

Studies on external genitalial morphology of subfamily Catocalinae (Lepidoptera: Noctuidae)

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ABSTRACT:

Genitalial morphology of fifteen species of the subfamily Catocalinae of Noctuidae was studied. The structure of uncus, saccus, valvae, Juxta and aedeagus of the male and corpus bursae, ductus bursae and signum of the female genitalia were analysed. The adult images, male and female genitalia were illustrated. A dichotomous key for the identification of species using genitalial structures is also presented.

Keywords:

Catocalinae, Noctuidae, Genitalial morphology.

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INTRODUCTION

Taxonomic differentiation of Lepidopteran species has been on the basis of morphology characters, such as labial palpi, antennae structure, wing venation etc. On occasions these characters were found to be less reliable for species segregation particularly when sibling species of geographical isolated were involved. Therefore attempts were made to evaluate other characters that are more reliable. The genital characters have peculiar morphological pattern. They show great divergence between species. The genital characteristics play a major role in their classification both in specific and higher taxonomic level as well as in morphology based cladistic phylogenies. Beuthine-Backer, (1914) explained the significance of external genital morphology in the Lepidopteran taxonomy and phylogeny. Several investigations have been made on the general external morphology of different groups. Busck and Heinrich (1921) discussed the systematic importance of the male genitalia in micro Lepidoptera. Ogata *et al.* (1957) discussed the morphological significance of uncus, socii in the male genitalia of Lepidoptera. Pierce (1909), Philpott (1927), Busck (1931), Diakonoff (1931), Richards (1935), Forbes (1939) and Smith (1965). Investigations had indicated that the structure of genitalia in association with other morphological and biological characters of the taxon would provide a satisfactory basis for taxonomic segregation. Among Lepidoptera, Noctuidae are very important ecologically and economically. An attempt was made to study the external genital structures of 15 different species of Noctuid moths belonging to Catocalinae subfamily. A dichotomous key is also presented for the species level identification of Catocalinae moths using genital characters.

MATERIALS AND METHODS

The adult moths of the subfamily Catocalinae were collected from Mercury light sources during night from different localities (Coonoor, Ooty, Doddabetta, Kothagiri and Kodaikanal) in the Southern region of Western Ghats of India. The collected moths were killed with Ethyl acetate vapor in the killing bottle. Genitalia were examined following the procedure outlined in Clarke (1941), Hardwick (1950) and Lafontaine (2004). The preparation of permanent slide mounts of genitalia was as follows. The abdomen was detached from the proximal segments

using microneedle and dropped into a boiling tube containing a small quantity of 10% KOH solution. The boiling tube containing KOH solution and abdomen was gently boiled and the KOH treated abdomen was washed in distilled water. The genitalia were dissected out with the help of fine needles. After proper dehydration the material was stained in Acid Fuschin and cleared in Carbol-Xylol solution prepared in 3:1 ratio. After the material was mounted in Canada balsam, the diagrams were made with the help of mirror type Camera Lucida. For naming the various parts of the genitalia the terminology proposed by Klots (1970) and Tuxen 1970 has been followed.

Observations

The genital morphology of fifteen species of the subfamily Catocalinae was studied. The descriptions of male and female genitalia of these fifteen species are given below.

Hypocala rostrata (Fabricius, 1794) (Fig. 1a)

Material Examined:

Tamilnadu (INDIA): Nilgiri District, Coonoor, 7. x. 2006, 4 ex. ; Kodaikanal, 8. x. 2006, 2 ex. ; Coonoor, 15. v. 2007, 8 ex. ; Kodaikanal, 16. v. 2007, 3 ex. ; Coonoor, 8. xii. 2007, 2 ex.

Male genitalia: Uncus divided fringed with hairs. Tegumen short, broad Vinculum long 'V' shaped with narrow arms. Valvae short and stumpy; cucullus broad, clothed with hairs. Harpe spine-like sclerotized, clasper rod-like. Juxta rectangular, cup shaped. Aedeagus long narrow, cornuti rod like and pointed. (Fig. 1b, 1c).

Female genitalia: Ovipositor lobes triangular. Both pairs of apophyses well developed. Anterior apophysis stronger than posterior apophysis and of equal length. Ductus bursae long, slender. Corpus bursae spherical signum present on the apical and distal part. (1d).

Hypocala biarcuata Walker, 1858 (Fig. 2a)

Material Examined:

Tamilnadu (INDIA): Nilgiri District, Coonoor, 1. i. 2007, 4 ex.; 8. xii. 2007, 5 ex.

Male genitalia: Uncus fringed with hairs stout, stalk having apical beak like part and sclerotized. Tegumen short and broad. Vinculum long, 'V' shaped saccus conical. Valvae simple; cucullus blunt; remaining part of valvae uniformly sclerotized and well differentiated. Transtilla, juxta membranous. Aedeagus rather long and stout. (Figs. 2b, 2c).

Female genitalia: Ovipositor lobes slightly inferior, triangular setose. Both pairs of apophysis well developed. Anterior apophysis hardly longer than posterior apophysis with spatulate tip. Ductus bursae long. Bursae copulatrix elongate membranous with fine wrinkles. Signum represents a narrow sclerotized band. (Fig. 2d).

***Hypocala deflorata* Fabricius, 1794 (Fig. 3a)**

Material Examined:

Tamilnadu (INDIA): Nilgiri District, Coonoor, 29. xi. 2006, 2 ex. ; 9. iv. 2007, 6 ex. ; 22. x. 2007, 4 ex. ; 8. xii. 2007, 4ex.

Male genitalia: Uncus bifurcate, fringed with hairs. Tegumen broad. Vinculum 'V'-shaped with narrow arms. Valvae short; cucullus triangular shaped; costa and sacculus well differentiated. Harpe spine-like sclerotized. Juxta bowl-shaped with raised margin. Aedeagus of moderate length, slender and slightly constricted into apical region; vesica bearing a short spine like cornuti; ductus ejaculatorius broad, long originated from vesica. (Figs. 3b, 3c)

Female genitalia: General aspect elongate ovipositor lobes inferior, clothed with hairs. Both pairs of apophyses strongly developed; anterior apophysis longer than posterior apophysis with spatulate tip. Ductus bursae very long and broad. Bursae copulatrix membranous, broad oval and fine wrinkles, signum ribbon-like. (Fig. 3d).

***Hypocala lativitta* Moore, 1877 (Fig. 4a)**

Material Examined:

Tamilnadu (INDIA): Nilgiri District, Coonoor, 8. xii. 2007, 4 ex.

Male genitalia: Uncus broad fringed with hairs, composed of a curved terminal lobe and having a subapical beak-like part. Genital capsule elliptical, tegumen broad, without penicular lobe. Vinculum 'V' shaped with narrow arms. Valvae symmetrical short; cucullus broad, flat and clothed with hairs; costa and sacculus well differentiated; sacculus narrow and heavily sclerotized. Juxta basket-shaped, sclerotized, projected with two arms. Aedeagus stout, rod-like cornuti; ductus ejaculatorius broad originate from vesica. (Figs. 4b, 4c).

Female genitalia: Ovipositor lobes prominent. Both pairs of apophyses strongly developed; anterior apophysis longer than the posterior apophysis with spatulate tip. Ductus bursae long and broad, with well sclerotized. Corpus bursae membranous, oval shaped with broad signum. (Fig. 4d).

***Anomis privata* Walker, 1865 (Fig. 5a)**

Material Examined:

Tamilnadu (INDIA): Nilgiri District, Coonoor, 10. iv. 2007, 2 ex. ; 8. xii. 2007, 3 ex.

Male genitalia: Uncus short, stout curved broadly, sword-shaped, medially setose. Tegumen broad. Tuba analis prominent. Vinculum broad 'U' shaped. Valvae simple and sclerotized costal arms not well developed; sacculus heavily sclerotized. Transtilla membranous. Juxta 'U' shaped. Aedeagus long, broad with thorn-like cornuti. (Figs. 5b, 5c).

Female genitalia: Ovipositor lobes well developed clothed with setae. Both pairs of apophyses strongly developed. Posteriores longer than anteriores. Ductus bursae long and stout. Bursae copulatrix membranous, approximately rhomboid without signum. (Fig. 5d).

***Anomis mesogona* Walker, 1858 (Fig. 6a)**

Material Examined:

Tamilnadu (INDIA): Nilgiri District, Coonoor, 18. v. 2007. 7 ex.

Male genitalia: Uncus long curved, medially broad. Tegumen short, broad. Scaphium well developed. Saccus broad. Valvae symmetrical, long; cucullus blunt, broad. Aedeagus long and slender; vesica bearing rod-like cornuti. (Figs. 6b, 6c).

Female genitalia: Ovipositor lobes prominent with strong setose. Both pairs of apophyses well developed. Ductus bursae long and broad. Corpus bursae membranous, rectangular with broad signum. (Fig. 6d).

***Polydesma lindsayi* Hampson, 1893 (Fig. 7a)**

Material Examined:

Tamilnadu (INDIA): Nilgiri District, Coonoor, 29. xi. 2006, 5 ex.; 7. vii. 2010, 2 ex.

Male genitalia: Uncus short curved apically hooked. Scaphium and tuba analis well developed. Tegumen broad. Vinculum long, broad 'U' shaped. Valvae asymmetrical apically narrow into a long lobe; a conical costal process; sacculus well sclerotized and tapering. Transtilla membranous. Juxta simple sclerotized. Aedeagus long and slender basally swollen, without cornuti. (Figs. 7b, 7c).

Female genitalia: Ovipositor prominent developed with long setose. Both pairs of apophyses well developed; posterior apophysis longer than the anterior apophysis. Ductus bursae short. Corpus bursae triangular in shape without signum. (Fig. 7d).

***Lacera noctilio* (Fabricius, 1774) (Fig. 8a).**

Material Examined:

Tamilnadu (INDIA): Nilgiri District, Coonoor, 12. xii. 2006. 5 ex. ; 27. xi. 2006. 3 ex. ; 5. i. 2007. 4 ex. ; 10. vii. 2007. 2 ex. ; 9. ix. 2007. 2 ex. ; 22. x. 2007. 3 ex. ; 8. xii. 2007. 46 ex. ; Kodaikanal, 10. vi. 2008. 2 ex.

Male genitalia: Uncus rather long, strong, apically dilated finally hooked, distally covered with hairs. Tegumen rather long narrow with penicular lobe. Vinculum short, 'U' shaped; cucullus broad outer margin with setose. Valvae not evenly developed; harpe long narrow finally curved with setose. Juxta club-shaped, long and broad. Aedeagus relatively large curved and widening anteriorly; apical region of aedeagus with elliptical shape. (Figs. 8b, 8c)

Female genitalia: General aspect elongate. Ovipositor lobes prominent, triangular, clothed with long setose. Both pairs of apophyses strongly developed; posterior apophysis longer than anterior apophysis, thin. Ductus bursae stout. Bursae copulatrix elongate and broad. (Fig. 8d).

***Sphingomorpha chlorea* Cramer, 1779 (Fig. 9a)**

Material Examined:

Tamilnadu (INDIA): Nilgiri District, Coonoor. 22. xi. 2007. 7ex

Male genitalia: Uncus strongly developed, broad apically hooked. Socii well developed. Genital capsule narrow; tegumen broad, long. Saccus very broad. Valvae symmetrical long and narrow; sacculus broad sclerotized. Juxta bifurcated. Aedeagus stout, acute posteriorly without cornuti. (Figs. 9b, 9c).

Female genitalia: Ovipositor lobes well developed. Both pairs of apophyses strongly developed. Posterior apophysis hardly longer than anterior apophysis. Ductus bursae short. Bursae copulatrix with irregular contour without signum. Ductus seminalis arising from base of bursae copulatrix. (Fig. 9d).

***Oxydes scrobiculata* Fabricius, 1775 (Fig. 10a)**

Material Examined:

Tamilnadu (INDIA): Nilgiri District, Coonoor, 29. xi. 2006, 15 ex. ; 18. xii. 2006, 13 ex. ; 1. i. 2007, 40 ex. ; 28. ii. 2007, 40 ex. ; 9. iv. 2007, 79 ex. ; 22. x. 2007, 31 ex. ; 8. xii. 2007, 98 ex. ; 23. i. 2008, 58 ex.

Male genitalia: Uncus long and sword-shaped. Tegumen long, broad. Vinculum long and broad; saccus 'U'-shaped. Valva with a well differentiated sacculus and costa; cucullus long and narrow. Juxta

'Y' shaped strongly sclerotized. Aedeagus long and stout in the anterior half and uniformly scobinate. (Figs. 10b, 10c).

Female genitalia: Ovipositor lobes well developed covered with hairs. Both apophyses strongly developed. Posteriores longer than anteriores. Ostium bursae simple. Ductus bursae dorsoventrally flattened, sclerotized and wider posteriorly. Bursae copulatrix elongate broader anteriorly. (Fig. 10d).

***Serrodes campana* Guenee, 1852 (Fig. 11a)**

Material Examined:

Tamilnadu (INDIA): Nilgiri District, Coonoor, 10. iv. 2007, 1 ex.; 6. vii. 2007, 1 ex. ; 22. x. 2007, 2 ex.

Male genitalia: Uncus short and stout, with a curved hooked apex. Tegumen broad; penicularlobe absent. Juxta narrow inversely bifurcated. Vinculum broad and heavily sclerotized, V- shaped and extended to form a prominent saccus. Valvae long and slender well sclerotized with small harpe. Aedeagus long and stout with strong double cornutes. (Figs. 11b, 11c).

Female genitalia: Ovipositor lobes inferior. Both pairs of apophyses strongly developed with spatulate tip. General aspect of bursae copulatrix massive; wall of corpus bursae membranous without signum. Ductus seminalis arising from posterior side of corpus bursae. (Fig. 11d).

***Chrysopera combinans* Walker, 1862 (Fig. 12a)**

Material Examined:

Tamilnadu (INDIA): Nilgiri District. Coonoor, 18. v. 2007, 7 ex.

Male genitalia: Uncus long and slender, with acutely pointed. Tegumen short. Saccus broad. Juxta broad with heavily sclerotized between the valvae. Valvae massive; harpe prominent. Aedeagus slender, vesica bearing with rod-like cornuti. (Figs. 12b, 12c).

Female genitalia: Ovipositor lobes small covered with setae. Posterior apophysis short and thin; anterior apophysis stout, longer than posterior apophysis. Ductus bursae much longer. Bursae copulatrix membranous with delicate signum. (Fig. 12d).

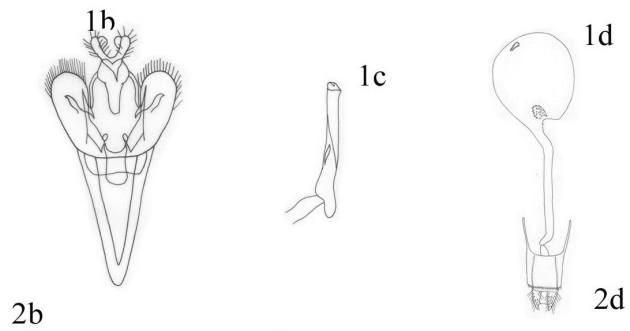
***Homoptera glaucinans* Guenee, 1852 (Fig. 13a)**

Material Examined:

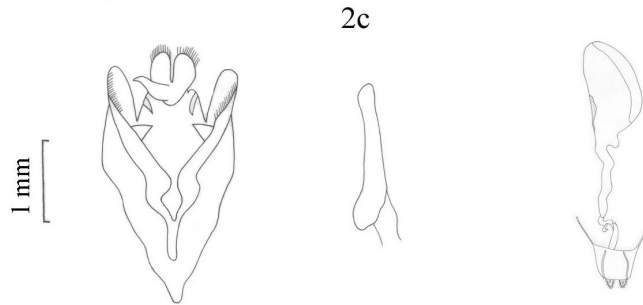
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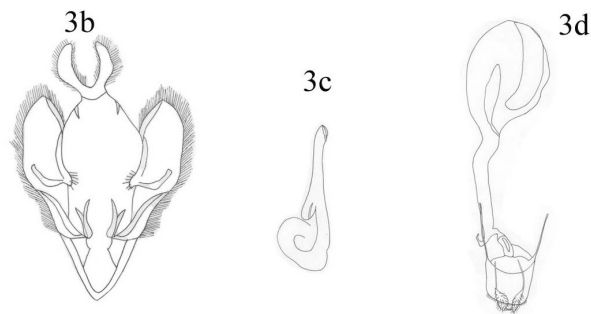
1a. *Hypocala rostrata*



2a *Hypocala biarcuata*



Hypocala deflorata



Hypocala lativitta

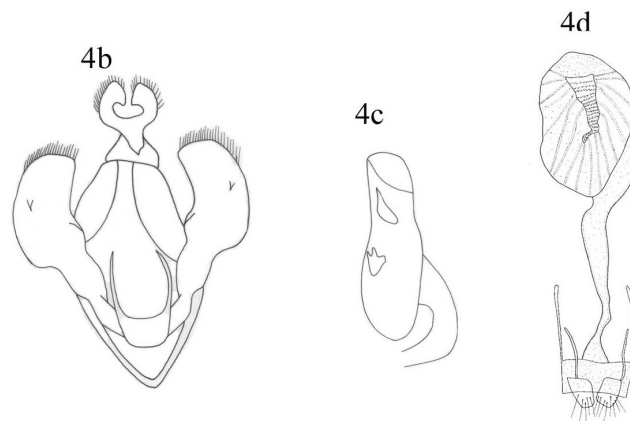
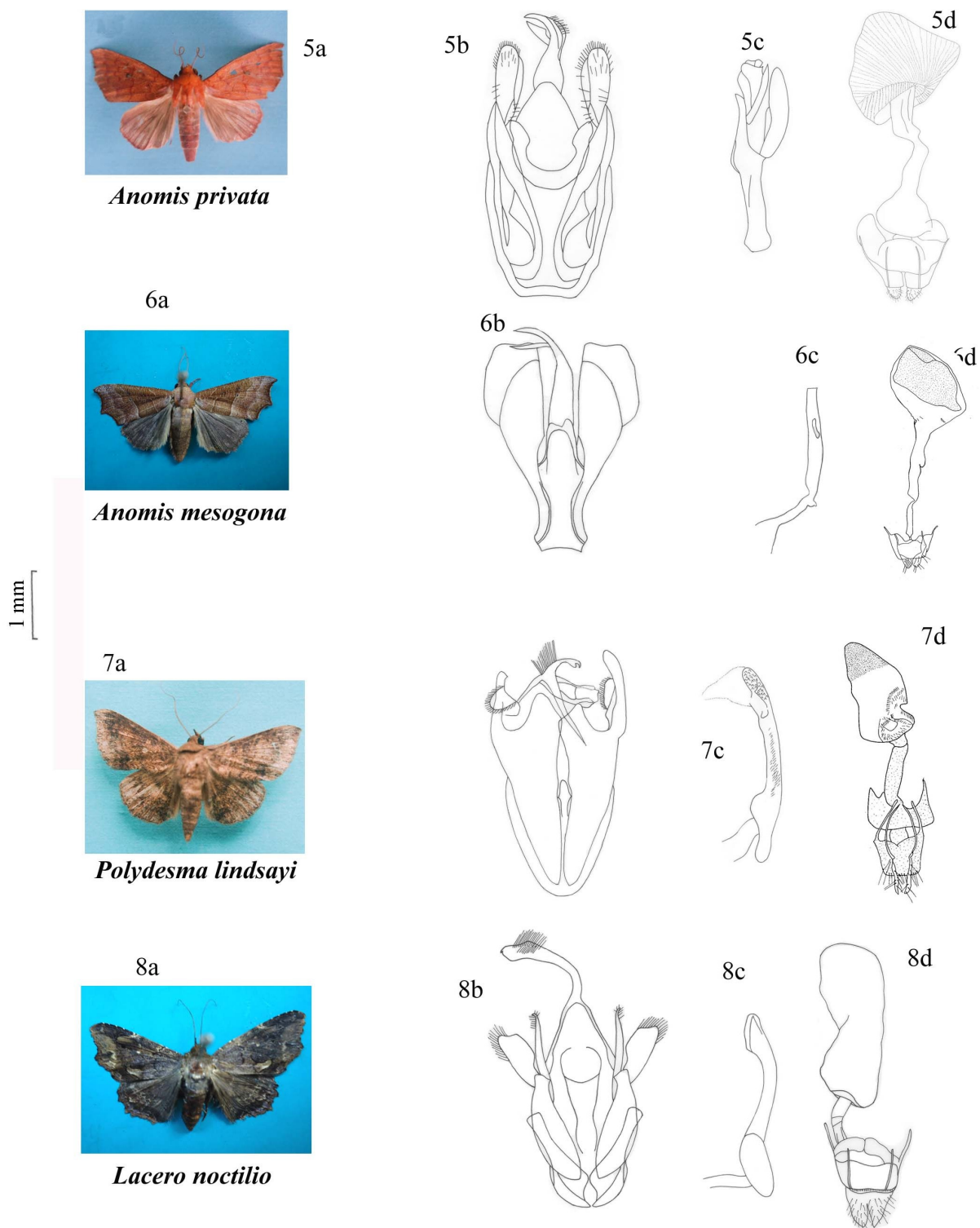
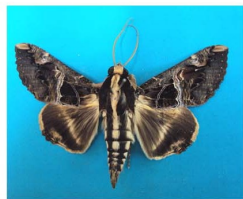


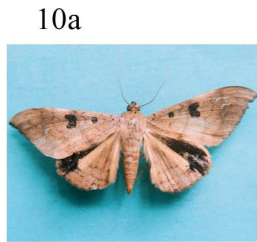
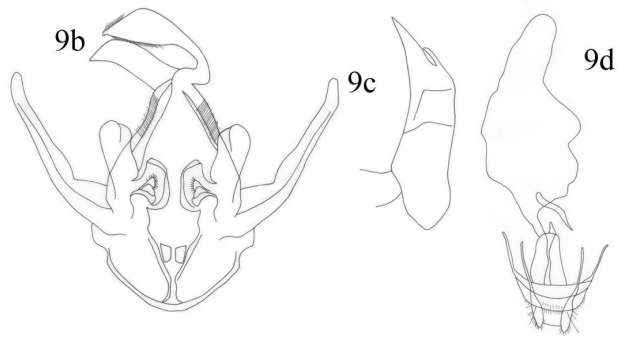
Figure 1.: 1a. *Hypocala rostrata*. - 1b. Male genitalia.- 1c. Aedeagus. - 1d. Female genitalia
 Figure 2.: 2a. *H. biarcuata*. - 2b. - Male genitalia.- 2c. Aedeagus. - 2d. Female genitalia
 Figure 3.: 3a. *H. deflorata*. 3b. -Male genitalia.- 3c. Aedeagus. - 3d. Female genitalia
 Figure 4.: 4a. *H. lativitta*. - 4b. Male genitalia.- 4c. Aedeagus. - 4d. Female genitalia
 Scale: 1 mm





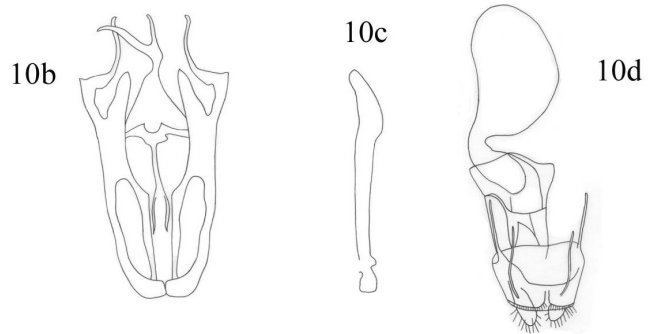
9a

Spingomorpha chlorea



10a

Oxyodes scrobiculata

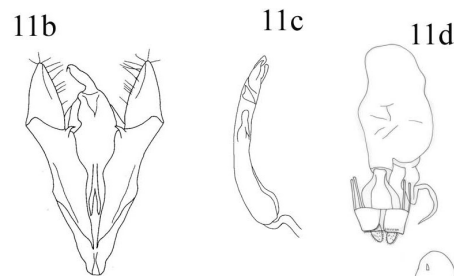


1 mm



11a

Serrodes campana



12a

Chrysopera combinans

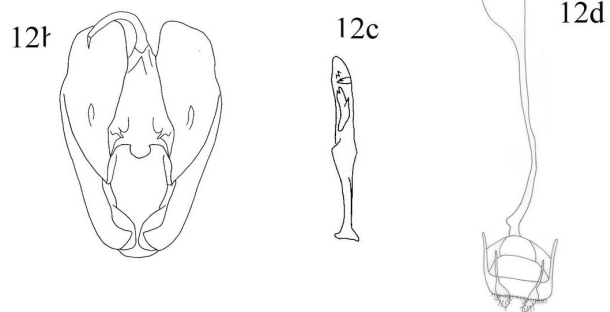


Figure 9. 9a. *Spingomorpha chlorea*. - 9b. Male genitalia. - 9c. Aedeagus. - 9d. Female genitalia

Figure 10. 10a. *Oxyodes scrobiculata*. - 10b. Male genitalia. 10c. Aedeagus. - 10d Female genitalia.

Figure 11. 11a. *Serrodes campana*. - 11b. Male genitalia. - 11c. Aedeagus. - 11d Female genitalia

Figure 12. 12a. *Chrysopera combinans*. -12b. Male genitalia. 12c. Aedeagus. - 12d Female genitalia. Scale: 1mm

Male genitalia: Uncus short, slender. Tegumen broad narrow, arms without penicular lobe. Valvae asymmetrical, elongate; costa and sacculus well differentiated; costa with narrow arms; costal process long and broad; sacculus broad sclerotized. Vinculum 'V' shaped long, much broad. Juxta sclerotized between the valvae with irregular contour. Aedeagus stout, vesica bearing a single massive rod like cornuti. (Figs. 13b, 13c).

Female genitalia: Ovipositor lobes prominent clothed with long setae. Both apophyses strongly developed with equal length. Ductus bursae heavily sclerotized. Bursae copulatrix massive. (Fig. 13d).

***Hulodes caranea* Cramer, 1779 (Fig. 14a)**

Material Examined:

Tamilnadu (INDIA): Nilgiri District, Coonoor, 8. xii. 2007, 5 ex.

Male genitalia: Uncus curved, acutely pointed and setose. Tegumen broad without penicular lobes. Vinculum markedly narrower and more strongly sclerotized, V- to U shaped and extended to form a prominent saccus. Juxta not prominent structure. valvae short and well sclerotized. Aedeagus long and slender; vesica short with long cornuti. (Figs. 14b, 14c).

Female genitalia: Ovipositor lobes well developed and sclerotized, covered with long hairs. Both pairs of apophyses strongly developed. Anterior apophysis shorter than posterior apophysis with spatulate tip. Ductus bursae long and broad. Bursae copulatrix broad without signum; ductus seminalis originating from posterior part of corpus bursae. (Fig. 14d).

***Oraesia emarginata* Fabricius, 1775 (Fig. 15a)**

Material Examined:

Tamilndau (INDIA): Nilgiri District, Coonoor, 29. xi. 2006, 2 ex.; 18. iv. 2010. 1 ex.; 7.vii. 2010, 3 ex.

Male genitalia: Uncus slender and curved. Genital capsule narrow, tegumen shorter than vinculum, bearing with penicular lobe. Vinculum much longer, U- shaped and extended to form a prominent saccus. Juxta small, bearing two pointed process. Valvae long and slender with slender harpe. Aedeagus much long and slender. (Figs. 15b, 15c).

Female genitalia: Ovipositor lobes and well separated. Anterior apophysis shorter than the posterior apophysis with spatulate tip. Ductus bursae long and slender. Corpus bursae membranous, elongated and emarginated at middle without signum. (Fig. 15d).

RESULTS AND DISCUSSION

The subfamily Catocalinae was first proposed by Boisduval, [1828]. Exhaustive treatise on the Indian noctuids is that of Sir George Hampson's Fauna of British India series, moth's volumes (II & III 1894, 1895). In this series, he recorded the Noctuid moths under ten subfamilies. He united the Catocalinae and Ophiderinae into one group. Kitching (1984) united Catocalinae (presence of spines on the mid-tibia) and Ophiderinae (absence of spines on the mid-tibia) in one group Catocalinae. Speidel *et al.* (1996) suggested a division of the Catocalinae and Ophiderinae complex into two groups. Male moth genitalia are usually bilaterally symmetrical. Francy and George Mathew (2005-2006) studied the genitalial morphology of some species of the subfamily Ophiderinae. They defined the uncus as well developed in all the species of the subfamily Ophiderinae. In this present study we noticed great variation. Uncus was more prominent; the shape and size varied in all species of subfamily Catocalinae. It was long and slender in *Anomis mesogona*, *Chrysopera combinans*, *Oxyodes scrobiculata* and *Oraesia emarginata*, stout and curved in *A. privata*, bifurcated in *Hypocala rostrata* and *Hypocala deflorata*, beak-like in *Hypocala lativitta*, short and hooked in *Polydesma lindsayi* and *Serrodes campana*, long and dilated in *Lacera noctilio*, swollen in *Sphingomorpha chlorea*, very much short in *Homoptera glaucinans* and moderately dilated in *Hulodes caranea*.

Francy and George Mathew (2005-2006) described the tegumen as long and narrow in *Anticarsia irrorata* Fabricius, *Ischyja manila* Cramer and *Ischyja infernae* Walker, short and broad in *Speiredonia suffusoma* Guenee. In our study tegumen belonging to the subfamily of Catocalinae was long and broad in *Oraesia emarginata*, *Hulodes caranea*, *Sphingomorpha chlorea*, *L. noctilio* and *Oxyodes scrobiculata*, short and narrow in *A. mesogana*, short and broad in *Homoptera glaucinans*, *C. combinans*, *Anomis privata*, *P. lindsayi*, *Serrodes campana* and shoulder shape in *Hypocala rostrata*, *H. deflorata*, *H. biarcuata* and *H. lativitta*.

Francy and George Mathew (2005-2006) demonstrated the structure of valvae with different shapes and sizes from the subfamily Ophiderinae. In the present study we observed that the valvae was well developed in all the species of the subfamily Catocalinae. It varied in shape and size. Valvae was asymmetrical in *P. lindsayi* and

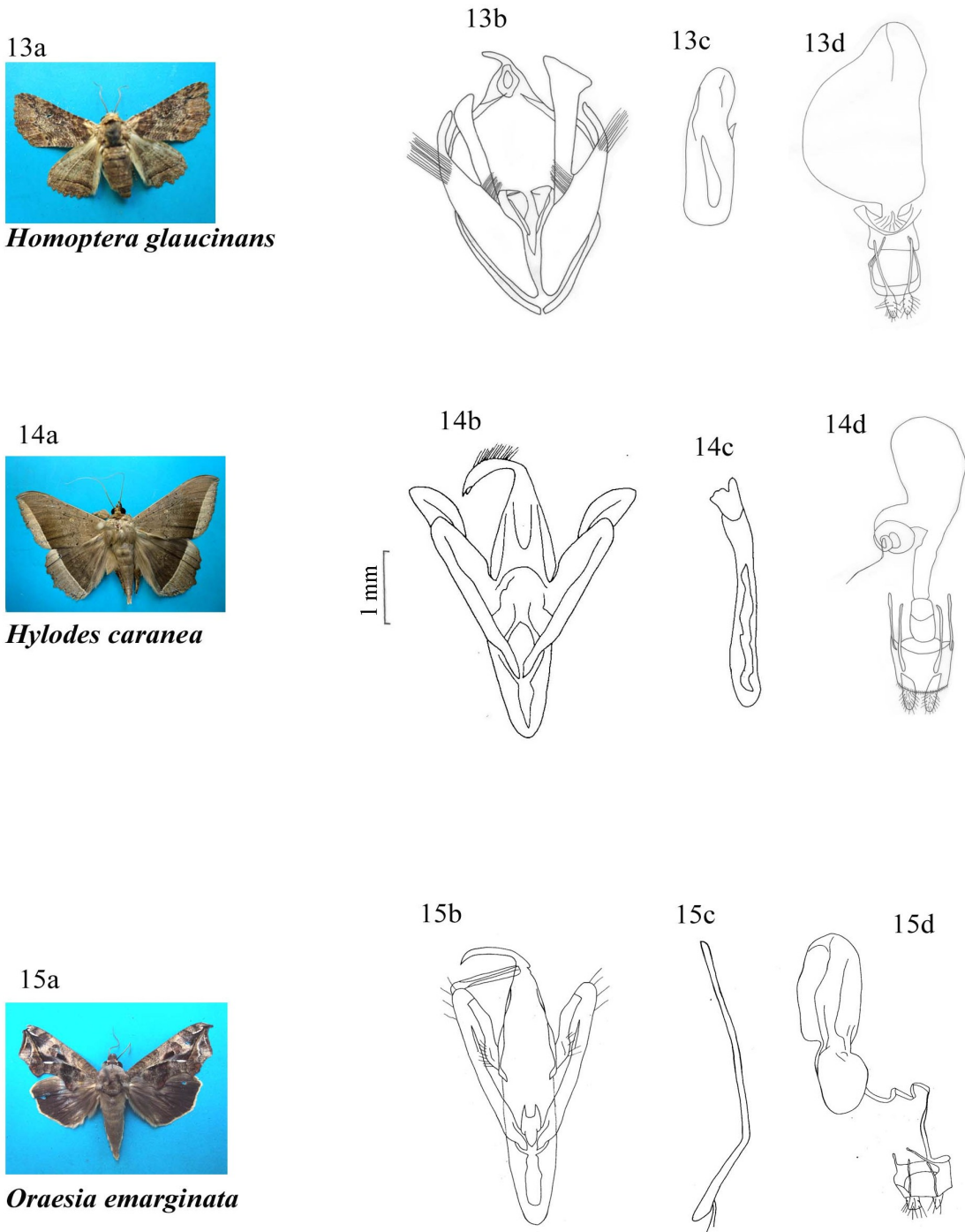


Figure 13. 13a. *Homoptera glaucinans*. -13b. Male genitalia. - 13c. Aedeagus. - 13d. Female genitalia
 Figure 14. 14a. *Hylodes caranea*. - 14b. Male genitalia. - 14c. Aedeagus. - 14d. Female genitalia
 Figure 15. 15a. *Oraesia emarginata*. - 15b. Male genitalia. - 15c. Aedeagus. - 15d. Female genitalia. Scale: 1mm

Homoptera glaucinans, and narrow in *Shingomorpha chlorea*.

Juxta was defined in the species belonging to subfamily Ophiderinae by Francy and George Mathew (2005-2006). It was highly sclerotised in *Anticarsia irrorata* Fabricius. In the present study juxta was bowl shaped in *A. privata* and *Hypocala rostrata* and basket shaped in *Hypocala lativitta*. It was highly sclerotized in *Hypocala biarcuata*, *C. combinans*, *Homoptera glaucinans*. Juxta was cylindrical in shape in *Hypocala rostrata*, small and bearing with two pointed process in *Oraesia emarginata*. Vinculum was long and ‘V’ shaped in *Hypocala rostrata*, *Hypocala deflorata* and *Hypocala rostrata*. It was V- to U shaped in *Homoptera glaucinans*, *Hulodes caranea* and *Oraesia emarginata* and U shaped in *Polydesma lindsayi*, *A. privata*, *Sphingomorpha chlorea* and *L. noctilio*.

Aedeagus was defined in the species of subfamily Ophiderinae by Francy and George Mathew (2005-2006). It was long and narrow in *Speiredonia suffusoma* Guenee and short and stout in *Episparis liturata* Fabricius and *Arcte modesta* Van der Hoev. In the present study aedeagus was

long and narrow in *Oraesia emarginata*, *Anomis mesogona* and *Oxyodes scrobiculata*, somewhat broad in *Hypocala rostrata*, *Hypocala deflorata*, *Hypocala biarcuata*, *P. lindsayi* and *Serrodes campana*, and short and stout in *Hypocala lativitta*, *Sphingomorpha chlorea* and *Homoptera glaucinans*. Vesica was simple scobination in all the species.

Francy and George Mathew (2005-2006) defined the female genitalic structure of the subfamily Ophiderinae. It varied in shape and size. In the present study female genitalia ovipositor lobes were well developed in all the species of the subfamily Catocalinae. Corpus bursae was rounded in *H. rostrata*, oval shaped in *Hypocala lativitta* rectangular in *Serrodes campana* and *L. noctilio*, and balloon-like in *Homoptera glaucinans*.

Key for identification of species

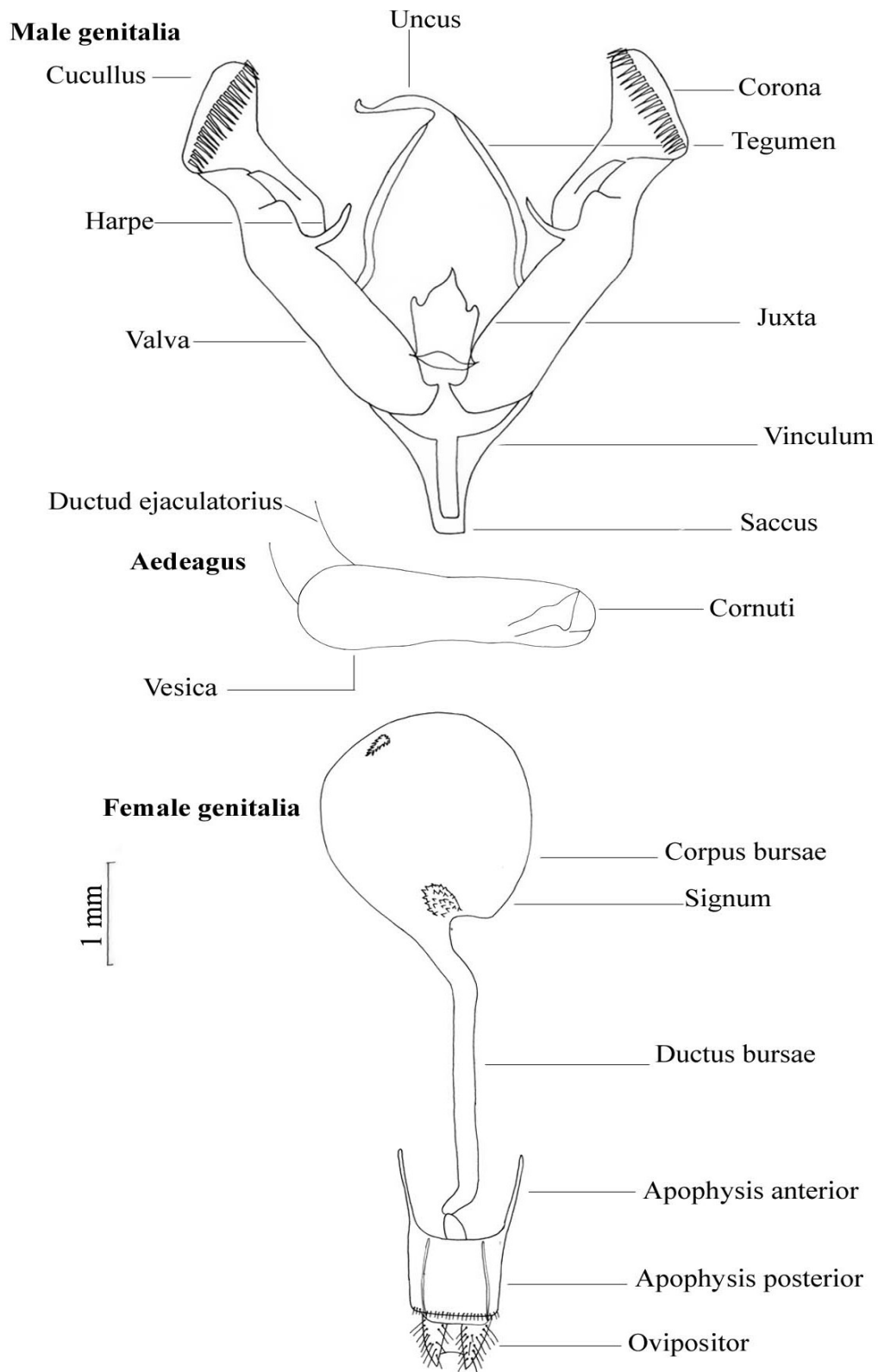
Sexual segregation was the most important criteria between species; no two species contained the same type of genitalia. The genitalia of each species was distinct. Using characters unique to each species, the following key had been devised to facilitate species segregation.

Key to the species based on male genitalic characters

Catocalinae

- 1. Uncus long.....*Chrysophora combinans*
- Uncus short.....2
- 2. Uncus undivided.....3
- Uncus divided.....12
- 3. Uncus curved.....4
- Uncus not curved.....9
- 4. Uncus stout.....5
- Uncus normal.....*Anomis mesogona*
- 5. Uncus apically dilated.....*Sphingomorpha chlorea*
- Uncus slender.....6
- 6. Uncus apically hooked.....7
- Uncus apically not hooked.....*Anomis privata*
- 7. Valvae asymmetrical.....*Polydesma lindsayi*
- Valvae symmetrical.....8
- 8. Valvae long and broad; vinculum long.....*Serrodes campana*
- Valvae not long; vinculum short.....*Lacero noctilio*
- 9. Tegumen short and broad.....10
- Tegumen long and narrow.....11
- 10. Valvae asymmetrical; vinculum ‘V’ shaped.....*Homoptera glaucinans*
- Valvae symmetrical; vinculum ‘U’ shaped.....*Oxyodes scrobiculata*
- 11. Juxta prominent; vinculum long.....*Oraesia emarginata*
- Juxta sclerotized; vinculum short.....*Hulodes caranea*
- 12. Vinculum long.....13
- Vinculum short.....14
- 13. Juxta cylindrical shape; valvae broad.....*Hypocala rostrata*
- Juxta heavily sclerotized; valvae narrow.....*Hypocala biarcuata*
- 14. Tegumen with penicular lobes; Aedeagus without cornuti.....*Hypocala deflorata*
- Tegumen without penicular lobes; Aedeagus with cornuti.....*Hypocala lativitta*

Generalised diagram of genitalia of Noctuidae



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