 7 species; Danaidae 3 species; Satyridae 3 species; Hesperidae and Acraeidae each 1 species. In this region Hesperidae and Acraeidae are poorly represented compared to other families. A brief description of each of the 43 species recorded at Visakhapatnam is produced here.

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INTRODUCTION

An estimated 20000-30000 species of butterflies occurred in the world. India is acclaimed as the paradise of butterflies with a butterfly fauna of 1501 species. The North-East India, Western Ghats, Eastern Ghats, Nilgiris and all the Riverine Plateaus in Southern India sustain an impressive diversity of butterflies. Nearly 250 species occur along the east coast. About 417 species are known from the Western Himalayas, 211 from Dehra Dun valley, 248 species from Palni Hills, 299 species from the Nilgiri Mountains, 61 from Nagpur, 60 from Visakhapatnam, and about 100 species in the Silent valley. The Western Ghats enjoy richness in terms of species (330 including 37 endemic species and another 23 shared only with Sri Lanka) and populations of butterflies. Butterflies occur in all parts of the world, even in the Arctic; they are primarily tropical and abundant both by numbers and species in the tropical rain forests in equatorial regions (Owen 1971; Goodden 1974). Diversity in the butterfly fauna of Australia and Africa is reviewed by Ackery (1991). The Tata Press brought out a desk diary (1986) under the title "Butterflies of India", providing habitat, distribution and larval food plants of 54 butterfly species along with colour photographs of live specimens. Larsen's (1986), "The fluttering rainbows" gives a brief account of the Zoogeography of South Indian butterflies and of the natural habitats of 13 butterfly species. Such unique and enchanting butterflies suffered losses and declines in the past decades not only in India but also elsewhere.

Study area

Andhra University: Andhra University campus is spread over 0.5 Sq. Km. and is in proximity to the coast line. The campus supports beautiful large patches of wilderness and is mainly of the deciduous secondary vegetation type with some ever green species. In the rainy season a luxuriant growth of a variety of herbs and shrubs occur and this growth gives a somewhat compactness to the vegetation.

Kambalakonda wild life sanctuary: Kambalakonda wildlife 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. The sanctuary harbours very rare and endemic flora with a variety of fauna. It provides an excellent opportunity for undertaking butterfly gardening with the local butterfly populations.

Collection and identification of butterflies:

Representative samples of butterflies were collected during field survey from both the sites 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 envelopes 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.

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 Andhra University campus. At Kambalakonda Eco-tourism Park they were observed along the line transect (2.3 km) which can be traversed in one hour during 1000 – 1100 h.

Analysis of data:

Seasonal Index:

The total number of butterflies sighted during each month for each butterfly species for the period of study (2007-2008) was calculated to compare the trends in the butterfly population.

$$\text{Seasonal Index} = \text{Month-wise mean} / \text{Overall mean} \times 100$$

Where month-wise mean is mean number of each butterfly over one year period and overall mean is the mean of all month-wise means.

Results:

During the period of the study 2007 & 2008 a total of 43 species of butterflies spread over eight families was recorded. At Andhra University campus 38 butterfly species representing 29 genera were observed. The number of species representing each of the eight families is Danaidae-3; Satyridae-3; Nymphalidae-11; Lycaenidae-6; Papilionidae-7; Pieridae-6 and Acraeidae and Hesperidae each 1. At Kambalakonda Eco-tourism Park 41 butterfly species were distributed in each of the family with: Danaidae-3; Satyridae-2; Nymphalidae-11; Lycaenidae-7; Papilionidae-8; Pieridae-8 and Acraeidae and Hesperidae each 1. A brief description of each of the 43 species recorded at Visakhapatnam is given below:

Family: DANAIDAE

The butterflies of this family are large and conspicuously coloured. Their flight is slow and awkward with wings positioned upright. All the three species visit the flowers.

1. Danaus chrysippus chrysippus (Linnaeus)

Wing span 70-80 mm. The upperside of both the wings is reddish brown with black borders and black apex in forewing. Forewing with variable number of white spots in the costa and apex. Hindwing with four small black spots around the cell in male and three in female and a pouch in male. Underside dull orange. Forewing dark brown in the upper half with white spots in the black area and hindwing with six black spots. It is mimicked by female danaid egg-fly *Hypolimnas misippus*.

2. Tirumala limniace leopardus (Butler)

Wing span 90-100 mm. The ground colour of upperside of wings is dark brown or black and marked with numerous blue streaks and spots. The wings on the underside are golden brown. Forewing has a black basal area. The male can be distinguishable by its pendulous flat pouch near the hindwing cell.

3. *Euploea core core* (Cramer)

Wing span 80-95 mm. The body is black with prominent white spots on it. Forewing much darker than hindwing. Upperside rich chocolate brown and Paler on the underside. Along the outer margins of all the wings two series of white spots are present. The inner series, especially on the hindwings, is composed of elongated spots and the outer series is of somewhat circular spots. A white spot at the cell end on the underside of the forewings is prominent. The male has velvety dark band near the rear edge of the upperside of the forewing and a white streak at the same place on the underside. The female has white streak only. Males are often seen flying with curved abdomen and extended powder-puff like yellow hair pencils. It was mimicked by female of danaid egg- fly *Hypolimnias bolina*.

Family: SATYRIDAE

Wings are usually short, they bear eye like spots, underside of wings variegated in wet season form while it is not so in dry season form. It is difficult to recognize them when they land on the ground or on the dried leaves. They settle underside during hot hours of the day and come out at dusk and don, their flight is rather jerky and rapid. When they are close to the ground their flight is slow and frequently settle during flight period. They are also collected at height lamps and are seen settling on roofs of the rooms and verandas at height. They do not forage at flowers but suck sap from rotten fruits, animal droppings and wounds on tree trunks.

4. *Elymnias caudata* Butler

Wing span 70-80 mm. Male and female are almost alike on underside, but distinguishable on upperside. In both male and female, underside is brown in colour with dark brown margin and white and purple colour patches, most prominent at the triangular apex. A small spot which is purplish white in colour near the costa region and three white coloured spots at the marginal end of the hindwing. In male upperside is blackish brown with purple gloss. Forewing with a sub-apical blue or bluish green band and a marginal series of three blue spots. Hindwing with a broad chestnut border. In female upperside reddish brown with apex and borders dark brown, having white spots. The female mimics the plain tiger *Danaus chrysippus* and the common tiger *D. genutia*.

5. *Melanitis leda ismene* (Cramer)

Wing span 60-80 mm. Upperside dull dark brown. Forewing with two white pupilled black ocelli, having orange inner borders. Forewing produced and angled prominently in female during wet season. Dry season form rich brown with black spots having yellow inner borders and a bar above them. Hindwing with three ocelli, more prominent in female and tail also prominent in female. Forewing angled in male and falcate in female. Hindwing with a single white spot above the tail in male and three spots in female. Underside grey with striated dark brown lines and 3-4 ocelli in forewing and six ocelli in hindwing, more prominent in female during wet season. Dry season form grayish brown, with rich black or brown streaks. Ocelli absent but with variable number of yellow spots.

6. *Mycalesis visala subdita* (Moore)

Wingspan ranges between 45 – 50 mm. Body is 23.0 – 27.0 (25.3 ± 0.16) mm long. Both wings have three brown wavy marginal lines on upper as well as lower side. Both male and female have similar characters.

Dorsally, forewing has two ocelli (dark brown with light brown border and a white spot centrally), one bigger towards lower side and the other indistinct towards upper side. Hindwing has a single, indistinct ocellus.

Ventrally, wing colour varies seasonally. In wet season form, there is a white longitudinal stripe present on both the wings. Towards outer discal area i.e. in between the white stripe and the wing margin, there are three ocelli on forewing and a series of seven ocelli more prominent and darker on hindwing. In dry season form, the ventral white stripe is replaced by brown line. The ocelli are reduced to minute white spots with dark brown border.

Family: NYMPHALIDAE

The butterflies are brilliantly coloured with a powerful flight. They are fond of basking in the sun. Each genus vary from the other in size, shape and form. Wings are sometimes sharply angled and indented. Many of the butterflies though visit flowers are attracted to over ripe fruits and spoiled flowers and also sap oozing from the tree trunks.

7. *Ariadne merione merione* Cramer

Wing span 52-62 mm. The common castor butterfly is a rusty brown butterfly with wavy black lines on its wings. A white dot is present on the front margin of the forewings. The margins of the hindwings may or may not be wavy. Underside often pale and duller in colour.

8. *Euthalia garuda* (Moore)

Wing span 55-80 mm. Upperside dark olive-brown. In male forewing is dark brown at the base with three U-shaped marginal bands and two groups of white spots. Hindwing with pinkish tinge at the anterior border, four black spots at the base and a sub marginal row of black spots. In female hindwing is olive brown, similar to male but with larger white markings and more rounded. Underside grayish brown with grey markings and black spots along with the wing margins and blackish rings at the base.

9. *Euthalia nais* (Forster)

Wing span 60-70 mm. Upperside brownish orange. Forewing with three black bands and a large black spot. Hindwing with large black spot at mid costa, a row of discal spots and black margin. Underside reddish brown. Two basal black spots, and an oblique discal brown band and four brownish white spots appear on forewing. A small crimson line at base, two black bordered crimson spots, a transverse discal white band appear on hindwing

10. *Hypolimnias bolina* (Linnaeus)

Wing span 70 – 110 mm. In male, the wings are black upperside. Each of the four wings has an iridescent bluish white spot, it being bigger on hindwing than forewing. The wing margins are wavy with an interrupted white border. Forewing has two white spots at its apex region, the bigger one located towards lower side and the other smaller towards upperside. Both wings have an outer discal row of white coloured spots and patches towards termen region, and centrally bluish cream to white coloured band is present on the fore wings. It could only be identified from the male of *H. misippus* by close observation.

In female upperside dark brown with discal row of cream or white coloured spots on both wings. The anterior costa of forewing possesses blue coloured spots. There is a broad cream or white coloured band, which is broader at termen region of hindwing, and narrower on forewing. Ventrally brown, with bands of white coloured spots and patches towards termen region. It is similar to the Danaid *Euploea core* but distinguishable by the blue spots present on the forewing and a broad cream or white coloured band on hindwing.

11. *Hypolimnias misippus* (Linnaeus)

Wing span 70-85 mm. Body black, thorax with white spots. The margins of the wings are wavy. Male and female individuals are morphologically distinctly different. In male, upperside black with dark iridescent blue or violet-ringed white, oval discal patch on both wings. Forewing with a small oval spot in the apex. Underside, oval spots are prominent. In female, upperside orange or orange-brown. Female is mimic of the distasteful milk weed butterfly *Danaus chrysippus*, but distinguishable by the more wavy hindwing margins and a large black spot present near the costa of the hindwing on dorsal side, instead of 3 or 4 small black spots present in *D. chrysippus*.

12. *Junonia almana* (Linnaeus)

Wingspan ranges between 60 – 65 mm. Upperside light yellowish brown with two ocelli in both wings; that near apex of hindwing large, having two white spots in peacock background and surrounded by yellow and black rings (hence the common name). Forewing with dark costal bars and both wings with brown wavy margins. Underside leaf like, brownish in male and yellowish in female. Ocelli more prominent in female during dry season.

13. *Junonia hierta* (Fabricius)

Wingspan is 45 – 55 mm. Body is 16.0 – 18.0 (17.0 ± 0.08) mm in length, brown in colour. The species is sexually dimorphic.

In female, dorsally forewing is yellow in colour. Wing border is black throughout; it is broad at apex. A prominent black ocellus is present towards tornus on yellow portion. The costal border has four dark brown bands

extending inwards. Hindwing is also yellow in colour. Black border is evident towards costa and termen. It is broader towards basal region with a bigger prominent dark blue oval patch. Two small black spots one at apex and other at tornus region are present on the yellow portion. Ventral side of both wings is pale, with brown wavy stripes more prominent on hindwing.

Male is yellow in colour dorsally, and brighter than female. There is black border throughout forewing. It is broad at apex with two elongated yellow markings. Ocelli at tornus are feeble on dorsal side, whereas it is very clear on ventral side. Hindwing has broad black costal and basal area with a brilliant bigger copper blue coloured oval patch. The two small spots present on hindwing in female are absent here in male.

14. Junonia iphita (Cramer)

Wingspan ranges between 55-80 mm. In both male and female the upperside is dark olive-brown with indistinct dark brown bands. Forewing with 1 or 2 (rarely without) minute ocelli and hindwing with obscure row of five dark brown ocelli. Apex of forewing and tornus of hindwing slightly produced and termen of forewing concave. Underside dark brown with wavy lines and less distinct ocelli.

15. Junonia lemonias (Linnaeus)

Wing span ranges between 45 – 60 mm. Upperside of both male and female is dark brown. Wing margins are wavy; two black and two yellow margin lobes are alternatively arranged. On forewing lemon yellow spots present along with two ocelli, the lower one is larger and prominent. Hindwing bears a large apical red ocellus.

16. Junonia orithya (Linnaeus)

Wingspan is between 40 – 60 mm. Upperside of female forewing basal two-thirds black and apex pale brown with white transverse bands. Hindwing predominantly bright blue (hence the common name). Both wings with two orange ringed ocelli each. Female larger, pale almost light brown. Blue markings in the hindwing slight and orange ringed spots bigger than in male. Underside grayish brown with white markings and wavy lines. Ocelli visible in forewing only.

17. Neptis hylas (Moore)

Wing span 50-60 mm. On the upperside the wings are black with two white bands composed of spots. The forewing is almost entirely white, with a triangular white mark in front of it. Underside golden brown with white markings as above, but sharply edged with black lines. The wings are narrow. The body is metallic green with a brown sheen. The male and female have same markings.

18. Phalanta phalantha phalantha (Drury)

Wingspan is between 50 – 60 mm. The male and female look similar. Upperside bright yellowish brown with rows of black spots and wavy lines. Markings slightly larger in females. Underside very pale brownish, markings as above but indistinct.

Family: ACRAEIDAE

Small in size with narrow wings and long slender abdomen. They are slow flying, gregarious and move close to the ground.

19. Acraea terpsicore (Fabricius)

Wing span 50-65 mm. Both male and female are morphologically identical. Forewings are brick-red with narrow dark termen and upper hindwing termen is black with white spots. The wings are marked with black spots. Body is of tawny colour with snuff coloured bands.

Family: LYCAENIDAE

Small in size. Have metallic bluish colour on the upper side and some have coppery orange - red colour. The underside is typically spotted, streaked and hind wings are often tailed. Their flight is quick and agile but not sustained. Fly in groups around the twigs, visit flowers and take moisture from damp patches.

20. Castalius rosimon rosimon (Fabricius)

Wing span 24-32 mm. It is a small white butterfly with a white face and black eyes. The underside of its wings is white with deep black markings. Forewing with narrow blackish brown costal band, outer marginal band, a

large disco cellular spot and an outer discal row of five spots. Hindwing with two sub-basal streaks near the abdominal margin and an outer band of six spots in three pairs. Upperside white with blue base and black markings. Forewing with markings as above. Hindwing basal spots clouded by blue scales.

21. *Everes lacturnus syntala* (Fabricius)

Wing span is 22-28 mm. In male upperside is deep violet-blue with a brown/black outer marginal band in both wings. Hindwing has broad black costal margin and a marginal row of white broadened black spots, and two middle spots with orange inner border and white-tipped black tail. Underside is grayish white with white edged markings. Forewing has a prominent lunular mark at the end of the cell and a discal row of six lunular marks. Hindwing with three sub-basal black spots, an apical spot, a brown central lunule and a discal row of lunules. Both wings with a terminal line enclosing two large sub-anal black spots having orange inner margin. Females are paler and whiter than male on the underside.

22. *Jamides celeno aelianus* Fabricius

Wing span 27-40 mm. Upperside of male pale bluish white. Forewing with a narrow outer black border. Hindwing with a prominent tail at the tornal region, having two or three black spots. Female with dark brown/black border. Hindwing with costal dark border and at least eight black spots and the tail. Underside both wings with white wavy lines and an orange bordered spot above the tail.

23. *Lampides boeticus* Linneaus

Wing span ranges between 25-35 mm. Male and female are distinguishable by their colouration on their dorsal side, the former being violet-blue and the latter brown, in both cases with a blue colouration at the wing base. Ventrally in both male and female, hind and forewings are pale brown to white traversed by light to reddish brown narrow bands. In both sexes hindwing show up at their tornus region two black spots, with orange tinge above and greenish tinge below. Each hindwing has a delicate black, white tipped tail.

24. *Rathinda amor* (Fabricius)

Wing span 26-28 mm. In both male and female upperside is dark brown in colour. Forewing with white band of large and smaller spots beyond the end of cell. Hindwing with two black tornal spots and a narrow dark reddish band of spots above and beyond them. They have three tails and the middle one is largest. Underside white to dark yellowish brown. Forewing with dark brown apical area irregular basal markings and curved white discal line. Hindwing has irregular dark spots, lines and silvery marginal lines.

25. *Spindasis vulcanus vulcanus* (Fabricius)

Wing span is 26-34 mm. In both male and female upperside is dark brown. Forewing has conspicuous black spotted orange-yellow transverse bands (5 in male 6 in female), more bluish gloss in male and without conspicuous leaden-coloured scaling in female. Hindwing has a outer border at the tornal area bright yellowish or orange with two spots and two delicate tails. Underside pale yellow with prominent black or brown bordered reddish bands.

26. *Zizeeria karsandra* Moore

Wing span 18-24 mm. It is a small butterfly though largest among the Grass Blues. Upperside dark blue, underside usually brown, occasionally grey. Spots rounded and dark.

Family: PAPILIONIDAE

They are large with varied markings, black or dark brown, strong tailed with rapid flight, skip quickly from plant to plant, hover at flowers wings fluttering. They form mud puddling congregations.

27. *Graphium agamemnon menides* Felder & Felder

Wingspan varies between 85-100 mm. Both male and female adults of this tailed jay are blackish green with stumpy tail. Basal stripes, discal cell and marginal spots are all bright green. Tail in female longer. Male has scent wool in dorsal fold.

28. *Graphium doson*

Wing span 70-80 mm. This is a black butterfly with a pale blue, semi-transparent central band that is formed by large spots. There is a marginal series of smaller spots. The underside of the wings is brown, with markings similar to the upperside but they are whitish. The sexes look alike. Mud-puddling was observed in this species.

29. *Pachliopta aristolochiae aristolochiae* (Fabricius)

Wingspan 80-110 mm. Upperside black. Hindwings bear five elongated white discal spots and red submarginal spots. Forewing has a discal area paler with black-fold stripes and well marked pale vein-stripes. Females paler with broader wings. Underside discal spot in the anal area red propulsion is almost entirely effected by the long narrow forewings while steering and balance are maintained by hindwings. The tail gives additional stability while in flight.

30. *Pachliopta hector* (Linnaeus)

Wingspan 90-120 mm. Upperside bluish black. The forewings show prominent interrupted and irregular apical and discal white bands. Hindwings bear discal and marginal rows of bright crimson spots. The bands and spots are broader in females. Underside forewings show dull brownish black and hindwings are black.

31. *Papilio crino* Fabricius

Wingspan 80 – 100 mm. Upperside brownish black, with green scales. Both wings with a bluish green discal band, pointed towards the apex in the male. A red/crimson semilunar markings in the apex of hindwing separates the band between the wings. Hindwing with a red-ringed black ocellus in the tornus and a green or blue-tipped tail. Bands broader in male than in female. Underside similar to the upperside but dull pale greenish brown to blackish brown with clear bands.

32. *Papilio polymnestor* (Cramer)

Wing span 120-150 mm. Upperside black. Forewing has a pale blue discal band. It decreases in size towards apex and traversed by black stripes along the veins, and an elongate red spot slightly visible at the base of the cell. Hindwings are black at the base. Outer three-quarters pale blue with discal, marginal and terminal series of prominent black spots. Females are slightly bigger and duller. Underside opaque black. Forewing has an elongated red spot and hindwing with five small, irregular red patches at the base of cell. It is a tailless butterfly with head, thorax and abdomen uniformly blackish brown. Mud-puddling was observed in this species.

33. *Papilio polytes polytes* Linnaeus

Wingspan 90-100 mm. Both sexes are morphologically distinct. In male upperside is black. Forewing has a terminal series of white or yellow spots, and they decrease in size towards the apex. Hindwing has a complete discal band of elongate white spots which are more prominent in females. Female occurs in three different colour forms: one resembling the male and the other two mimicking the red-bodied swallowtails i.e. *Pachliopta aristolochiae* and *P. hector*. Both sexes have tails. Mud-puddling was observed in this species.

34. *Princeps demoleus* Linnaeus

Wing span 60-70 mm. Both male and female are black and tailless. Upper forewing has a broad irregular yellow discal band divided into large irregular spots and patches. Marginal and terminal rows of yellow spots are present on fore and hindwings. Tornal red spot and apical black and blue spots are present on upper forewing. Head is pale black with white markings and antennae are snuff coloured. As the age advances the yellow markings on the wings become deep orange. Mud-puddling was observed in this species.

Family: PIERIDAE

Small to medium sized, white or yellowish in color with marginal black markings on wings. They are fond of basking in the sun seen flying around the trees and shrubs in congregations even in hot periods. They visit flowers and damp patches.

35. *Anaphaeis aurota* (Fabricius)

The wingspan ranges between 50 – 60 mm. Male and female individuals are morphologically distinguishable. In male upperside is pure white with black apex in the forewing and black outer margins in both wings. Black area with white spots elongated in the forewing and rounded in the hindwing. Females are similar to male, but with thicker and broader veins, apex and outer margins. Hockey stick like spot is present in the middle of

forewing. In male underside spots in the apex, yellowish in the forewing and yellow with black veins in hindwing. Females are more yellowish during wet season.

36. *Catopsilia pomona* (Fabricius)

Wingspan is between 55 – 80 mm. In male upperside white with outer area yellow. Forewing costal margin black at the apex and outer narrow, dark marginal spotted border. Underside greenish white. Both wings have a discocellular, reddish brown-ringed silvery spot. Hindwing with a post discal series of small, reddish brown spots and marginal dots. Antennae red. In female upperside is sulphur-yellow to white. Forewing markings are just like male but the outer margin denote on the inner side and an anterior post-discal series of blackish brown spots and a prominent disco-cellular rounded spot. Hindwing with small reddish brown marginal vein spots. Underside colour variable, reddish brown, brownish yellow, deep yellow to greenish yellow or white.

37. *Catopsilia pyranthe* (Linnaeus)

Wingspan 50-70 mm. Upperside is dull white or greenish. In male forewing has a narrow black border at the apex and termen and a small cell spot. Hindwing has no markings. Females are similar to male but forewing has larger cell spot broader black border and black costal border. In underside both sexes have closely mottled with fine brown or green lines. Females with or without red ringed silver spots.

38. *Colotis danae* (Fabricius)

Wingspan is between 45 – 50 mm. Male and female individuals are morphologically distinguishable. Upperside male is white with a broad inwardly black-edged crimson tip of forewings and the termen of hindwing is with black spots. On the forewings of female, crimson area is rather reduced and paler. It is crossed by a line of small black spots. The upper hind wing of both male and female bears a line of small black spots. In underside of forewing the tip is pale red and hindwing yellow with a central band of black spots.

39. *Colotis eucharis eucharis* (Fabricius)

Wingspan is between 40 – 45 mm. In male, upperside is pure white. Forewing has a broad apical orange-yellow patch bordered with a black outer margin. Hindwings bear black terminal spots. The cells of both wings show disco-cellular spots. Underside of wings is also white. Forewing base has a sulphur-yellow colour. Hindwing is with a pale brownish-yellow base, and with a series of large marginal spots. In female, forewing base upperside and costa are more black in colour. Disco-cellular spots are rather larger than in male. Apical area black with three elongate orange spots. Hindwing base is grayish black in colour. Spots are larger than male. Underside lines and spots are much numerous than in male.

40. *Eurema hecabe simulata* Moore

Wingspan 40-50 mm. In male upperside is bright yellow. Forewing has a broad black excavated border in the apex and termen. Hindwing has a narrow irregular border. In both wings the borders are broad. In both the underside is yellow. Forewing has two cell black spots. Irregular ring spots outside the cell in both wings. Female also bears broader black border as the fore wings. Fore wing has two black spots.

41. *Leptosia nina nina* (Fabricius)

Wingspan 40-50 mm. It is a very delicate butterfly, probably the weakest of the Pierids, with a slow and irregular flight. Flies very close to the ground. Body is white with greenish white head. The wings are white in colour, thin and semitransparent. Forewing is characteristic in bearing a large black pear shaped spot both dorsally and ventrally at outer discal area. The apex is black dorsally. Costa margin possesses minute black dots. Hindwing is entirely white with no markings. Ventrally it is dull white. Apex and the margins of the costa and termen region of the forewing have green striations. Hindwing is with green striations, which help the butterfly to camouflage.

42. *Pareronia valeria anais* (Cramer)

Wingspan is between 65 – 80 mm. Body is copper blue. It is mid-dorsally black and ventrally white in colour. Eyes are brown in colour. Wings of male are dorsally shiny copper blue with black veins and margins. The costa and termen margins of forewing are broadly black. The apex region has bluish white coloured spots. The termen margins of hindwing are broadly black. Female is bluish white dorsally with broader margins and veins. Ventrally both sexes have markings similar to those on dorsal side of the wings, but they are paler with pale black or brown ill-defined veins.

Family: HESPERIIDAE

Small and stout body, wings strong, flight exceedingly rapid, dull coloured with light markings on the wings.

43. Borbo cinnara Wallace

Wingspan 30-36 mm. It has dark brown wings that have semi-transparent spots on the forewings and white spots on the underside of the hindwings. The upper side of the hindwings is unmarked. The semi-transparent spots on the forewings decrease in size from the lower margin of the wing towards the upper margin. There is a series of white spots, some of which may be missing, forming an arch on the underside of the hindwings. The underside of the wings is much paler brown than the upper side.

Discussion:

India is described as a 'butterfly paradise' (Venkataramani 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 Hesperidae; 1 against 2 of Acraeidae. It is thus evident that in this region Hesperidae and Acraeidae are poorly represented compared to other families. Among these butterfly species the largest one is *Papilio polymnestor* with a wing span of 120-150 mm and the smallest is *Zizeeria karsandra* with a wing span of 18-24 mm. At Visakhapatnam *Papilio polymnestor*, *Princeps demoleus*, *Pachliopta aristolochiae aristolochiae*, *P. hector*, *Junonia almana*, *J. orithya*, *Phalanta phalantha phalantha* are some of the pretty butterflies with multihued wings.

In the present study at Visakhapatnam the diversity of butterfly fauna is more at Kambalakonda Eco-tourism Park which is a part of Kambalakonda wild life sanctuary extending to an area of 7,139 ha. with the diversified habitat. 'Indira Gandhi Zoological Park' is another location present near Kambalakonda that suits the requirements of a wide spectrum of butterfly fauna. In the present study the polyphagous species such as *Euploea core*, *Elymnias caudata*, *Melanitis leda*, *Hypolimnas bolina*, *H. misippus*, *Junonia almana*, *J. hierta*, *J. lemonias*, *J. 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*, *P. hector*, *P. 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. The Krishna Peacock (*Papilio krishna* Moore) found in North-East India is one of the most beautiful butterfly of the world, and is considered as the pride of India. The southern birdwing (*Troides minos* Cramer) is the largest Indian butterfly which is endemic to the Western Ghats; it is not found anywhere in the world. The tiniest butterflies in the world are the Grass Jewel and the Tiny Grass Blue; both occurring in Peninsular India. Butterflies are highly diversified in their habits and require specified ecological conditions for survival. Such unique and enchanting butterflies suffered losses and declines in the past decades not only in India but also elsewhere. Worldwide, several hundred butterfly species and subspecies are recognized as either rare or endangered by various government and conservation agencies. One of the main causes for the decline in the butterfly wealth is habitat destruction by deforestation for urbanization, industrialization and agriculturalization, which also causes changes in temperature, humidity and rainfall. Pollution caused as a result of industrialization and urbanization is also harmful to butterflies. *Papilio polymnestor*, the largest butterfly from Eastern Ghats with beautiful wing colour is the commonest species in the Western Ghats and Nilgiris. As the species prefers to mate in the interior of the forest it is presumed that it may be a resident of Eastern Ghats and so appeared throughout the year at Kambalakonda Eco-tourism Park in the present study. Special attention may be taken to rear this beautiful species as the conditions in this area suit its development. Since *Pachliopta hector* is endemic to South India and Sri Lanka it also needs special attention. 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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