



Morphology of the external male genitalia of five Indian geometrid species (Lepidoptera)

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In a study of the moths of the family Geometridae of Solan in Himachal Pradesh, five species belonging to the subfamily Ennominae were recorded in the collections between August and November 2004. Moths belonging to subfamily Ennominae can be easily recognized by the presence of a fovea or pit of hyaline membrane on the underside of forewing at the base of anal vein. Another important taxonomic feature to identify these moths is from their hindwing venation, as the vein M2 is obsolete (Hampson 1895). In the present study, the external male genital morphology has been studied. Terminology used by Klots (1970) has been adopted. Nomenclature has been followed after Holloway (1993, 1996 & 1997), Walia (1994, 1995, 2000), and Walia & Anju (2005). Collection of moths was made by setting up light traps. The collected moths were killed and preserved in air tight wooden boxes. For external genitalia studies the detached abdomens were potashed in 10% solution (Robinson 1976), then washed in 1% glacial acetic acid and dissected in 30% alcohol for taking out male genitalia. After proper dehydration, the genital structures were preserved in vials containing a mixture of alcohol and glycerol in the ratio of 3:1. The Illustrations were drawn with the help of a graph eye piece fitted in a stereo zoom binocular.

Family: Geometridae
Subfamily: Ennominae

Hindwing with vein M2 obsolete; M1 and M3 considerably approximated; Sc+R1 free and running close along Rs to about middle of cell, very rarely anastomosing with it. A fovea or pit of hyaline membrane on underside of forewing at base of anal vein, probably acting as a tympanum, developed in many

species in males, a character hardly found in any other group of Lepidoptera. Hind tibia dilated in male, with a fold containing a tuft of long hairs acting as a scent organ.

Genus *Hypomecis* Hübner

Hübner, 1821, *Index exot. Lepid. Colln* 7.

Type species: *Cymatophora umbrosaria* Hubner.

Labial palpus upturned, fringed with hairs. Antenna bipectinate with long branches in male. Forewing with the discal cell less than half the length of wing; vein R1, R2 arising from cell; R3, R4, R5, stalked from near upper angle; vein Cu1 from near angle of cell. Hindwing with vein Cu1 from near angle of cell.

1. *Hypomecis infixaria* (Walker) (Figs. 1-3)

Walker, 1860, *Lepid. Ins. Colln. Br. Mus.* 21: 379.

Distribution: Throughout India.

Material examined: 3 males, 6.ix.2004; 3 males, 8.x.2004; 4 males, 15.x.2004; 1 male, 30.x.2004, Sabathu, Himachal Pradesh. Collections deposited in the museum of Department of Zoology P.U. Patiala.

External male genitalia: Uncus short, broad at base, tapering towards tip, well sclerotized, setosed with setae; tegumen longer than uncus, membranous, v-shaped; acrotergite present; vinculum longer than tegumen, u-shaped; saccus well developed; juxta present, weakly developed; valva heavily setosed with setae at top, a well developed saccular projection is present; aedeagus well sclerotized having two prominent spine like structures; ductus ejaculatorius enters apically.

Genus *Petelia* Herrich-Schaffer

Herrich-Schaffer, 1855, *Syst. Bear. Sch. Eur.* 6: 109

Type species: *Petelia medardaria* Herrich-Schaffer.

Labial palpus upturned. Antenna of male bipectinate. Fore tibia with a long process and tuft of hair. Hind tibia not dilated. Forewing with vein R1 free; R2, R3, R4, R5 stalked, from before upper angle; Cu1 from near angle of cell. Hindwing with vein Cu1 from angle of cell.

2. *Petelia medardaria* Herrich-Schaffer (Figs. 4-6)

Herrich-Schaffer, [1856], *Samm. neuer oder wenig bek. aus. Sch.* 1(1): 23-25.

Distribution: Throughout India.

Material examined: 2 males, 8.x.2004, 1 male, 15.x.2004; 1 male, 30.x.2004, Sabathu, Himachal Pradesh. Collections deposited in the museum of Department of Zoology, Panjabi University, Patiala

External male genitalia: Uncus long, narrow, curved at tip, heavily sclerotized, setae present; tegumen longer than uncus, weakly sclerotized, v shaped; vinculum longer than tegumen, u-shaped; saccus well developed; juxta prominent, lower arms

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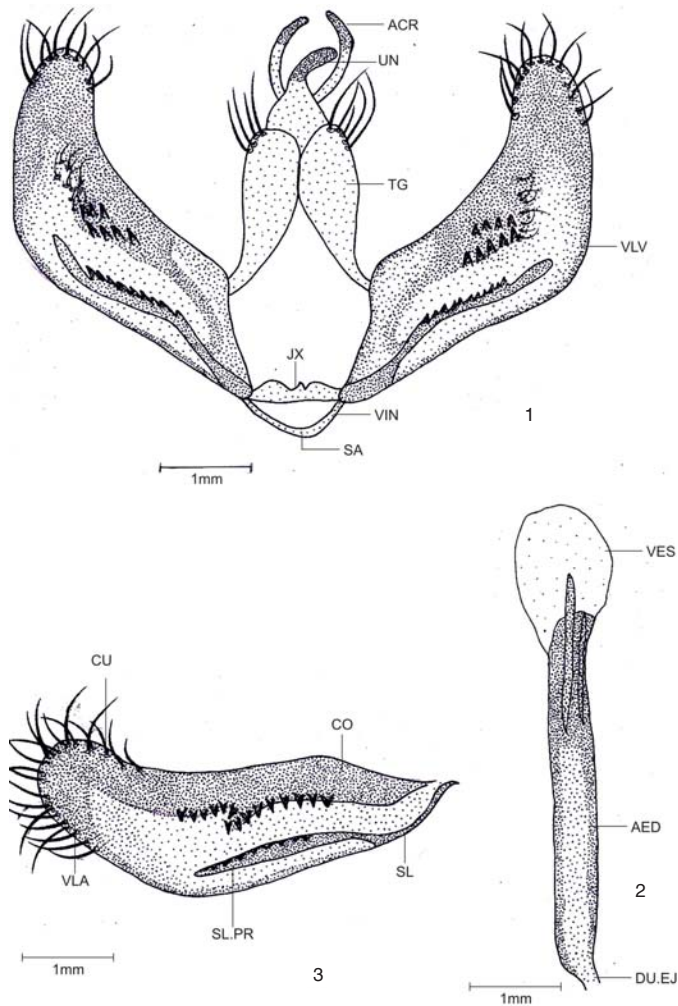
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Abbreviations: ACR - Acrotergite; AED - Aedeagus; CO - Costa; CU - Cucullus; DU.EJ - Ejaculatory duct; JX - Juxta; SA - Saccus; SL - Sacculus; SL.PR - Saccular Projection; TG - Tegumen; UN - Uncus; VES - Vesica; VIN - Vinculum; VLA - Valvula; VLV - Valva



Figures 1-3. *Hypomecis infixaria* (Walker)
1 - Male genitalia-ventral view; 2 - Aedeagus; 3 - Left valve

long, upper arms short; valva weakly sclerotized, narrow at base, broaden towards tip, setosed with setae; aedeagus well developed, sclerotized towards distal region; ductus ejaculatorius enters apically.

Genus *Peratophyga* Warren

Warren, 1894, *Novid. zool.* 1: 407

Type species: *Acidalia aerate* Moore.

Labial palpus porrect, hairy, not reaching beyond frons. Antenna serrate and fasciculate in male. Hind tibia dilated. Forewing of male with fovea; veins R₂, R₃, R₄ and R₅ stalked from before angle; M₁ and M₂ stalked from upper angle; Cu1 from just before angle of cell. Hindwing with vein Cu1 from angle of cell.

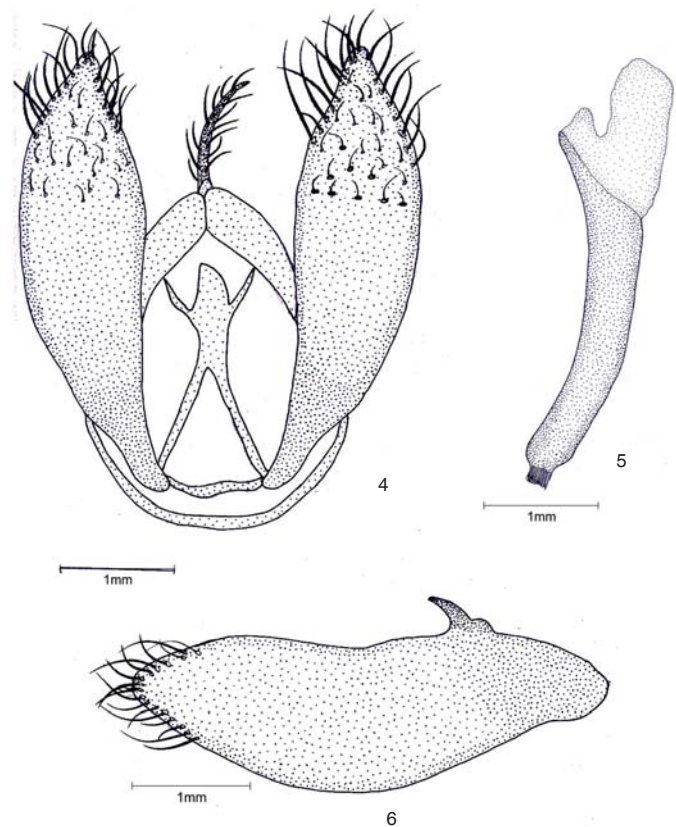
3. *Peratophyga hyalinata* (Kollar) (Figs. 7-9)

Kollar, [1844], *kasch, und das Reich der Siek* 4(2): 491.

Distribution: Shimla; Khasis.

Material examined: 1 male, 7.viii.2004; 1 male, 8.viii.2004; Sabathu, 2 males, 6.ix.2004; 1 male, 15.x.2004, Nauni, Himachal Pradesh. Collections deposited in the museum of Department of Zoology, Panjabi University, Patiala.

External male genitalia: Uncus long, wavy, narrow at base,



Figures 4-6. *Petelia medardaria* Herrich-Schaffer
4 - Male genitalia-ventral view; 5 - Aedeagus; 6 - Left valve

broadened gradually towards the tip ending in a short spine; tegumen shorter than uncus which is u-shaped, membranous; vinculum longer than tegumen, u-shaped; saccus weakly developed; juxta plate like; valva narrow at base, broaden towards middle, well sclerotized at top, setosed with setae; aedeagus long and broad; ductus ejaculatorius enters subapically.

Genus *Biston* Leach

Leach, [1815] 1830, *Bre. Edin. Ency.* 9: 134.

Type species: *Geometra prodromaria* (Denis and Schiffermuller).

Labial palpus short and hairy. Thorax stout and clothed with thick pile. Legs hairy. Hind tibia not dilated. Forewing with apex rounded; outer margin oblique; vein R₁ and R₂ stalked; R₃, R₄ and R₅ stalked from near upper angle; Cu1 from near angle of cell. Hindwing with cell long; vein Cu1 from angle.

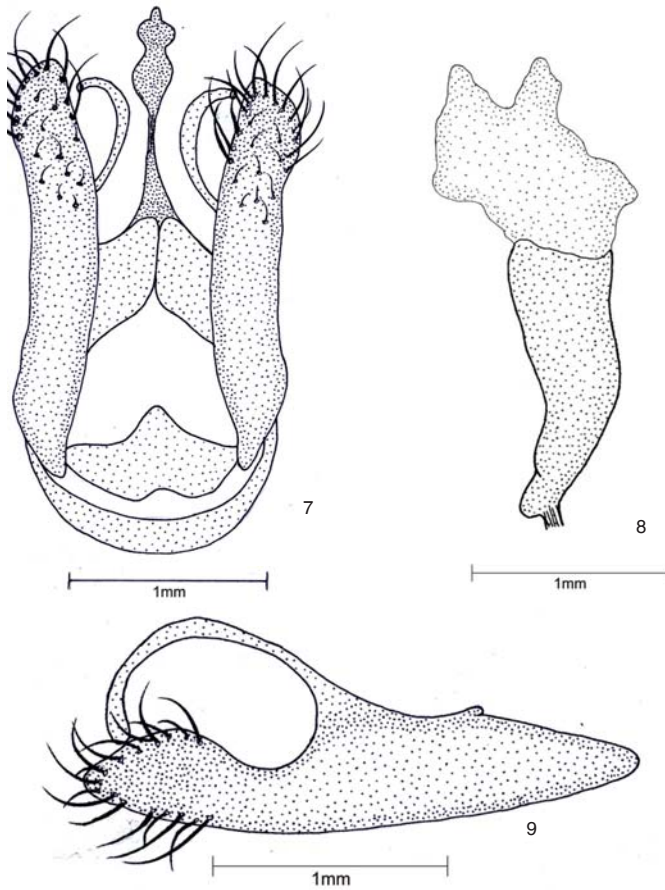
4. *Biston suppressaria* (Guenee) (Figs. 10-12)

Guenee, [1858], *Hist. nat. Ins. (Spec. gen. Lepid.)* 9: 210.

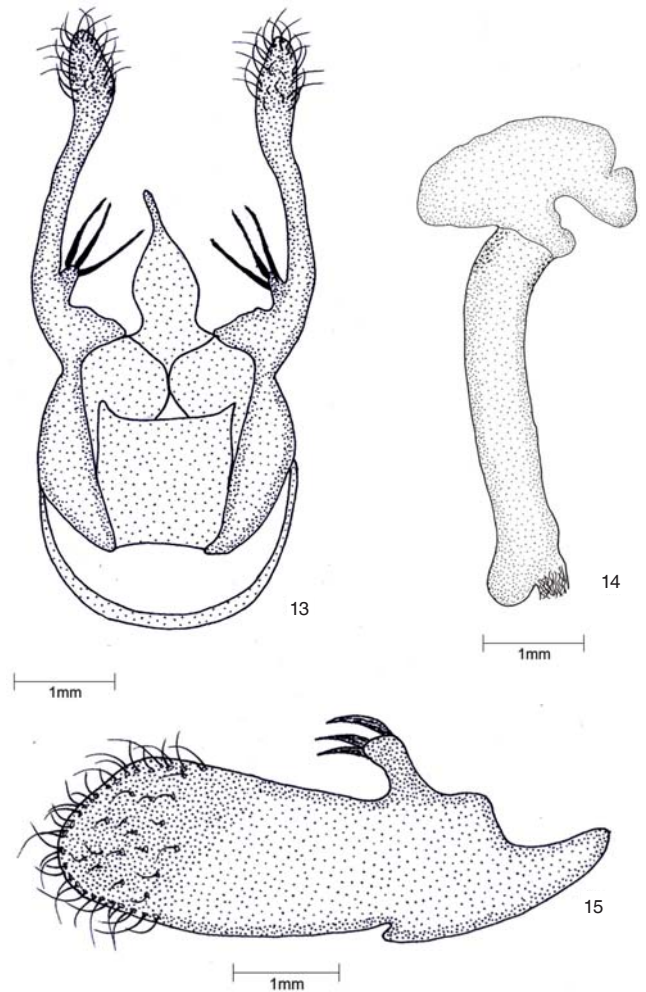
Distribution: Sikkim; Assam; Kangra.

Material examined: 4 males, 7.viii.2004; 1 male, 8.viii.2004, Nauni, Himachal Pradesh. Collections deposited in the museum of Department of Zoology, Panjabi University, Patiala

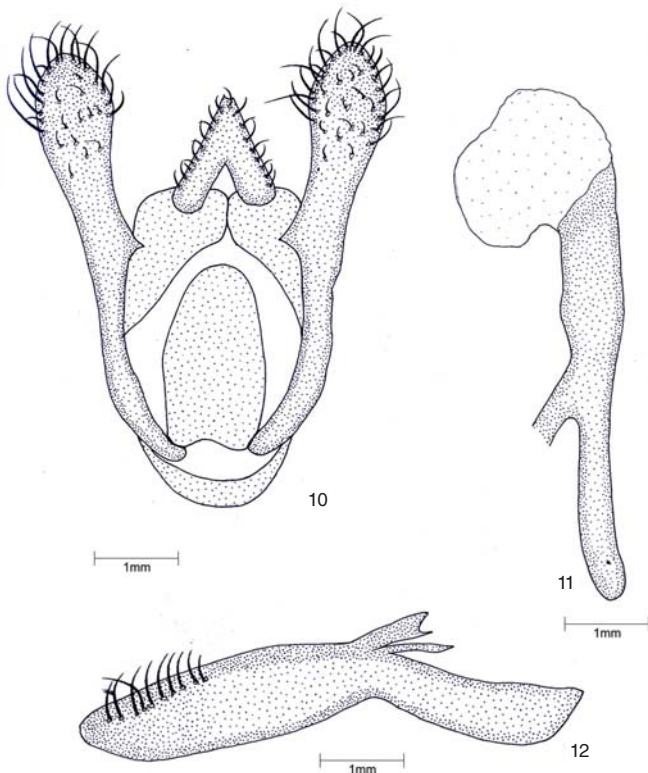
External male genitalia: Uncus short, broad at base, narrow towards tip, well sclerotized; tegumen longer than uncus, v-shaped, weakly sclerotized; vinculum longer than tegumen, u-



Figures 7-9. *Peratophyga hyalinata* (Kollar)
7 - Male genitalia-ventral view; 8 - Aedeagus; 9 - Left valve



Figures 13-15. *Gnophos tephrosaria* Moore
13 - Male genitalia-ventral view; 14 - Aedeagus; 15 - Left valve



Figures 10-12. *Biston suppressaria* (Guenee)
10 - Male genitalia-ventral view; 11 - Aedeagus; 12 - Left valve

shaped; saccus weakly developed; juxta well developed, oval; valva narrow at base, well sclerotized, upper part well differentiated into cucullus and valvula, heavily setosed with setae; aedeagus long and broad, well sclerotized; ductus ejaculatorius enters laterally.

Genus *Gnophos* Treitschke

Treitschke, 1823, *Schmett Eur.* 5(2): 432.

Type species: *Geometra furvata* (Denis and Schiffermuller). Labial palpus porrect, fringed with hair below. Hind tibia usually dilated with a fold containing a ridge of hair. Wings with outer margins crenulate. Forewing broad, with vein R₃, R₄, R₅ stalked from near upper angle; Cu1 from before or near angle of cell. Hindwing with vein Cu1 from before or near angle of cell.

5. *Gnophos tephrosaria* Moore

(Figs. 13-15)

Moore, 1888, *Descr. new Ind. Lepid. Ins. Colln* 1888(3): 247.

Distribution: Sikkim.

Material examined: 1 male, 6.ix.2004, 2 males, 2 females, 8.x.2004, Sabathu, Himachal Pradesh; 1 male, 16.x.2004, Nauri, Himachal Pradesh. Collections deposited in the museum of Department of Zoology, Panjabi University, Patiala.

External male genitalia: Uncus short, broad at the base, narrow towards the tip, curved; tegumen shorter than uncus, v-shaped; vinculum longer than tegumen, u-shaped; saccus well developed; juxta membranous; valva narrow at base, broadened towards the tip, setosed with well developed setae, ampulla developed bearing three prominent spines; aedeagus short and broad; ductus ejaculatorius enters subapically.

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