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Biosystematic study of the Satyrinae (Lepidoptera: Nymphalidae) fauna of Kerala, India

George Mathew* and K.C. Soumya

Forest Health Division, Kerala Forest Research Institute, Peechi- 680 653, Kerala, India.
E mail: gmathewkfri@gmail.com

ABSTRACT: A general survey was carried out on the Satyrine fauna of the Kerala Western Ghats recording 27 species compared to 29 species recorded from the Western Ghats. External genitalial morphology of fourteen species under 6 genera was studied. Based on an evaluation of resemblances of the genital parts, particularly of the valvae, uncus and phallus of the male external genitalia, these species were categorised under two separate groups. The first group contained *Melanitis leda, Melanitis* (*phedima*) *varaha, Mycalesis anaxias, Mycalesis oculus, Lethe* (*drypetis*) *todara, Lethe* (*rohria*) *neelgheriensis* and *Zipaetis saitis.* Of these, *Mycalesis anaxias, Mycalesis oculus* and *Lethe* (*rohria*) *neelgheriensis* formed a subgroup distinct from the others. The second group contained *Mycalesis* (*perseus*) *tabitha* and *M. igilia*. These species shared resemblance with *Lethe rohria, Mycalesis oculus, Mycalesis* (*perseus*) *tabitha, Mycalesis subdita, Mycalesis igilia* and *Mycalesis adolphei.* Each of the remaining species *viz., Mycalesis* (*Patnia*) *junonia, Mycalesis subdita* and *Ypthima* (*baldus*) *madrasa* showed distinctness in their identity. Among these, *Y.* (*baldus*) *madrasa* stood out separately from all the rest. The study shows the heterogeneity of taxa included under the various satyrine genera suggesting the need for a detailed taxonomic revision of the group. Information generated in this study has also shown very good survival of most of the satyrine species in the Kerala part of the Western Ghats mainly due to protection of the natural habitats.

KEYWORDS: External genital morphology, Butterflies

* Author for correspondence

INTRODUCTION

Satyrids are shade loving butterflies generally confined to thick evergreen forests. They prefer to remain in cool, dense vegetation, seldom venturing out in the open. They are usually dull-colored, brown or blackish brown butterflies and are popularly known as Browns. The wings have cahracteristic eye spots (ocelli) and white or tawny bands. Their flight is weak and jerky, keeping close to ground level and flying to a short distance. They have a definite preference for sap exuding from trees, toddy and rotting fruits lying on the forest floor. Excepting *Elymnias* spp. which feed on palms, the immature stages of almost all species develop on grasses or bamboos.

Studies on the Indian satyrids have been made by Ferguson (1891), Moore (1891, 1892 & 1893), Sevastopulo (1973), Evans (1932), Talbot (1947), Wynter-Blyth (1957), D' Abrera (1985), Ackery (1988), Larsen (1988), Sathyamurthy (1994), Gaonkar (1996), Mathew (1999), Kehimkar (2008), Kunte (2000), Ghorpade and Kunte (2010) and Ghosh (1914). Classification of this family is based mainly on the wing venation at higher taxonomic levels and on colour and wing pattern at species level. However, many species exhibit seasonal or habitat linked variations in colour patterns rendering identification difficult.

The significance of the morphological details of the external genitalia in resolving the taxonomic identities is well recognized (Miller, 1968). Recently, Sharma and Rose (1999) segregated *kalinda* Moore and *shallada* Marshall & de Niceville of the genus *Paralasa* Moore based on the structural details of the external genitalia. The Satyrine butterflies found in the forests of Kerala show considerable variations in response to season or habitat. It was in this context that the present study on the morphological details of the external genitalia was undertaken to confirm their taxonomic identities and the findings are presented in this paper.

MATERIALS AND METHOD

Samples of butterflies required for the morphological and taxonomical studies were collected by conducting a field survey in the Kerala part of the Western Ghats. The locations covered in this study included Peechi-Vazhani, Vazhachal, Palappilly, Sholayar, Kattlapara, Nelliyampathy Malayattoor, Thattakkad, Kothamangalam, Rajmala, Thenmala, Wynad, Parambikulam, Rockwood, Pandimatta, Muthanga, Wayanad and Chembra peak. The specimen are deposited at the KFRI, Peechi

RESULTS

Checklist of Satyrinae of Kerala:

1. *Elymnias caudata* Butler
2. *Lethe europa* Fabricius
3. *Lethe* (*drypetis*) *todara* Moore

4. *Lethe* (*rohria*) *neelgheriensis* (Guerin-Meneville)
5. *Melanitis leda* Linnaeus
6. *Melanitis* (*zitenius*) *gokala* Moore
7. *Melanitis* (*phedima*) *varaha* Moore
8. *Mycalesis adolphei* Guerin-Meneville
9. *Mycalesis anaxias* Hewitson
10. *Mycalesis igilia* Fruhstorfer
10. *Mycalesis igilia* Fruhstorfer
11. *Mycalesis* (*khasia*) *orcha* Evans
12. *Mycalesis davisoni* Moore
13. *Mycalesis* (*mineus*) *polydecta* (Cramer)
14. *Mycalesis oculus* Marshall
15. *Mycalesis* (*Patnia* Moore) *junonia* Butler
16. *Mycalesis* (*perseus*) *tabitha* Fabricius
17. *Mycalesis subdita* Moore
18. *Mycalesis visala* Moore
19. *Orsotriaena* (*medus*) *mandata* Moore
20. *Ypthima* (*asterope*) *mahretta* Moore
21. *Ypthima* (*avanta*) *striata* Hampson
22. *Ypthima* (*baldus*) *madrasa* Evans
23. *Ypthima ceylonica* Hewitson
24. *Ypthima chenui* Guerin-Meneville
25. *Ypthima huebneri* Kirby
26. *Ypthima* (*philomela*) *tabella* Marshall & *de* Niceville
27. *Ypthima ypthimoides* (Moore)
28. *Zipaetis saitis* Hewitson
29. *Parantirrhoea marshelli* Wood-Mason

Identity, ecology and status of satyrine butterflies collected in this study with notes on the morphology of their external genitalia:

A general description of satyrid butterflies collected in this study along with notes on their distribution, habits, hosts, status and genitalia morphology is presented herein.

1. *Elymnias caudata* Butler (The Tailed Palmfly) (Plate I, Fig. 1)

Butler (1871). *Proc. Zool. Soc. Lond.*, p. 520 (Canara)

Talbot (1947). *Faun. Brit. India. Butterflies*, Vol. **2**: 384.

Evans (1932). *Id. Ind. Butterflies,* p. 128.

Larsen (1988). *JBNHS*, **84**: 561.

Ferguson (1891). *JBNHS*, **6**:437.

D'Abrera (1985). *Butterflies of the Oriental Region*, Part II: 475.

Wynter-Blyth (1957). *Butterflies of the Indian Region*, Bombay Nat. Hist. Soc., p. 126.

Description: The COMMON PALMFLY measuring 65-80 mm in expanse is brightly coloured. The male is blackish brown, with a purple gloss. The upper side of the fore wing bears a bluish band and a series of bluish white spots along the margin. The upper side of the hind wing has a broad chestnut border. The female is reddish brown with the apex and margins tinged with dark brown and having white spots. Fore wing with broad white band below apex. Sexual dimorphism is very strong, the female mimicking *Danaus genutia* and *D. chrysippus*.

Genitalia morphology: Male (Plate II, Fig. 1) - Uncus long, narrow, rod-shaped and pointed at the tip, borne on a broad basal plate bearing a narrow, curved lobe on either side. Valvae of medium length and of more or less uniform width throughout; bearing an elongate, narrow lobe on the inner margin, slightly projecting beyond the apex which is broad, fringed with short, stiff hairs. Saccus pronounced, V-shaped, vinculum with elongate, narrow arms. Arms of tegumen short. Transtilla broad with a median curve. Phallus long, narrow with a slight constriction, apex flat. Ductus ejaculatorius enters the phallus sub-basally.

Habits: These are the commonest and the most widely distributed palm butterflies usually found in cane and palm plantations. Ferguson (1891) states that it is common up to 3000 ft. They are shade-loving butterflies. Their flight is weak and the male may be often seen sitting for long periods on palm trees with the wings closed.

Hosts: Larvae develop on canes and palms. *Cocos nucifera, Areca catechu, A. triandra, Arenga wightii, Calamus rotang, Phoenix* sp. and ornamental palms are some of the recorded host plants (Sevastopulo, 1973: Gaonakar, *un publ.*).

Distribution: The range covers Peninsular India and Sri Lanka. It is rather scarce in the Nilgiris and it has been collected from Travancore to Mysore covering the Nadgani Ghat, Silent Valley, Sholayar and Nelliyampathy.

Plate I (Figs. 1- 14): Some Satyrine butterflies recorded from Kerala

1. *Elymnias caudata*

2. *Lethe (drypetis) todara*

3. *Lethe (rohria) neelgheriensis*

4. *Melantis leda* Upper side

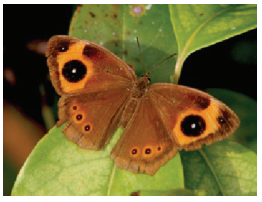
4b. *Melantis leda* Underside

5. *Melantis (phedima) varaha*

6. *Mycalesis adolphei*

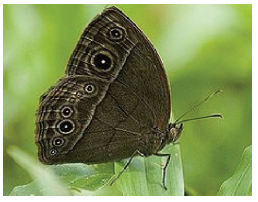
7. *Mycalesis anaxias*

8. *Mycalesis igilia*



9. *Mycalesis oculus*

10. *Mycalesis (Patnia) junonia*



11. *Mycalesis (perseus) tabitha*

12. *Mycalesis subdita*

13. *Ypthima (baldus) madrasa*

14. *Zipaetis saitis*

Plate II (Figs. 1-4): Male external genitalia of Satyrine butterflies collected in this study

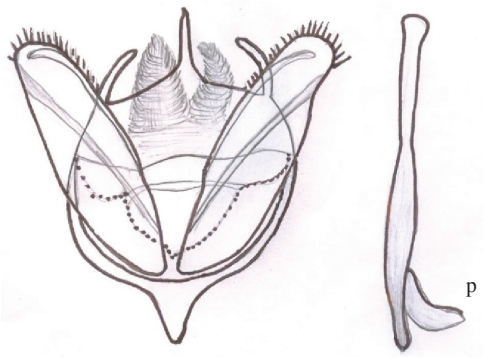


Fig. 1. *Elymnias caudata* (ventral view), p. Phallus.

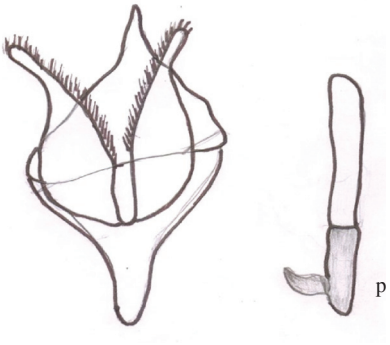


Fig. 2. *Lethe* (*drypetis*) *todara* (ventral view), p. Phallus

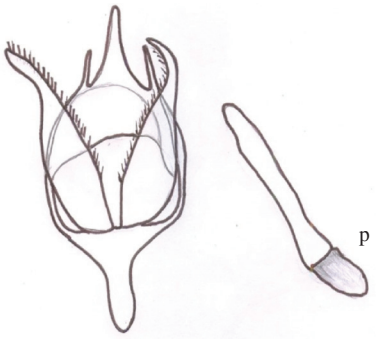


Fig. 3. *Lethe* (*rohria*) *neelgheriensis* (ventral view), p. Phallus

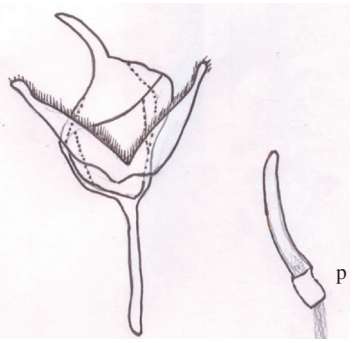


Fig. 4. *Melantis leda* (ventral view), p. Phallus.

Status: Common, wide spread (Gaonkar, 1996).

2. *Lethe europa* (Fabricius) (The Bamboo Treebrown)

Papilio europa, Fabricius (1775). *Syst. Ento.* **(5) 1**: 500.

Talbot (1947). *Faun. Brit. India. Butterflies*, Vol. **2**: 197.

Evans (1932). *Id. Ind. Butterflies*, p. 105.

Larsen (1988). *JBNHS*, **84**: 561.

D'Abrera (1985). *Butterflies of the Oriental Region*, Part II: 416.

Wynter-Blyth (1957). *Butterflies of the Indian Region*, Bombay Nat. Hist. Soc., p. 92.

Collection data: Palappilly, 3 Nov. 2009.

Description: The BAMBOO TREEBROWN measuring 65-75 mm in expanse is brown above. Hind wing caudate at vein 4. Ocelli on the under side of hind wing more or less disintegrated and no markings inside basal line (line that runs from the costa through mid cell towards dorsum). Fore wing fringe chequered. Female always with a continuous white band on the upper side of fore wing. Under side of hind wing with no discal band. Male without brands.

Habits: Visits damp areas, rotting fruits and fresh cowpats. Can be trapped using bait traps with rotting crabs.

Hosts: Bamboos - *Arundinaria falcata, Bambusa arundinica, Dendrocalamus strictus,* Grasses (Sevastopulo, 1973; Gaonakar, *un publ. m.s.*).

Distribution: Southern India (Kerala, Tamil Nadu, Karnataka, Goa, Gujarat, Maharastra (Gaonakar, 1996), Madhya Pradesh, Assam and Myanmar.

Status: Common, wide spread (Gaonkar, 1996).

3. *Lethe* (*drypetis*) *todara* Moore (The Tamil Treebrown) (Plate I, Fig. 2)

Moore (1881). *Trans. Ent. Soc.* Lond. (3): 305.

Talbot (1947). *Faun. Brit. India. Butterflies*, Vol. **2**: 203.

Evans (1932). *Id. Ind. Butterflies,* p. 105.

Larsen (1988). *JBNHS,* **84**: 561.

Ferguson (1891). *JBNHS,* **6**:436.

D'Abrera (1985). *Butterflies of the Oriental Region*, Part II: 418.

Wynter-Blyth (1957). *Butterflies of the Indian Region*, Bombay Nat. Hist. Soc., p. 93.

Collection data: Wayanad, 5 May, 2010.

Description: The TAMIL TREEBROWN measures 65 – 70 mm in expanse. Under side of hind wing with discal band and with ocelli in 3, 4 and sometimes 5, all of which are equal in size. The male is dark brown. The hind wing bears a post-discal series of three or four black ocellar spots. The female is similar to the male but paler, with a broad, oblique white discal bar and two white pre-apical spots on the upper side of the fore wing. The markings on the underside are relatively more sharply defined than in the male.

Genitalia morphology: Male (Plate II, Fig.2) - Uncus short, conical with a bluntly pointed apex. Tegumen and vinculum with narrow arms of uniform width. Valvae short, with the apical 1/3rd portion constricted and appearing as a blunt lobe. Basal part of valva swollen. A fringe of short hairs present on the inner margin of the valva extending from about 1/3rd distance from base to the apex. Saccus elongate, stout and blunt at the tip. Phallus short, of uniform length

throughout and with the basal 1/3rd portion appearing as the handle of a dagger. Apex broad. Ductus ejaculatorius enters the phallus sub-basally.

Habits: It is generally found in forests having bamboo breaks on which their larvae develop. As a result, they are found both in the plains as well as in forests to altitudes above 7000 feet in the Western Ghats. The flight is very erratic. They are attracted to toddy, sugar or sappy exudations of trees and are also reported to frequent animal (leopard) droppings.

Hosts: Its larvae feed mostly on bamboos (*Bambusa arundinacea*) (Sevastopulo, 1973) but they also seem to feed on grasses. The eggs are laid singly on the underside of leaves.

Distribution: Sri Lanka, South India to Pachmarhi, Kashmir to Assam and Burma. It has been reported from Kotagiri in the Nilgiris, the moist-deciduous forests in Biligiriranga and Wynad, the Nadgani Ghat and Silent Valley. Gaonakar (1996) reports it from Kerala, Tamil Nadu, Karnataka, Goa, Gujarat and Maharastra.

Status: The species is endemic to Sri Lanka and South India. Common, widespread (Gaonkar, 1996).

4. *Lethe rohria neelgheriensis* (Guerin-Meneville) (The Indian Treebrown) (Plate I, Fig. 3)

Guerin-Meneville (1893). *In*, *Ind. Deles., Souv. Von. Ins*., **2**: 74.

Talbot (1947). *Faun. Brit. India. Butterflies*, Vol.**2**: 201.

Evans (1932). *Id. Ind. Butterflies,* p. 108 (as *nilgiriensis*).

Larsen (1988). *JBNHS*, **84**: 562.

Ferguson (1891). *JBNHS*, **6**:436 (as *neelgheriensis*).

D'Abrera (1985). *Butterflies of the Oriental Region*, Part II: 418.

Wynter-Blyth (1957). *Butterflies of the Indian Region*, Bombay Nat. Hist. Soc., p. 93.

Collection data: Thattakkad, 5 Nov. 2009.

Description: The COMMON TREEBROWN measures 58-70 mm in expanse. The male is dark brown. The upper side of the fore wing has apical and costal white spots. In the hind wing, the ocelli of the under side are seen as black spots. The under side of the fore wing has a broad and a narrow discal bands arranged in the form of a V. On the under side of the hind wing with a basal white line and with ocelli in 3, 4 and some times 5, all elongated and distorted; the apical ocellus is much larger. The antennae and the head, thorax and abdomen are brown.

Genitalia morphology: Male (Plate II, Fig. 3)- Uncus with a pointed stout, pointed process. Tegumen and vinculum with narrow, elongated arms. Saccus stout, basally broad, blunt at the

Plate III (Figs. 1-4): Male external genitalia of Satyrine butterflies collected in this study

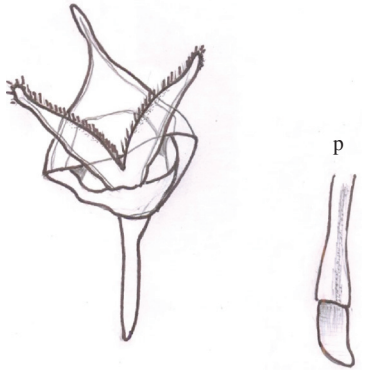


Fig. 1. *Melantis* (*phedima*) *varaha* (ventral view), p. Phallus

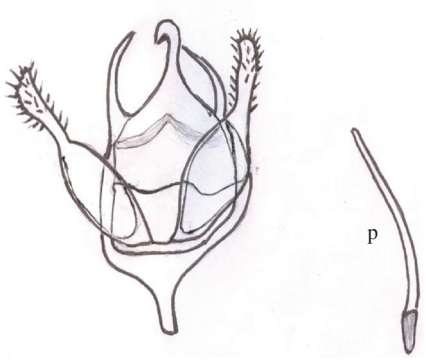


Fig. 2. *Mycalesis adolphei* (ventral view), p. Phallus

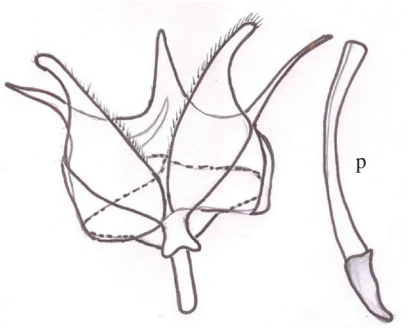


Fig. 3. *Mycalesis anaxias* (ventral view), p. Phallus

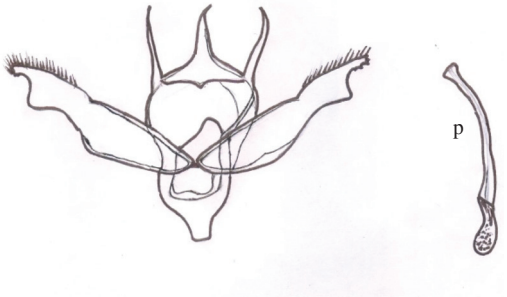


Fig. 4. *Mycalesis igilia* (ventral view), p. Phallus

proximal end and appearing as the handle of a dagger. Valvae short, apical half narrowed, ending is a blunt lobe-like portion. Phallus short, slightly narrowed in the middle, with a slight sub-apical notch.

Habits: It is an inhabitant of subtropical, evergreen and moist-deciduous forest.

Distribution: The distribution of this species extends from Sri Lanka and south India to Kashmir to Kumoan, Sikkim, Assam and Myanmar. It has been reported from the Nilgiris, Malabar and Silent Valley. Gaonkar (1996) reports it from Kerala, Tamil Nadu, Karnataka, Goa, Gujarat and Maharastra.

Hosts: Feeds on grasses (Sevastopulo, 1973).

Status: Common, wide spread (Gaonkar, 1996).

5. *Melanitis leda* Linnaeus (The Familiar Evening Brown) (Plate I, Figs. 4a, b)

Linnaeus (1758). *Syst. Nat.* **1** (2): 773.

Talbot (1947). *Fauna of British India*, *Butterflies*, **2**: 366.

Larsen (1988). *JBNHS*, **84**: 560.

Ferguson (1891). *JBNHS*, **6**: 437.

D' Abrera (1985). *Butterflies of the Oriental Region*, Part II: 410.

Wynter-Blyth (1957). *Butterflies of the Indian Region,* Bombay Nat. Hist. Soc., p. 122.

Collection data: Parambikulam, 30 April, 2009; Vazhachal, 1, 5 May, 2009; Kattlapara, 14 Oct. 2009; Vazhani, 3 May, 2010.

Description: The FAMILIAR EVENING BROWN measuring 60-80 mm in expanse is dark brown in colour. Fore wing with 2 parallel ocelli having orange inner borders. Hind wing with 3 ocelli. Seasonal forms present. In the wet season form (*determinate* Butler), there is a large, black spot at vein 3 of fore wing and another smaller one on vein 4. Under side is greyish with striae and black lines. In the dry season form (*ismene* (Cramer), the colour is brownish and the black spots have s short yellow bar above them. Under side blotched or spotted with black.

Genitalia morphology: Male (Plate I, Fig. 4) - Uncus with an elongate, slender, blunt lobe, borne on an expanded basal part. Tegumen and vinculum with narrow, elongate arms. Valvae short, swollen in the basal and middle part and narrowed at the apical 1/3rd portion. There is a slight sub-apical constriction. The apex is blunt and rounded. Inner margin of valva fringed with a row of short, stiff hairs. Saccus with an exceptionally elongate lobe having a blunt tip. Phallus short, stout, slightly curved in the middle; proximal part broad and appearing like the handle of a sword. Distal end broadly blunt. Ductus ejaculatorius enters the phallus through the proximal end. Female - Bursa vesicular and appearing as a hood-shaped structure. Ductus long, narrow and of uniform width; basal portion swollen.

Habits: It is common on the hills up to an altitude of 4000 feet. It is also found near agricultural farms and in countryside. Its flight is rather weak, and it keeps close to the ground, frequenting both thick forest and open country. It comes out more in the open sunshine. The wet season form is as a rule more heavily ornamented with markings. Visits flowers of Lantana.

Hosts: Larvae develop on Graminae (Sevastopulo, 1973). It is a minor pest of paddy, sorghum, wheat, grasses, bamboos etc. Gaonkar (*un publ.*) gives *Cyrtococcum, Eleusine*, *Oplismenns composites, Oryza sativa* and *Sorghum* as host plants.

Distribution: The range of the species extends over Sri Lanka, Peninsular India, Assam, Burma, Andamans and even into the Malayan Sub-region. Reported from Kerala, Karnataka, Tamil Nadu, Goa and Maharashtra (Gaonkar, 1996). Specifically reported from the Nilgiris, Peechi, Sholayar, Silent Valley, Nelliyampathy, Nilambur and Parambikulam.

Plate IV (Figs. 1-4): Male external genitalia of Satyrine butterflies collected in this study

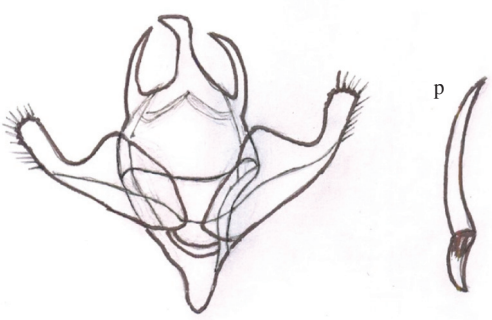


Fig. 1. *Mycalesis oculus* (ventral view), p. Phallus

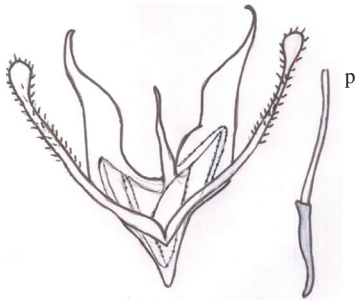


Fig. 2. *Mycalesis* (*patnia*) *junonia* (ventral view), p. Phallus

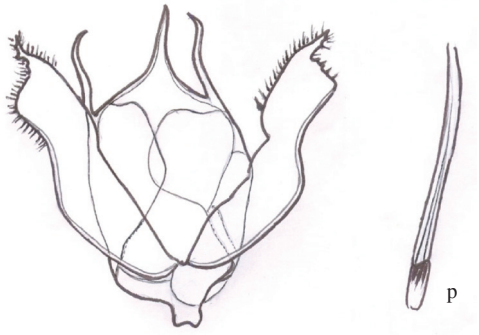


Fig. 3. *Mycalesis* (*perseus*) *tabitha* (ventral view), p. Phallus

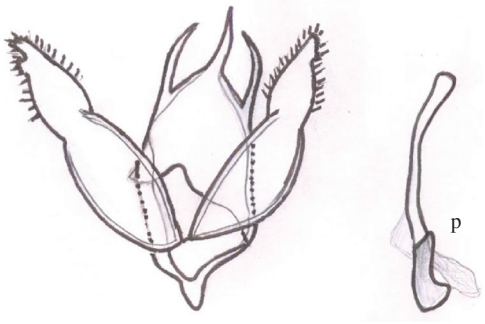


Fig. 4. *Mycalesis subdita* (ventral view), p. Phallus

Status: Common, wide spread in Kerala (Gaonkar, 1996).

6. *Melanitis (phedima) varaha* Moore (The Dark Evening Brown) (Plate 1, Fig. 5)

Moore, *In*, Horsfield & Moore (1857) *Cat. Lep. Ins*. E.I. Co. **1**: 224 (Canara)

Talbot (1947). *Faun. Brit. India. Butterflies*, Vol. **2**: 370.

Evans (1932). *Id. Ind. Butterflies,* p. 126.

Larsen (1988). *JBNHS*, **84**: 561.

Ferguson (1891). *JBNHS*, **6**:437 (as *bela* Moore)

D'Abrera (1985). *Butterflies of the Oriental Region*, Part II: 412.

Wynter-Blyth (1957). *Butterflies of the Indian Region*, Bombay Nat. Hist. Soc., p. 123.

Collection data: Parambikulam, 1 May, 2009; Vazhachal, 5, May, 2009; Rockwood, 15 Oct. 2009; Kattlapara, 14 Oct. 2009; Thattakkad, 22 Nov. 2009; Chimmony, 3 Nov. 2009.

Description: The DARK EVENING BROWN measuring 60-85 mm in expanse is blackish brown in colour and without prominent marks. Seasonal forms present. In the wet season form, the upper side is blackish brown without markings. The termen of the fore wing is straight and not produced. The black sub-apical markings are either reduced or absent. The hind wing is uniformly dark brown, without ocelli, and its margin bears a prominent tooth-like projection at vein 3 and streaked with pale purplish lines.

The dry season form is distinguished from the wet season form by the upper side of the fore wing being pale purplish towards the terminal margins. The general ground colour is dark above. On the under side, the general ground colour is darker and the ocelli are reduced to pale spots.

Genitalia morphology: Male (Plate III, Fig. 1) - Uncus narrow, slightly narrowed basally and sub-basally swollen, apex blunt. Arms of tegumen and vinculum narrow. Valvae short, spindle-shaped, sub-epically narrowed with a blunt apex, fringed with short, stiff hairs on the inner margin. Saccus elongate, stout and bluntly pointed at the tip. Phallus short, stout, basal 1/3rd portion demarcated and appearing like the handle of a knife; apical half narrow, apex flat.

Habits: It is confined to dense, evergreen forests and is rarely found in low forests. This species resembles the preceding one closely in its habits, except that its flight is weaker and it keeps more to the jungles. This species is readily distinguished from the preceding one by the ground colour of its upper side which is much darker.

Hosts: Graminae (Sevastopulo, 1973: 165). Gaonkar (*un publ.*) gives *Andropogon, Apinda, Bambusa arundinacea, Cymbopogon, Oryza sativa, Panicum, Pennisetum, Seteria, Sorghum* (all Poaceae)

Distribution: The distribution covers Sri Lanka, Myanmar, Peninsular India (Kerala, Tamil Nadu, Karnataka, Goa, Maharastra, Gaonkar, 1996), the Himalayas, Kashmir to Sikkim, Assam and Naga Hills. It has been recorded from Kallar, Mukkali and the Nadgani Ghat.

Status: Common, wide spread (Gaonkar, 1996).

7. *Melanitis zitenius gokala* Moore (The Great Evening Brown)

Moore, *In*, Horsfield & Moore (1857). *Cat. Lep. Ins.* E.I. Co. **1**: 224 (Canara)

Talbot (1947). *Faun. Brit. India. Butterflies*, Vol.**2**: 375.

Evans (1932). *Id. Ind Butterflies,* p. 126.

D'Abrera (1985). *Butterflies of the Oriental Region*, Part II: 410.

Wynter-Blyth (1957). *Butterflies of the Indian Region*, Bombay Nat. Hist. Soc., p. 124.

Larsen (1988). *JBNHS*, **84**: 560

Ferguson (1891). *JBNHS*, **6**: 437.

Collection data: Parambikulam, 30 April, 2009; Nelliampathy, 13 May, 2009.

Description: The GREAT EVENING BROWN measuring 75-85 mm in expanse has a general resemblance to the Common Evening Brown, but larger. The costa of the fore wing is more rounded, and the apical markings on the upper side of the fore wing are generally more luxuriant than in *M. leda*. The dry season form is pale brown below with a few black patches. Fore wing more prominently angled. In the wet season forms, the dark discal line is prominent and the ground colour is reddish brown. Seasonal forms present.

Habits: Found only in deep jungles up to 4000 ft., usually hiding under bushes.

Hosts: Graminae: Bamboos. *Bambusa arundinacea*, Ochlandra (Sevastopulo, 1973:165; Gaonkar (*un publ.* notes)

Distribution: The distribution covers South India and from Kumaon to Indo China. It is mostly confined to dense forests up to 4000 feet elevation. It has been recorded from the Coonoor Ghat, Kallar and the Nadgani Ghat.

Status: Common, wide spread in Kerala (Gaonkar, 1996).

8. *Mycalesis adolphei* Guerin-Meneville (The Red Eye Bushbrown) (Plate I, Fig. 6)

Guerin-Meneville (1843). *In, Deless. Sour. Voy. Ind*. **II**: 76.).

Talbot (1947). *Faun. Brit. India. Butterflies*, Vol. **2**: 147.

Larsen (1988). *JBNHS*, **84**: 564.

Evans (1932). *Id. Ind. Butterflies*, p. 100.

D'Abrera (1985). *Butterflies of the Oriental Region*, Part II: 457.

Wynter-Blyth (1957). *Butterflies of the Indian Region*, Bombay Nat. Hist. Soc., p. 88.

Collection data: Chembra, May, 2010.

Description: The RED EYE BUSHBROWN measuring about 60 mm in expanse is chocolate brown above, with small ocelli from 2 to 4 on hind wing and in 2 and 5 in fore wing and with a reddish brown ring in 5. Male with no brand on under side of fore wing.

Genitalia morphology: Male (Plate III, Fig. 2) - Uncus conical, distal end curved, pointed hook-shaped. Tegumen and vinculum with narrow arms. Arm of tegumen elongated, pointed at the

tip and distally. Saccus short, stout and blunt resembling the handle of a knife. Valvae short, narrow, basal 2/3 rd swollen and the apical part narrow, apically broad, bearing short hairs. Phallus long, very slender, curved in the middle, apex blunt and basal part resembling the handle of a sword.

Habits: Generally found along dense forest tracts between 4000 to 7000 ft. Flies at the edges of sholas. Recorded from May to December.

Distribution: Southern India: Coorg, the Nilgiris. North of Palghat gap in Kerala, Tamil Nadu and Karnataka.

Hosts: Grasses (Gaonkar, *in prep.*).

Status: Common in sholas in the Nilgiris above 1900 ft. (Larsen, 1988). Restricted (Gaonkar, 1996)

9. *Mycalesis anaxias* Hewitson (The White bar Bushbrown) (Plate I, Fig. 7)

Hewitson (1862). *Exot. Butt*. **3**: 86

Talbot (1947). *Faun. Brit. India. Butterflies*, Vol. **2**: 119.

Evans (1932). *Id. Ind. Butterflies,* p. 97.

Larsen (1988). *JBNHS,* **84**: 562.

Ferguson (1891). *JBNHS,* **6**:436 (as *M.* (*virapa*) *anaxias*).

D'Abrera (1985). *Butterflies of the Oriental Region*, Part II: 452.

Wynter-Blyth (1957). *Butterflies of the Indian Region*, Bombay Nat. Hist. Soc., p. 83.

Collection data: Pandimatta, 14 Oct.2009, Thattakkad,; 5 Nov.2009.

Description: The WHITE BAR BUSHBROWN Measures 48-55 mm in expanse. It is dark brown in colour with a sub-apical white bar on the Fore wing. No ocelli. Male with a black brand each on the upper side of fore and hind wings.

Genitalia morphology: (Plate III, Fig. 3) Male - Uncus conical with a long, pointed lobe. Tegumen and vinculum short with narrow arms. An elongate, slender, apically pointed, curved lobe on either side of the base of uncus. Saccus short w-shaped, with a notch in the middle. Valvae short, more or less of uniform width throughout, the apical portion narrow with a sub-basal hump, the distal end of valvae drawn out into a narrow, pointed lobe; fringes of short, stiff hairs present apically. Outer margin of valvae uneven and curved. Phallus long and slender slightly curved, of uniform width; distal end narrow and blunt, proximal part distinctly resembling the handle of a dagger.

Habits: It is a hill species confined to the wet evergreen forests up to 6000 feet elevation. Flies low, close to the ground.

Distribution: Distribution covers hills of south India (Kerala, Tamil Nadu, Karnataka, Goa, Maharastra, Gujarat) Sikkim to Assam and Myanmar. It has been recorded from Coorg, Coonoor, the Nadgani Ghat, and Silent Valley (Mathew, 1999).

Hosts: Poaceae (Gaonkar, *un publ.*).

Status: Common, wide spread (Gaonkar, 1996).

10. ***Mycalesis igilia*** **Fruhstorfer (The Small Long-brand Bushbrown) (Plate I, Fig. 8)**

Fruhstorfer (1911). *In*, Seitz, *Macrolep. of the World*, **9**: 346).

Larsen (1988). *JBNHS*, **84**: 563.

D' Abrera (1985). *Butterflies of the Oriental Region*, Part II: 457.

Collection data: Chembra, May, 2010.

Description: The SMALL LONG-BRAND BUSHBROWN measuring 40-48 mm in expanse is brownish in colour and it can be easily identified by its very long brand on the Fore wing which extends beyond the white discal line which is often angled towards the tornus at vein 1b. Seasonal forms present.

Genitalia morphology: Male (Plate III, Fig. 4)- Uncus narrow, long with a sharply pointed apex which is slightly bent to one side; basal part broad bearing an elongate, apically curved and pointed lobe on either side. Saccus short, U- shaped, with a flat tip. Valvae elongate, narrow, basal 2/3rd portion lanceolate and with a constriction; apical part deeply notched and humped sub-apically; with an apical blunt lobe-like tip. A fringe of short, stiff hairs present for nearly 1/3rd length from apex along the inner margin. Phallus long, narrow, slightly curved, distal end swollen, basal portion appearing as the handle of a sword.

Habits: It is commonly found in dense moist deciduous forests, usually in bamboo area up to 3000 feet elevation. Commonly found in the Nilgiri Biosphere Reserve at about 3000 feet during the months September to October. Restricted to humid, evergreen forests (Gaonkar, 1996).

Distribution: Recorded from Coorg, the Nilgiris, Wynad and Silent Valley.

Hosts: Grasses (*Lophopogon tridengtatus, Leersia* spp., *Oryza sativa*) (Gaonkar, *in prep.*).

Status: It is endemic to Southern India. Rare, restricted (Gaonkar, 1996).

11. *Mycalesis* (*khasia*) *orcha* Evans (The Pale-brand Bushbrown)

Evans (1912). *JBNHS*, **21**: 596.

Talbot (1947). *Faun. Brit. India. Butterflies* Vol. **2**: 143 (as *M. visala orcha* Evans).

Larsen (1988). *JBNHS*, **84**: 563.

Wynter-Blyth (1957). *Butterflies of the Indian Region*, Bombay Nat. Hist. Soc., p. 87.

Description: The PALE-BRAND BUSHBROWN measuring 42-55 mm in expanse is brownish with a white and broad discal band. Seasonal forms present. Ground color pale in wet season forms. Brand on the upper side of hind wing yellowish brown. The brand does not go beyond the white discal line.

Habits: It is found in dense, moist deciduous or evergreen forests.

Distribution: The range covers Southern India and Assam up to Myanmar. It has been reported from Palnis, Shevaroys, Coorg, the Nilgiris and Wayanad.

Hosts: Grasses (Gaonkar, *in prep.*).

Status: Common, but restricted (Gaonkar, 1996)

12. *Mycalesis (mineus) polydecta* (Cramer) (The Dark-brand Bushbrown)

Papilio polydecta Cramer, 1777, *Pap. Op.ct.* **2**: 46.

Talbot (1947). *Faun. Brit. India. Butterflies*, Vol. **2**: 136.

Evans (1932). *Id. Ind. Butterflies,* p. 98.

Larsen (1988). *JBNHS*, **84**: 563.

Ferguson (1891). *JBNHS*, **6**: 936 (as *M.* (*Celystrina*) *mineus* Linnaeus form *justina*).

D'Abrera (1985). *Butterflies of the Oriental Region*, Part II: 458.

Wynter-Blyth (1957). *Butterflies of the Indian Region*, Bombay Nat. Hist. Soc., p. 85.

Collection data: Vazhachal, 1 May, 2010.

Description: The DARK-BRAND BUSHBROWN measures 40-50 mm in expanse. Brown in colour with the ocellus on the upper side of fore wing situated in a more or less pale area. Under side with a sub marginal white line across the wing, a series of ocelli and a broad white band.

Hosts: Grasses (Sevastopulo, 1973). *Lophopogon tridentatus, Leersia hexandra, Oryza sativa* (Gaonkar, *un publ*.)

Distribution: It is found on the hills and plains at low elevations. The range covers Sri Lanka, most of India- Kerala, Tamil Nadu, Karnataka, Goa, Maharastra and Gujarat (Gaonkar, 1996) - the Philippines, Taiwan and Malaysia. Recorded from Nadgani and Mukkali.

Status: Common, wide spread (Gaonkar, 1996).

13. ***Mycalesis oculus*** **Marshall (The Red- disc Bushbrown) (Plate I, Fig. 9)**

Marshall (1880). *J. asiat. Soc. Beng*. **49 (2)**: 247.

Talbot (1947). *Faun. Brit. India, Butterflies*, Vol. **2**: 148.

Ferguson (1891). *JBNHS,* **6**: 436.

Wynter-Blyth (1957). *Butterflies of the Indian Region*, Bombay nat. Hist. Soc., p. 84.

Description: It is rich brown above. There are prominent ocellus in 2 on upper side of fore wing placed on broad and deep yellow area.Small ocellus in 5 and small ocelli in 2 to 4 on upper side of hind wing. In males, black colour brand seen in under side of fore wing and black brand with brown tuft in the upper side of hind wing.

Genitalia morphology: Male (Plate IV, Fig. 1) - Uncus short, stout, apically with a conical part resembling the head of a bird, with a poined tip. An elongate, slender, pointed process present basally on either side. Arms of tegumen and vinculum narrow. Valvae swollen in the basal part with a sharp constriction at about 1/3rd length from the apex producing a stout apically flat lobe fringed with short, stiff hairs. Phallus long, slender, slightly curved pointed at the apex. Basal portion of phallus, curved, stout and pointed proximally.

Habits: It is high elevation *Mycalesis* in hills to south Nilgiris. Generally found in jungle country above 3,000 feet.

Distribution: Hills of Southern India. (South of Nilgiris)

Hosts: *Bambusa* sp. (Gaonkar *in prep.*).

Status: Endemic, common, restricted (Gaonkar, 1996).

14. ***Mycalesis*** **(*patnia* Moore)** ***junonia*** **Butler (The Glad - eye Bushbrown) (Plate I, Fig. 10)**

Butler (1868). *Cat. Satyridae Brit.* Mus., p.146.

Talbot (1947). *Faun. Brit. India. Butterflies*, Vol.**2**: 164.

Evans (1932). *Id. Ind. Butterflies* p. 102.

Larsen (1988). *JBNHS,* **84**: 562.

Ferguson (1891). *JBNHS*, **6**: 436.

D'Abrera (1985). Butterflies of the Oriental Region, Part II: 457.

Wynter-Blyth (1957). Butterflies of the Indian Region, Bombay Nat. Hist. Soc., p. 91.

Collection data: Vazhachal, 5 & 6 May, 2009; Pandimatta, 14 Oct. 2009; Rockwood, 15 Oct. 2009; Thattakkad, 15 Nov. 2009.

Description: The GLAD-EYE BUSHBROWN measuring 40-45 mm in expanse is characterized by the pupilled ocellus in 2 on the upper side of fore wing which is set on the lower and outer edge of a circular white or yellow patch. Wings are rounded and the underside variegated.

Genitalia morphology: Male (Plate IV, Fig.2) - Uncus long, slender, slightly curved, apically narrow and bluntly pointed at the tip. Tegumen and vinculum with narrow, slender arms. Saccus 'V'- shaped with a blunt apex. Valvae with an outer elongate, narrow lobe with an apically round lobe and fringed with short, stiff hairs on the distal ½ portion; an inner, basally swollen lobe having a narrowed, wavy, curved apical half ending in a pointed apex. Phallus long, narrow with the basal 1/3rd part stout with wavy margins and appearing as a tool handle; the remaining part of uniform width, slightly curved and with the apex blunt.

Habits: Tropical and subtropical evergreen forests and bamboo jungle. Rarely found in disturbed forests. Observed in large numbers on fruits of Figs lying on the forest floor. Attracted to toddy or sugar (Larsen, 1988).

Distribution: Southern India (Kerala, Tamil Nadu, Karnataka (Gaonkar, 1996) and Sri Lanka. Recorded from Kotagiri and upto 6000 ft. in the Nilgiris.

Hosts: Grasses. *Oryza* (Sevastopulo, 1973). It can sometimes form a pest of the cultivated rice (Gaonkar, *in prep.*).

Status: Endemic to Southern India and Sri Lanka. Common, restricted (Gaonkar, 1996).

15. *Mycalesis (perseus) tabitha* (Fabricius) (The Indian Bushbrown) (Plate 1, Fig. 11)

Papilio tabitha Fabricius (1793). *Ent. Syst*. **(3) 1**: 743.

Talbot (1947). *Faun. Brit. India. Butterflies*, Vol. **2**: 131.

Larsen (1988). *JBNHS*, **84**: 562.

Ferguson (1891). *JBNHS*, **6**: 436.

D'Abrera (1985). *Butterflies of the Oriental Region*, Part II: 458.

Wynter-Blyth (1957). *Butterflies of the Indian Region*, Bombay Nat. Hist. Soc., p. 85.

Collection data: Vazhachal; 5, 6 May, 2009; Pandimatta, 14 Oct. 2009; Palappilly, 3 Nov. 2009; Chimmony, 3 Nov. 2009; Thattakkad, 5 Nov. 2009; Vazhani, 3 May, 2010.

Description: The INDIAN BUSHBROWN measuring 38-55 mm in expanse is brownish in colour. Upper side of fore wing with an ocellus which is not ringed. The male can usually be recognised by the brand on the under side fore wing tornus which is very small and black. On the hind wing under side the eye-spot in space 3 is usually out of line with the others tormal eye-spots, a condition slightly approached in some other species. Seasonal forms present.

Genitalia morphology: Male (Plate IV, Fig. 3) - Uncus conical, dorsally broad, distal end long, narrow, slightly curved and sharply pointed at the tip. Tegumen and vinculum with narrow arms. Arms of tegumen elongate, extended distally, sinuous and sharply pointed at the tip. Phallus of medium length, slender, curved in the middle with a linear sclerotized patch in the center.

Habits: It is found in wet, dense forests. Usually keeps to low elevations although it may ascend to 3000 or 4000 feet elevation. Usually found in shady places. It is a weak flier. Can be attracted to sugar and rotting fruit. Rarely found to visit flowers. The males are occasionally found on damp places.

Hosts: Grasses (Sevastopulo, 1973). *Imperata cylindrica* (Gaonkar in press); *Oryza, Oplismenus composites* (Poeceae).

Distribution: The species is found in Sri Lanka and most of India- Kerala, Tamil Nadu, Karnataka, Goa, Maharastra and Gujarat (Gaonkar, 1996) - and Malaysia. It has been recorded from the Nilgiris, Nadgani and Silent Valley (Larsen, 1988).

Status: Common, wide spread (Gaonkar, 1996).

16. *Mycalesis subdita* Moore (The Tamil Bushbrown) (Plate 1, Fig. 12)

Moore (1891). *Lep. Ind*. **1**: 194.

Talbot (1947). *Faun. Brit. India. Butterflies*, Vol.**2**: 143.

Evans (1932). *Id. Ind. Butterflies,* p. 99.

Larsen (1988). *JBNHS*, **84**: 563.

D'Abrera (1985). *Butterflies of the Oriental Region*, Part II: 457.

Wynter-Blyth (1957). *Butterflies of the Indian Region*, Bombay nat. Hist. Soc., p. 86.

Collection data: Parambikulam, 1 & 2 May, 2009, Palappilly, 3 Nov. 2009; Vazhani, 3 May, 2010.

Description: The TAMIL BUSHBROWN measuring 45-55 mm in expanse is dark brown above with a prominent eye spot with narrow well defined ring in 2 on the upper side of the wing and with a prominent pale marginal line followed by two black lines. Seasonal forms present. The wet season form is very dark below which has an ocellus in 1 on under side of hind wing.

Genitalia morphology: Male (Plate IV, Fig.4) - Uncus long, narrow and apically pointed. A long, narrow, apically pointed lobe present basally, on either side of the uncus. Arms of tegument and vinculum narrow. Valvae ovate with a constriction in the middle. Apical portion of valva bearing a fringe of short, stiff hairs and with a sub basal notch, leading to the formation of a distinct apical lobe. Saccus short V-shaped. Phallus short, narrow, curved in the middle. Proximal part of phallus stout, curved on one side and appearing as the handle of a knife. Apex of phallus distinctly broad.

Habits: Common in low elevations in hills to about 3000 ft.

Distribution: Sri Lanka and Southern India (Kerala, Tamil Nadu, Karnataka, Goa, Maharashtra and Gujarat). Recorded from the eastern slopes of the W. Ghats (Gaonkar, 1996). the Nilgiris, Common in Kallar of the Nilgiris.

Status: Rare, restricted (Gaonkar, 1996).

17. ***Mycalsesis visala*** **Moore (The Long- brand Bushbrown)**

Moore, *In*, Horsfield & Moore (1857). *Cat. Lep. Ins. Mus. East Ind. Coy.* **1**: 230.

Talbot (1947). *Faun. Brit. India, Butterflies,* Vol. **2**: 140.

Evans (1932). *Id. Ind. Butterflies,* p. 98.

Larsen (1988). *JBNHS*, **84**: 563.

Ferguson (1891). *JBNHS,* **6**: 936 (as form of *M.* (*Celysima*) *perseus* Fabricius).

D'Abrera (1985). *Butterflies of the Oriental Region*, Part II: 457.

Wynter-Blyth (1957). *Butterflies of the Indian Region*, Bombay nat. Hist. Soc., p. 6.

Collection data: Nelliampathy, 12 & 13 May 2009, Vazhachal, 6 May, 2009.

Description: The LONG-BRAND BUSHBROWN measuring 45-55 mm in expanse is dark brown above with a prominent eye in 2 on the upper wing. Seasonal forms present. Fore wing sharp, pointed in Dry Season Form and rounded in Wet Season Form.

Habits: Scarce in north-west of its range, fairly abundant elsewhere at low elevations.

Distribution: Southern Kerala, Tamil Nadu, Karnataka (Gaonkar, 1996) and Central India, Sikkim, Assam, Myanmar, Thailand, Indo China. In low land forest and occasionally above 1800 ft. (Gaonkar, *in prep.*)

Hosts: Grasses (Sevastopulo, 1973).

Status: Common, but restricted (Gaonkar, 1996).

18. *Orostrionea (medus) mandata* Moore (The Nigger or Medus Brown)

Mycalesis mandata Moore, 1857. *In,* Horsfield & Moore (1857) *Cat. Lep. Ins. E. I.* Coy. 1: 234.

Talbot (1947). *Faun. Brit. India. Butterflies*, Vol. **2**: 350.

Evans (1932). *Id. Ind. Butterflies,* p. 123.

Larsen (1988). *JBNHS*, **84**: 564.

Ferguson (1891). *JBNHS*, **6**: 436.

D'Abrera (1985). *Butterflies of the Oriental Region*, Part II: 446.

Wynter-Blyth (1957). *Butterflies of the Indian Region*, Bombay Nat. Hist. Soc., p. 120.

Collection data: Thattakkad, 5 Nov. 2009; Vazhani, 3 May, 2010, Chembra, 6 May, 2010.

Description: The NIGGER measuring 45-55 mm in expanse is dark brownish, unmarked above except for two very narrow pale line on the termen. The discal band from below shows through faintly. Below, there is a white discal band across both wings. Underside of fore wing with very prominent ocelli in 2 and 5 and under side of hind wing in 2, 5 and a smaller one in 6.

Habits: Prefers low level wet forests. Generally seen during the monsoon season.

Distribution: Southern India (Kerala, Tamil Nadu, Karnataka (Gaonkar, 1996), Sri Lanka and up to Australia. Recorded from Kallar in the Nilgiris.

Hosts: Grasses. *Imperata* sp. and *Oryza sativa* (Sevastopulo, 1973).

Status: Monobasic genus, fairly common, but restricted (Gaonkar, 1996).

19. *Ypthima asterope mahratta* Moore (The Regular Threering)

Talbot (1947). *Faun. Brit. India, Butterflies*, Vol. **2**: 525.

Evans (1932). *Id. Ind. Butterflies,* p. 100.

Larsen (1988). *JBNHS*, **84**: 565.

D'Abrera (1985). *Butterflies of the Oriental Region*, Part II: 464.

Wynter-Blyth (1957). *Butterflies of the Indian Region*, Bombay Nat. Hist. Soc., p. 115.

Description: The REGULAR THREERING measures 30-37 mm in expanse. Seasonal forms present. In the wet season form, the upperside is dull brown with a whitish fringe. The fore wing bears a white-centred black sub-apical ocellus. The hind wing is uniform with a single small sub-tornal ocellus.The underside is greyish white with very fine transverse striations. On the underside of the fore wing a discal and sub terminal dark brown bands are present,

meeting below the ocellus to form a loop. Three ocelli present on the underside of the hind wing- one apical and two tornal. Upperside of hind wing with an ocellus on 2 only. The antennae, head, thorax and abdomen are dull brown. In the dry season form, the ground colour is paler and the ocelli on the underside are reduced to minute specks or absent altogether.

Habits: It is generally found in the plains and rarely found at higher elevations. Abundant all the year round in the plains and in forest where it is generally found among bushes flying at low levels.

Distribution: The distribution covers the whole of India and Baluchistan and Myanmar. Kerala, Karnataka, Tamil Nadu and Goa (Gaonkar, 1996). It has been reported from the Nilgiris and the Nadgani Ghat (Larsen, 1988).

Hosts: Grasses - *Cynodon dactylus, C. plectostachyus* (Gaonkar, *in prep.*).

Status: Common, widespread (Gaonkar, 1996).

20. ***Ypthima avanta*** **Moore (The Jewel Fourring)**

Moore (1874). *Proc. Zool. Soc*. Lond., p. 567.

Talbot (1947). *Faun. Brit. India, Butterflies*, Vol. **2**: 332.

Evans (1972). *Id. Ind. Butterflies,* p. 121.

Larsen (1988). *JBNHS*, **84**: 565.

D'Abrera (1985). *Butterflies of the Oriental Region*, Part II: 466.

Wynter-Blyth (1957). *Butterflies of the Indian Region*, Bombay nat. Hist. Soc., p. 118.

Description: The JEWEL FOUR RING measuring 30-45 mm in expanse has three tornal ocellus in a straight line and two apical ocellus in 5, 6.

Distribution: Peninsular India (Kerala, Karnataka, Tamil Nadu, Goa and Maharastra (Gaonkar, 1996), Sri Lanka. Recorded at 3000 ft. elevation in the Nilgiris during August, December and January, also from Burnside Estate at 1400m.

Hosts: *Arundinella* spp., *Cynodon* spp. (Gaonkar, *un publ.*).

Status: Common, but restricted (Gaonkar, 1996).

21. ***Ypthima* (*baldus*) *madrasa*** **Evans (The Hindustan Fivering) (Plate 1, Fig. 13)**

Evans (1923). *JBNHS*, **29**:787.

Evans (1972). *Id. Ind. Butterflies,* p. 122.

Larsen (1988). *JBNHS*, **84**: 566.

Ferguson (1891). *JBNHS*, **6**: 436.

D' Abrera (1985). *Butterflies of the Oriental Region*, Part II: 466.

Wynter-Blyth (1957). *Butterflies of the Indian Region*, Bombay Nat. Hist. Soc., p. 117.

Collection data: Vazhachal, 6 May, 2009; Pandimatta, Oct. 2009; Chimmony, 3 Nov. 2009; Rockwood, 15 Oct. 2009; Thattakkad, 5 Nov. 2009.

Description: The HINDUSTAN FIVE RING measures 32–48 mm in expanse. Seasonal forms are present. In the wet season form, the upper side is brownish, with the terminal margin of wings more dark. The fore wing bears a double-pupillated, yellow-ringed, black ocellus and two smaller, single-pupillated ocelli on the hind wing.

The underside is brownish white, with transverse brown striations. The fore wing has a large ocellus as on the upperside and the hind wing bears six smaller ocelli arranged in three pairs. There are also distinct sub-terminal, discal and sub-basal transverse brown bands on both the wings on the under side. There is a prominent sex brand.

The area surrounding the ocellus on the upper side in both wings are paler in the female. The ground colour on the under side of wings is also paler and the transverse bands are more sharply defined. The dry season form is paler. In this, the ocelli on the under side of the hind wing are reduced and appear as dots. The antennae, head, thorax and abdomen are dull brown.

Genitalia morphology: Male (Plate V, Fig. I) - Uncus basally broad, distally narrowed and pointed. Tegumen elongate with narrow arm. Vinculum short. Saccus short, U- shaped. Valvae short, apically broad and with a notch in the middle; sub-apically with a deep constriction on

Plate V (Figs. 1-2): Male external genitalia of Satyrine butterflies collected in this study

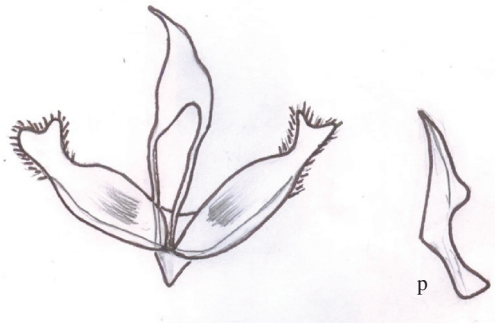


Fig. 1. *Ypthima baldus* (*madrasa*) (ventral view), p. Phallus

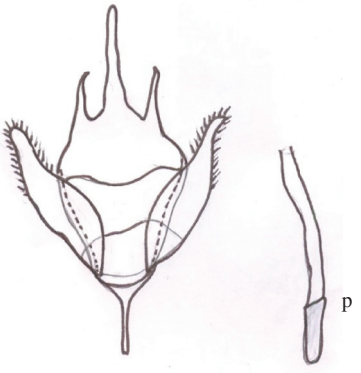


Fig. 2. *Zipaetis saitis* (ventral view), p. Phallus

the inner margin; fringe of short, stiff hairs confined to the apical part. Phallus short, basal 1/3rd portion appearing as the handle of a knife and having a hump-shaped portion at about the middle; apical portion sharply pointed.

Habits: The flight is stronger. Frequent visitor to flowers and often basks in the sun with the wings three-fourths open.

Distribution: It is a very common and widely distributed species found all over India from the Himalayas to Southern India. It is extremely common in Southern India, being found in all seasons of the year both in the plains and in the hills up to an altitude of about 7000 feet. It inhabits both open country and forest regions of tropical, subtropical and mixed deciduous types. It has been collected from Silent Valley and Sholayar. Its distribution covers the whole of India and then east to Japan. It is not reported from Sri Lanka.

Hosts: Grasses - *Cynodon dactylus, C. plectostachyus* (Gaonkar, *un publ.*).

Status: Common, widespread (Gaonkar, 1996).

22. *Ypthima ceylonica* Hewitson (The Ceylon / White Fourring)

Hewitson (1865). *Trans. ent. Soc. Lond.*, 1864: 288.

Talbot (1947). *Faun. Brit. India, Butterflies*, Vol. **2**: 328.

Larsen (1988). *JBNHS*, **84**: 565.

Ferguson (1891). *JBNHS*, **6**: 436.

D'Abrera (1985). *Butterflies of the Oriental Region*, Part II: 464.

Wynter-Blyth (1957). *Butterflies of the Indian Region*, Bombay Nat. Hist. Soc., p. 115.

Description: The CEYLON / WHITE FOURRINGD measuring 30-35 mm in expanse has three tornal and one apical ocellus on the under side of hind wing. Upperside of hind wing with ocelli in 2 and 3 and not on a dark band unlike in *Y. chenui* in which the ocelli are on a dark band. Tornal half of upperside of hind wing white. Seasonal forms present.

Habits: Found in clearings, along roadsides and in open hill country up to 3000 ft.

Distribution: North Western India to Peninsular Malaysia, Sri. Lanka, Singapore, Thailand. Kerala, Karnataka, Tamil Nadu and Goa (Gaonkar, 1996). Reported from Palnis, Coorg, the Nilgiris, Travancore, Orissa and Bengal.

Hosts: Grasses (Sevastopulo, 1973). *Cynodon dactylus* (Gaonkar, *un publ.*).

Status: Locally common, widespread (Gaonkar, 1996).

23. *Ypthima chenui* Guerin-Meneville(The Nilgiris Fourring)

Guerin-Meneville (1843). *In*, *Deless. Voy. Ind*. **II**:77.

Talbot (1947). *Faun. Brit. India, Butterflies*, Vol. **2**: 326.

Evans (1972). *Id. Ind. Butterflies,* p. 121.

Larsen (1988) *JBNHS,* 84: 566.

Ferguson (1881). *JBNHS*, **6**: 436.

D'Abrera (1985). Butterflies of the Oriental Region, Part II: 466.

Wynter-Blyth (1957). Butterflies of the Indian Region, Bombay Nat. Hist. Soc., p. 115.

Collection data: Parambikulam, 1 May, 2009.

Description: The NILGIRI FOURRING measures 36-46 mm in expanse. They are brownish. Underside of hind wing whitish with prominent white and chestnut bands and three tornal and one apical ocellus. Ocellus on the upper side of hind wing prominent. Seasonal forms not present.

Habits: It inhabits the open plateaux, above 6000 ft in the Nilgiris, above 4000 ft. in Coorg and at about 800 ft. in Travancore (Larsen, 1988).

Distribution: Kerala, Karnataka, Tamil Nadu, Goa and Maharastra (Gaonkar, 1996). It is endemic to the highest mountains north of the Palghat gap. It has been reported from Coorg, the Nilgiris and the Anamalai hills. It inhabits the open plateau above 6000 feet in the Nilgiris and also at as low as 800 feet in Travancore.

Hosts: *Arundinella* spp., *Cynodon* spp. (Gaonkar, *un publ.*).

Status: Endemic to southern India (Nilgiris). Common, but restricted (Gaonkar, 1996).

24. *Ypthima huebneri* Kirby (The Hubner's Fourring)

Kirby (1891). *Syst. Cat. Diurn. Lep*., p. 95.

Talbot (1947). *Faun. Brit. India, Butterflies*, Vol. **2**: 329.

Evans (1972). *Id. Ind. Butterflies,* p. 121.

Larsen (1988) *JBNHS*, 84: 565.

D'Abrera (1985). *Butterflies of the Oriental Region*, Part II: 464.

Wynter-Blyth (1957). *Butterflies of the Indian Region*, Bombay nat. Hist. Soc., p. 116.

Collection data: Kattlapara, 14 Oct. 2009; Rockwood, 15 Oct. 2009; Chimmony, 3 Nov. 2009; Thattakkad, Nov. 2009; Vazhachal, May, 2010; Wayanad, May, 2010.

Description: The HUBNER'S FOURRING measuring 30-40 mm in expanse has three tornal and one apical ocellus on the under side of hind wing. Upper side of hind wing with ocelli in 2 and 3 and not on a dark band unlike in *Y. chenui* in which the ocelli are on a dark band. Tornal half of upper side of hind wing not white. Seasonal forms strongly marked. Seasonal forms present.

Habits: Found both in open hill country and forest. Prefer tropical evergreen forests up to 4000-5000 ft. Generally found in bamboo areas.

Distribution: Himalayas, India (Kerala, Karnataka, Tamil Nadu, Goa and Maharastra (Gaonkar, 1996), Sri Lanka and Myanmar.

Hosts: Adults generally visit fallen fruits. Larvae feed on grasses: *Cynodon dactylon, C. plectostachyus* (Gaonkar, *un publ.*).

Status: Common, widespread (Gaonkar, 1996).

25. *Ypthima (Philomela) tabella* Marshall (The Baby Fivering)

Marshall (1883). *Butterflies of India, Burma and Ceylon*, **1**: 221- 234.

Talbot (1947). *Faun. Brit. India, Butterflies*, Vol. **2**: 335.

Evans (1972). *Id. Ind. Butterflies,* p. 121.

Larsen (1988). *JBNHS*, **84**: 566.

D'Abrera (1985). *Butterflies of the Oriental Region*, Part II: 465.

Wynter-Blyth (1957). *Butterflies of the Indian Region*, Bombay Nat. Hist. Soc., p. 117.

Collection data: Chembra, 6 May, 2010.

Description: The BABY FIVERING is a small brown butterfly measuring 23-25 mm in expanse. It has a prominent double-pupillated ocellus below the apex of the fore wing. Under side of hind wing with three tornal ocelli not in line. Below, with the only marginal band which is obscure. Male with no brand.

Habits: Prefers clearings in forest and on grassy hill tops fluttering close to the ground.

Distribution: The distribution covers North Burma, Vietnam, Malaysia, Sumatra, Java, Bali and Sulawesi. It has been reported from Kerala (Wayanad), Karnataka, Tamil Nadu (The Nilgiris), Goa and Maharastra (Gaonkar, 1996).

Hosts: *Arundinella* spp., *Cynodon* spp. (Gaonkar, *un publ.*).

Status: Extremely rare (Gaonkar, 1996).

26. *Ypthima ypthimoides* (Moore)

Callerebis ypthimides Moore (1887). *Lep. Ceylon*, **1**: 307

Talbot (1947). *Faun. Brit. India, Butterflies*, Vol. **2**: 326..

Collection data: Rajamala, 30 April, 2010; Mannavan Shola, 30 April, 2010.

Distribution: Southern India (Talbot, 1947). Kerala (Travancore) and Tamil Nadu (Gaonkar, 1996).

Hosts: *Arundinella ciliata, A. setosa, Cynodon* spp. (Gaonkar, *un publ.*)

Status: Endemic, common, but restricted (Gaonkar, 1996).

27. *Zipaetis saitis* Hewitson (The Tamil Catseye) (Plate 1, Fig. 14)

Hewitson (1863). *Illustr. Exot. Butts*. **3**: 100

Talbot (1947). *Faun. Brit. India, Butterflies*, Vol. **2**: 345.

Larsen (1988). *JBNHS*, **84**: 564.

D'Abrera (1985). *Butterflies of the Oriental Region*, Part II: 472.

Wynter-Blyth (1957). *Butterflies of the Indian Region*, Bombay Nat. Hist. Soc., p. 119.

Collection data: Nelliyampathy, 13 May, 2009; Kattlapara, 14 Oct. 2009; Pandimatta, 14 Oct. 2009.

Description: The TAMIL CATSEYE measurs 60-65 mm in expanse. The upperside is velvety black. The fore wing bears a broad, oblique, white band from the middle of the costa to nearly the margin on the termen. The hind wing bears a similar broad, white band extending almost parallel to the posterior portion of the terminal margin. The outer margin of this band is concavely excavated between the veins.

The under side is similar, but paler. The white bands are as on the upper side. There is a sub-terminal wavy line on both the fore and hind wings on the underside. The underside of the fore wing is without ocelli, but the underside of the hind wing bears a row of five large, prominent ocelli. The head, thorax and abdomen are dark brown and the antennae reddish brown.

Genitalia morphology: Male (Plate V, Fig.2) - Uncus with elongate, slender, blunt lobe, borne on an expanded basal part bearing an elongate apically pointed lobe on either side. Tegumen and vinculum with narrow, elongate arms. Saccus basally U- shaped bearing an elongated narrow process. Phallus elongate, narrow, more or less of uniform width, slightly curved sub-apically, the proximal part appearing like the handle of a sword, slightly narrowed and blunt at the proximal end.

Habits: Its flight is weak and seldom comes out into the open. It is attracted to sugar solution and over-ripe fruits.

Distribution: Kerala, Karnataka, Tamil Nadu and Goa (Gaonkar, *in prep.*). It is found along the slopes of the Western Ghats between 1000 and 3000 feet elevation. It has been reported from Mettupalayam, the Nadgani Ghats, Mukkali and Silent Valley. It is endemic to south India and the range covers western and southern India, the Nilgiris, Anamalais, Cochin and Travancore.

Hosts: *Bambusa* sp. (Gaonkar, *in prep.*), *Ochlandra* sp.

Status: Endemic, rare, restricted (Gaonkar, 1996).

DISCUSSION

A comparison of external genitalia of species studied:

Species belonging to *Melanitis, Lethe, Mycalesis, Zipaetis, Ypthima* and *Elymnias* were studied. Under *Melanitis* two species *viz., M. leda* and *M.* (*phedima*) *varaha* were studied. The male genitalia of these species were apparently similar except for the structure of the saccus which was more slender and elongated in the former. The phallus also showed slight differences: more slender and slightly arched in *M. leda* whereas it was stout and more or less straight in *M.* (*phedima*) *varaha*.

In *Lethe,* two species were studied *viz., L.* (*drypetis*) *todara* and *L.* (*rohria*) *neelgheriensis.* The general structure of the male genitalia was more or less the same in both the species although in *L.* (*rohria*) *neelgheriensis,* there was a sub-basal, slender, finger-like lobe, one on either side of the uncus. The saccus was relatively short and narrowed basally and the phalus was apically narrowed. In *L.* (*drypetis*) *todara,* saccus and the phallus were stouter.

In *Mycalesis,* seven species have been studied *viz., M. anaxias, M. perseus, M. subdita, M. igilia, M. adolphei, M. patnia* and *M. oculus.* Of these, *M. anaxias, M. oculus* and *M. adolphei* showed more resemblance on the basis of valvae which were basally broad and apically narrowed. The latter was quite distinct in possessing valvae with the apical half uniformly narrow, fringed with short hairs and appearing as a distinct lobe. *M.* (*perseus*) *tabitha, M. igilia* resembled closely in possessing valvae with a wavy margin appearing as curled. In *M. subdita,* valvae were sharply constricted in the middle giving the appearance of two lobes. *M.* (*Patnia*) *junonia* also possessed valvae with an uneven margin, but there were two elongate, slender, apically round lobes beset with short hairs, arising from one on either side of the base

of the valvae. With regard to the uncus, excepting *M.* (*Patnia*) *junonia,* all species possessed the sub uncus lobes. The saccus also showed difference, being w-shaped in *M. anaxias* and *M.* (*perseus*) *tabitha,* V-shaped in *M. subdita, M.* (*Patnia*) *junonia* and *M. oculus* and handle-shaped with a flat base in *M. igilia* and *M. adolphei.*

Elyminias caudata resembled *M. anaxias, M.* (*perseus*) *tabitha, M. subdita, M. igilia* and *M. adolphei* in possessing the sub-uncus lobes. The valvae were however different. In the case of *Ypthima* (*baldus*) *madrasa,* the structure was quite different from all the others.

Resemblances in the external genitalia of various species:

Melanitis leda, M. (*phedima*) *varaha, Mycalesis anaxias, M. oculus, Lethe* (*drypetis*) *todara, L.* (*rohria*) *neelgheriensis* and *Zipaetis saitis* showed resemblance in possessing valvae which were broad in the basal half and narrowed in the distal half. Except for *Melanitis leda, M.* (*phedima*) *varaha* and *Lethe* (*drypetis*) *todara,* all the remaining species resembled in possessing sub-uncus lobes and all these species can be considered as forming one group. Similarly, *Mycalesis* (*perseus*) *tabitha* and *M. igilia* showed resemblance in possessing valvae having a wavy margin. These species resembled *L.* (*rohria*) *neelgheriensis, M. oculus, M.* (*perseus*) *tabitha, M. subdita, M. igilia* and *M. adolphei* in possessing sub-uncus lobes. *M. patnia* and *M. subdita* were quite different from the others. Based on an evaluation of resemblances shared by various species, the following species groups were identified:

Group I: Seven species *viz., Melanitis leda, M.* (*phedima*) *varaha, Mycalesis anaxias, M. oculus, Lethe* (*drypetis*) *todara, L.* (*rohria*) *neelgheriensis* and *Zipaetis saitis* were included under this group. Of these, *Mycalesis anaxias, M. oculus* and *L.* (*rohria*) *neelgheriensis* formed a subgroup within Group I. *Elymnias caudata* also shared some resemblance to this subgroup.

Group II: *Mycalesis* (*perseus*) *tabitha* and *M. igilia* formed a distinct group. These species shared resemblance with *L. rohria, Mycalesis oculus, M.* (*perseus*) *tabitha, M. subdita, M. igilia* and *M. adolphei.* Each of the species *Mycalesis* (*Patnia*) *junonia, Mycalesis subdita*, *Ypthima* (*baldus*) *madrasa* was quite distinct from all others. Of these, *Y.* (*baldus*) *madrasa* stood out separately from all the rest in the structure of valvae, uncus and phallus.

Investigations made in this study have shown that excepting a few, most of the satyrids reported from the southern Western Ghats are well represented in the forests of Kerala. Although most of these are identifiable using colour / wing pattern, the external genitalia morphology will be helpful in confirming their identity especially in cases where seasonal forms occur or when the wing pattern is not clear.

The study has shown clear cut affinities among various species and genera. *Melanitis leda, M.* (*phedima*) *varaha, Mycalesis anaxias, M. oculus, Lethe* (*drypetis*) *todara, L.* (*rohria*) *neelgheriensis, Elymnias caudata* and *Zipaetis saitis* showed overall resemblance on the basis of the morphology of valvae. Among these, *Mycalesis anaxias, M. oculus, Elymnias*

caudata and *L.* (*rohria*) *neelgheriensis* shared some resemblance on the basis of the structure of sub uncus lobes.

With regard to *Mycalesis, M.* (*perseus*) *tabitha* and *M. igilia* showed more resemblance. These species also showed resemblance to *L.* (*rohria*) *neelgheriensis, Mycalesis oculus, M.* (*perseus*) *tabitha, M. subdita, M. igilia* and *M. adolphei.* Each of the species *Mycalesis patina, Mycalesis subdita, Ypthima* (*baldus*) *madrasa* was quite distinct from all the others. Of these, *Ypthima* (*baldus*) *madrasa* stood out separately from all the rest in the structure of valvae, uncus and phallus. Further studies involving all the species will be helpful in bringing out the exact interrelationships of the various taxa.

The morpho- taxonomical analysis carried out in this study has brought out the congeneric nature of various satyrid species. The evolutionary relationships and species boundaries among the satyrine butterflies of Peninsular India may be further clarified by detailed morphological and molecular studies.

Nearly 1500 of butterflies have so far been recorded from the Indian region, of which, about 351 species are known to occur in peninsular India. However, the number of species of butterflies that are exclusively found in the Southern India is only about 45 and most of these butterflies are found in the hilly tracts of the Southern Western Ghats. Of these areas, the latter extending from north of Nagarcoil (Tamil Nadu) to the Palghat Gap is the most important with respect to faunistic diversity with the largest number of species and endemics. Among satyrids, several unique species such as *Mycalesis oculus, Ypthima ypthimoides* and *Mycalesis davisoni* are confined to this region. The second region of high diversity is the central Western Ghats, extending north of the Palghat gap from Nilgiri-Waynad area to South Goa. The only butterfly unique to this area is *Mycalesis adolphei.* Information generated in this study has shown very good survival of most of the species mainly due to protection of the natural habitats.

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