GENITALIAL MORPHOLOGY OF SOME HAWK MOTHS (LEPIDOPTERA: SPHINGIDAE: SPHINGINAE) FROM NORTHWESTERN INDIA

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Abstract

External genitalial morphology of seven species belonging to the subfamily Sphinginae (Sphingidae) i.e., Agrius convolvuli (Linnaeus), Psilogramma menophron menophron (Cramer), Psilogramma incereta Walker, Acherontia styx styx (Westwood), Leucophlebia emittens Walker, Marumba dyras dyras (Walker) and Polyptychus trilineatus trilineatus Moore were studied. Besides this, keys to the subfamilies, tribes, genera and species studied are given.

Keywords

Genitalia, India, Lepidoptera, Sphingidae

The sphinx or hawk moths are fast fliers and members of the Order Lepidoptera. There are as many as 1354 species and subspecies of these moths in the world, out of which, about 204 belong to India (D’Abrera, 1986). Before this, Bell and Scott (1937) published an account of 183 species of these moths from British India (Burma, Ceylon, Andamans, India). During the course of our studies, seven species belonging to the subfamily Sphinginae were collected from localities such as Dasua, Dhar, Dunera, Hoshiarpur and Punjabi University, Patiala. Besides re-examination of the adult morphology and wing venation, detailed structure of the male and female genitalia have been furnished to improve diagnosis.

Agrius Hübner

Agrius Hübner (1819) 1816, Verz. bekannter Schmett., 140.

Agrius convolvuli (Linnaeus)

Sphinx convolvuli Linnaeus, 1758, Syst. Nat. (Edn. 10), 1: 490.

Material examined


Distribution

Throughout the Indian subregion, low altitudes of Eastern Hemisphere, rarely in England (Bell & Scott, 1937).

Diagnosis

Male genitalia: (Figs. 1-2). Uncus neck broad, weakly sclerotised, apex slightly pointed; gnathos flap-like band; tegumen elongated, weakly sclerotised; vinculum V-shaped; valva elongated, heavily setosed, costa nearly straight, weakly arcurated towards apex, heavily setosed at apex, setae numerous, outer margin nearly straight; sacculus extended into a curved and pointed harpe, harpe divided into a ventral and dorsal process, ventral process somewhat spatulate; transstilla a thin, membranous; juxta broad, U-shaped; aedeagus small, thick, almost straight, weakly sclerotised; vesica not armed with cornuti.

Female genitalia (Fig. 3). Ovipositor lobes distinctive, formed by a number of papillae each emitting a spine; posterior apophyses almost equal to length as that of anterior apophyses; both apophyses long, rod-like, slender; ostium bursae indefinite; ductus bursae rather short gradually given into corpus bursae; corpus bursae oblong, rugose as that of ductus burse; signi rounded, scobinate patch.

Alar expanse: Male 80-95mm; Female 98-100mm.

Food plant

Plants of Family Leguminosae and Convolvulaceae (Bell & Scott, 1937).

Remarks

While reporting the species convolvuli Linnaeus under the genus Herse Oken, Bell and Scott (1937) have mentioned that it occurs throughout the Indian subregion in both the dry and

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Figures 1-3. Agrius convolvuli (Linnaeus)

1 - Male genitalia - ventral view; 2 - Aedeagus; 3 - Female genitalia

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wet areas. During the course of the present study, seven specimens of this species were identified to examine the male and the female genitalia critically which have otherwise been briefly outlined with outdated nomenclature being followed for various constituent parts by Bell and Scott (1937) and Pierce and Berine (1938). In the male genitalia, the uncus is entire and the harpe is bifid and these characters conform (congeneric) to the type species, has been as discussed by Holloway (1987). The species, under reference, has erroneously been reported the type species, has been as discussed by Holloway (1987). Yet, another sample comprising six specimens including genitalia (Bell & Scott, 1937; D’Abrera, 1986; Holloway, 1987). Yet, another sample comprising six specimens has been identified as Psilogramma menophron menophron Walker. The critical examination of the latter species shows that characters such as a naked stripe over the inner surface of labial palpi and bifid uncus, vestigial harpe, forked apical process of the aedeagus of the male genitalia conform to the diagnosis of the genus, as outlined by Holloway (1987).

**Psilogramma Rothschild and Jordan**


**Remarks**

Rothschild and Jordan (1903) proposed the genus *Psilogramma* with *Sphinx menophron* Franer as its type species and contains four species from the Oriental and Australian regions (D’Abrera, 1986). While dealing various species, Bell and Scott (1937) have stated “the moth very variable in size, colour and markings, some specimens being very dark with subbasal, acute medial, median and post median lines showing plainly, others very grey with these lines obsolete. The black streaks under R1, M1 and Sc5 are always present”.

Holloway (1987) pointed out that the genus has forewing fascia similar to *Agrius* but the marking on the hindwings, abdomen and those on the labial palpi make them very distinct from each other. During the course of present studies, two specimens have been identified as *Psilogramma menophron menophron* Cramer on the basis of various morphological characters, including genitalia (Bell & Scott, 1937; D’Abrera, 1986; Holloway, 1987). Yet, another sample comprising six specimens has been identified as *P. incerta* Walker. The critical examination of the latter species shows that characters such as a naked stripe over the inner surface of labial palpi and bifid uncus, vestigial harpe, forked apical process of the aedeagus of the male genitalia conform to the diagnosis of the genus, as outlined by Holloway (1987).

**Psilogramma menophron menophron** *(Cramer)*


**Material examined**


**Distribution**

Throughout the Indian sub-region, China, Solomon Islands (Bell & Scott, 1937).

**Diagnosis**

Male genitalia: (Figs. 4 - 5). Uncus bifid, process long, slender, curved, apex pointed, bent, sclerotised; gnathos, short broad, sinuated, angles slightly produced, sides distally rounded; vinculum U-shaped; saccus elongated, V-shaped; valva broad, long, highly setosed, costa excrurate, apex rounded, sacculus simple; aedeagus of moderate length, straight, slender, a wedge shaped process at the lower tip of sheath, very characteristic.
Key to the species of the genus Psilogramma Rothschild and Jordan

1. Forewing with ground colour brown; male genitalia with saccus present .... *menophron menophron* (Cramer)
1A. Forewing with ground colour grey; male genitalia with saccus absent ........................................... *increta* Walker

**Psilogramma menophron menophron** (Cramer)

4 - Male genitalia - ventral view; 5 - Aedeagus

asymmetric in shape, reflexed, short forked.

**Alar expanse**: Male 108mm.

**Food plant**

*Olea dioicum*, *Jasminum*, *Ligustrum*, *Nyctanthes Arbor-tristis* (family Oleaceae); *Tectona grandis*, *Clerodendron infortunatum*, *Vitex negundo*, *Callicarpa arborea* (Family : Verbenaceae) (Bell and Scott, 1937).

**Remarks**

The species, under reference, appears to be quite scanty in the Shivaliks in view of collection of only two individuals. Thus, no comments can be made on the variability in colour and markings, as pointed out by Bell and Scott (1937). According to D’Abrera (1986), the species *Psilogramma menophron* Cramer has three subspecies i.e., *menophron menophron* Cramer (Oriental region, Australian region, except new Caledonia), *menophron lifuense* Rothschild (New Caledonia, Loyalty Island) and *menophron jordana* Bethune-Baker (Fiji) from the respective geographical regions/locality/country. Accordingly, the present sample from the Shivaliks is referred as *P. menophron menophron* Cramer.

**Psilogramma increta** Walker


**Material examined**


**Distribution**

China, India, Japan (Hampson, 1892).

**Diagnosis**

**Male genitalia**: (Figs. 6 - 7). Uncus well developed, simple long, bifid, bifurcation deep, erect lobiform processes, tip acuminate, curved ventrally, sclerotised heavily at apex; tuba analis present; gnathos slightly bifid mesially or weakly sinous; tegumen broad, weakly sclerotised; vinculum V-shaped; saccus nearly absent; valva elongated, sole shaped, thickly setosed from the middle to apex; costa sclerotised, margin nearly straight, apex broad; sacculus well developed, marginally sclerotised; transtilla a thin band, edges on lateral sides of aedagus slightly developed; anellus present; aedeagus of moderate length, straight, slender, ankylosed; a wedge shaped process forked at apex.

**Female genitalia**: (Fig. 8). Ovipositor lobes as that of typical sphingid type; posterior apophyses smaller in length than anterior apophyses, both long, rod-shaped; ostium bursae wid, with an angular free plate, posterior portion of the plate sclerotised, smooth, scaled, half moon shaped, with lateral margins elevated; ductus bursae rather short, thick, weakly sclerotised, curved; ductus seminalis entering nearly the anterior end of ductus bursae; corpus bursae oblong, much elongated.

**Alar expanse**: Male 85mm; Female 110mm.

**Food plant**

Not known.
Remarks
As pointed out under the remarks of the genus *Psilogramma*
Rothschild and Jordan, the species *P. incereta* Walker
completely agrees with the characters of type species i.e., *Sphinx menophron* Cramer. It may be added that Hampson (1892) has
given *incereta* Walker as a synonym of genus *Pseudosphinx* discristriga Walker as Anceryx incerta Walker and has reported
it from China, India and Japan. Accordingly, the collection of
the present sample from the Shivaliks is an additional record.

*Acherontia* Laspeyres


*Acherontia styx styx* (Westwood)
*Sphinx* (Acherontia) *styx* Westwood, 1847, *Cabinet Oriental Ent.* : [88], pl. 42, fig. 3.

Material examined

Distribution
Burma, Ceylon, Throughout India (Bell and Scott, 1937).

Diagnosis
Female genitalia: (Fig. 11). Ovipositor lobes of typical sphingid type, outer lobes made of number of papillae, each emitting a spine, spines very thin, lower spines longer, inner lobes small; posterior apophyses longer than anterior apophyses, both apophyses rod-like; ostium bursae with a proximal transverse flap, which is shallowly sinuate mesially; ostium bursae narrow, rounded, eight sternite sclerotised encircling the ostium; ductus bursae elongated, weakly sclerotised anteriorly; ductus seminalis entering near corpus bursae; corpus bursae elongated, globular pouch, wrinkled interiorly, membranous; signi absent.

Alar expanse: Female 105mm.

Food plant
Pest of *Sesamum indicum* (Pedaliaceae) and also fed on plants of family Solanaceae, Verbenaceae, Leguminosae, Oleaceae, Bignoniaceae, Labiatae (Bell & Scott, 1937).
modified, a thin curved plate, with a setae well marked at its junction with valva; juxta V-shaped; aedeagus of moderate length, nearly straight, vesica membranous, lacks cornuti.

**Alar expanse:** Male 50mm.

**Food plant**
Not known.

**Remarks**
According to D’Abrera (1986), the genus *Leucophlebia* Westwood is represented by four species i.e., *L. lineata* Westwood (Afrotropical & Oriental); *L. emittens* Walker (N.W. to Central India), *L. afra* Karsch (Senegal to Angola, to the Sudan) and *L. neumannii* Rothschild (Norther Uganda to Western Ethiopia) from the respective regions mentioned in parenthesis. The former two species have also been reported from India, the first one being from western and eastern southern India. The collection of five specimens from the foothills of Shivaliks is an additional record in Western Himalayas (Bell & Scott, 1937). It may also be added that the tribes for many genera including *Leucophlebia* Westwood is not certain and in the present studies, the latter genus is tentatively described under the tribe Semithrini for the time (Pittaway, pers. comm.).

**Marumba Moore**


**Marumba dyras dyras** (Walker)

**Material examined**

**Distribution**
Western and Eastern Himalayas, South India, Ceylon, Andaman Islands (Bell and Scott, 1937).

**Diagnosis**
**Male genitalia:** (Figs. 12-13). Uncus divided into two slender process slight curved neutrad setosed, seta very fair thick, apex acute; gnathos arms narrow medially fused, given off into a thick medial spine like projection, area from the arms towards uncus membranous, setosed basally; tegumen broad, sclerotised; vinculum broad V-shaped; saccus absent; valvae elongated, costa nearly straight sclerotised broadly towards apex valvae sclerotised marginally, strongly setosed, setae very thick, apex rounded blunt, sacculus well developed, given of into harpe, harpe irregularly tuberculate, spously setosed; anellus developed; transtilla spined equally an both sides of aedeagus; aedeagus of moderate length, sheath more or less rugose or granulose towards the end, vesica lacks cornuti.

**Alar expanse:** Male 90mm.

**Food plant**
Food plants belonging to families Malvaceae (*Bombax*, etc.); Sterculiaceae (*Sterculia*, etc.); Tiliaceae (*Grewia*); Euphorbiaceae (*Bridelia*); Sapindaceae (*Schleichera trijuga* Willd.) (Bell & Scott, 1937).

**Figures 9-10. Leucophlebia emittens Walker**
9 - Male genitalia - ventral view; 10 - Aedeagus

**Figures 12-13. Marumba dyras dyras (Walker)**
12 - Male genitalia - ventral view; 13 - Aedeagus
Remarks
According to D’Abrera (1986), the genus Marumba Moore is represented by six species viz., M. spectabilis Butler (N. India, Sikkim and Assam), M. poloitis Hampson (Ganjam, Orissa (India)), M. decoratus Moore (Sikkim, Assam, Peninsula, Malaya, Sumatra), M. nympha Rothschild and Jordan (southern India), M. bengalensis Hampson (India, Chota-Nagpur) and M. indicus Walker (N. Central India) from India. During the course of present studies, two specimens of M. dyras Walker has been collected from the Shivaliks in Punjab. Though, Bell and Scott (1937) have mentioned that they have breed this species in Western Himalayas (Shivalik mountains), yet, during the present survey work, only two specimens could be collected, thereby meaning that the species is becoming quite rare. The species, under reference, is represented by four subspecies i.e. M. dyras dyras Walker, (Ceylon, N.W. India, southern Myanmar, Indo China, China), Marumba dyras javanica Butler (Sundaland to Philippines), M. dyras andamana Moore (Andaman Islands) and M. dyras tenimberi Clark (Tanimbar Island) and accordingly the nominotype is reported as M. dyras dyras (Walker). As such the type species is unique in having weakly falcate forewing and with termen somewhat sinous. The male genitalia is conspicuous due to bifid uncus, strongly developed harpe, especially each of the transtilla is developed as strong spine equally on either side of the aedeagus.

Polyptychus Hübner
Polyptychus Hübner (1819) 1816, Verz. bekannter Schmett.: 141.


Polyptychus trilineatus trilineatus Moore

Material examined

Distribution
Ceylon (Bell and Scott, 1987); northwestern India, Assam, Sikkim, Burma (D’Abrera, 1986).

Male genitalia: (Figs. 14-15). Uncus long, strongly dilated, hood shaped; tuba analis present; gnathos developed, weakly sclerotised, distal edges slightly bisinuate; tegumen elongated, arms somewhat narrower, weakly sclerotised; vinculum V-shaped, broad, saccus elongated, thin slender, weakly sclerotised; valva sole shaped; costal region sparsely setosed, setae very fine, costal margin nearly straight; sacculus gien off into harpe, harpe two in number, right arm of harpe long, pointed, projecting beyond ventral edge of valvae, left arm short, curved; anellus small tube like; aedeagus thin, elongated, slender, apex like fish tailed process, tip acute, sharp much curved bent, vesica membranous.

Discussion
Moths belonging to the family Sphingidae are long, narrow, with pointed fore wing, short triangular hind wing, large eyes, powerful thorax and sharply pointed abdomen. The eggs are either nearly spherical or more or less oval in shape. The surface is usually smooth and shining, and the colour varies from green.
to yellow. The larvae, when full-fed are nearly cylindrical in some subfamilies, but taper more or less strongly towards the head in others, the head being either rounded or triangular. There is always a horn on the twelfth segment, straight and bifid in the first instar, of various shapes and more or less strongly chitinized in the later instars, while it may be reduced to a short tubercle or a knob in some species. The pupae are usually short, cigar-shaped, rounded in front and pointed behind (Bell & Scott, 1937).

REFERENCES

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