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SHORT COMMUNICATION

PRESENT STATUS OF THE GENUS *SPHRAGEIDUS* MAES, 1984 (LEPIDOPTERA: EREBIDAE: LYMANTRIINAE) FROM INDIA

Amritpal Singh Kaleka, Devinder Singh & Gagan Preet Kour Bali

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Present status of the genus *Sphrageidus* Maes, 1984 (Lepidoptera: Erebiidae: Lymantriinae) from India

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Abstract: The surveys to different localities of Himachal Pradesh, Jammu & Kashmir and Uttarakhand yielded three species of genus *Sphrageidus* Maes, namely *S. similis* (Fuessly), *S. simlensis* (Gupta) and *S. xanthorrhoea* (Kollar) of subfamily Lymantriinae. The external morphological characters particularly wing maculation and venation along with genitalia characteristics have been studied and illustrated in detail. The male genitalic features like distinct saccus, ring-like juxta, simple valva, aedeagus with a hook or reversed spine at the apex and distinct wing venation, i.e., absence of vein M₂ in hindwing completely conform the characterization of the genus. In the present studies, the species *simlensis* has been placed under genus *Sphrageidus* Maes making a new combination as *Sphrageidus simlensis* (Gupta) for its proper placement. The genus diagnosis has also been updated. The external morphological characters including wing maculation, venation and particularly the genitalic features proved significant from taxonomic point of view in all the three species.

Keywords: African, Palaearctic, similis, simlensis, xanthorrhoea.

Abbreviations: 1A—First anal vein | 2A—Second anal vein | 3A—Third anal vein | AED—Aedeagus | APS—Apical spur | ANT.APO—Anterior apophyses | CRN—Cornuti | CRP.BU—Corpus bursae | CU₁—First cubital vein | CU₂—Second cubital vein | DU.BU—Ductus bursae | JX—Juxta | M₁—First median vein | M₂—Third median vein | PAP.A—Papilla analis | PO.APO—Posterior apophyses | R₁—First radial vein | R₂—Second radial vein | R₃—Third radial vein | R₄—Fourth radial vein | R₅—Fifth radial vein | SA—Saccus | Sc—Subcosta | Sc+R₁—Subcosta+First radial vein | TG—Tegumen | UN—Uncus | VIN—Vinculum | VLV—Valva.

For the proper placement of a group of Palaearctic, African, and Madagascan species with white or yellowish forewings and a yellow anal tuft, genus *Sphrageidus* by Maes (1984) with *similis* Fuessly, 1775 as its type species from Europe was proposed. Holloway (1999) updated the status of *virguncula* Walker, 1855 and *xanthorrhoea* Kollar, 1848; he placed them under the genus *Sphrageidus*. He further remarked that the genus is related to two other genera namely *Toxoproctis* Holloway, 1999 and *Urocoma* Herrich-Schaffer, 1858 on the basis of long saccus in male genitalia. The genus is closely allied to genus *Euproctis* Hübner, 1819, but it is distinct in terms of wing venation, i.e., absence of vein M₂ in hindwing and male genitalic features such as ring-shaped juxta and presence of hook or reversed spine at apex of aedeagus. It also resembles with other allied genera namely *Somena* Walker, 1856 and *Orvasca* Walker, 1865 due to the absence of vein M₂ in hindwing (Holloway 1999). It is widely distributed in India, Africa, Myanmar, Sundaland, and Thailand. Gupta (1986) described a new species i.e., *simlensis* under genus *Porthesia* Stephens, 1829 from Shimla (Himachal Pradesh) but the male genitalia completely conforms the characterization of genus *Sphrageidus*. A new combination as *Sphrageidus simlensis* (Gupta, 1986) is

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Competing interests: The authors declare no competing interests.

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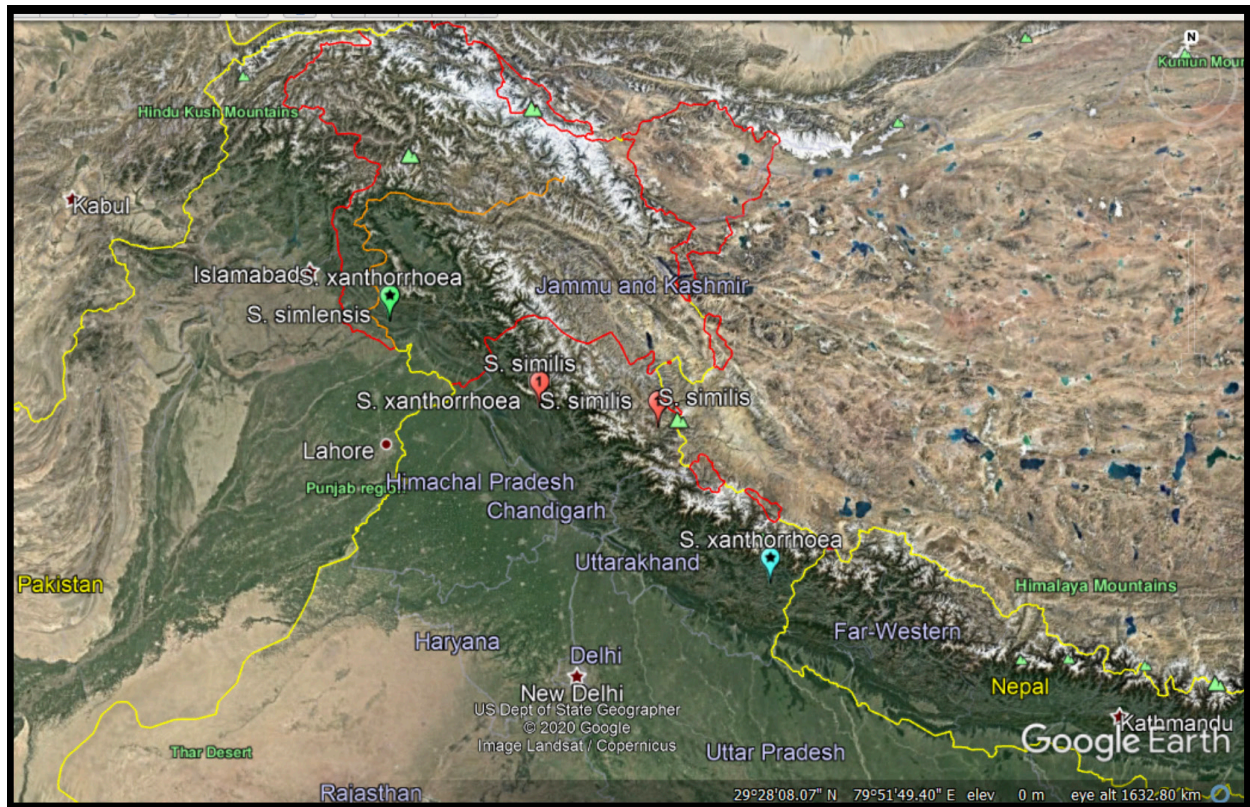


Image 1. Distribution of the genus *Sphrageidus* Maes in India.

proposed for the proper placement of the species.

MATERIAL AND METHODS

Different localities of Himachal Pradesh (32.084°N & 77.571°E), Jammu & Kashmir (34.083°N & 74.797°E), and Uttarakhand (30.316°N & 78.032°E) were surveyed for the collection of adult moths. The distribution map of the species studied was also drawn (Fig.1). The light traps equipped with a 160w mercury bulb and vertical white sheet were used for collection. To study of wing venation, the methodology proposed by Zimmermann (1978) was followed. The male and female moths were dissected to examine the external genital features (Robinson 1976) and the terminology for naming various genital parts given by Klots (1970) was followed in the present communication.

RESULTS AND DISCUSSION

The external morphological characters like ornamentation of antennae, legs and abdomen, wing maculation, wing venation, and significantly the external genitalic features contributed towards the authentic identification and characterization of examined taxa. The taxonomic status of the genus *Sphrageidus* has been

updated along with the upgradation of the distribution range.

Genus *Sphrageidus* Maes, 1984

Maes, 1984, *Nota. Lepid.*, 7(1): 55–58; Holloway, 1999, *Moths Borneo*, 5: 59.

Type species: *Phalaena similis* Fuessly, 1775

Distribution: Africa, Europe, Pakistan, India, China, Nepal, Myanmar, Thailand, South Korea, Sundaland.

Diagnosis: Small sized moths, usually white in colouration. Labial palpi porrect, hairy. Antennae bipectinate in both sexes. Forewing with ground colour whitish or yellowish; discal cell half the length of wing, closed; 1A+2A from base of wing, reaching apex; 3A absent; R_5-R_2 stalked, R_5 branching off more basally from R_s system than R_2 ; Sc from base of wing not reaching the apex. Hindwing with ground colour white; discal cell half the length of wing, closed; 1A+2A from base of wing, reaching apex; 3A absent; Cu_1 and M_3 stalked or arising independently from lower angle of cell; M_2 absent; M_1 and R_s stalked from upper angle of cell; $Sc+R_1$ from base of wing anastomosing with discal cell. Legs dressed with scales; fore-tibia with an epiphysis; mid-tibia with one pair of tibial spurs of unequal length; hind-tibia with two

Key to the studied species of the genus *Sphrageidus*

1. Head with orangish-yellow line; forewing with marginal area without yellow scales. Male genitalia with saccus having emarginate apex; juxta without any projection *similis* (Fuessly)
- Head without orangish-yellow line; forewing with marginal area irrorated with yellow scales. Male genitalia having saccus without emarginate apex; juxta with backwardly directed projection 2
2. Hindwing with ground colour white, costal area irrorated with grey scales, underside dressed with grey scales; forewing with M_1 shortly stalked with common stalk of R_5-R_2 . Male genitalia with saccus long, having rounded tip; juxta dome-shaped; valva with distal end reaching the level of uncus *simlensis* (Gupta) comb. nov.
- Hindwing with ground colour black, basal area irrorated with white scales, underside dressed with black scales; forewing with vein M_1 from upper angle of cell. Male genitalia with juxta ring-like having backwardly directed projection; valva reaching above the level of uncus *xanthorrhoea* (Kollar)

pair of tibial spurs of equal length. Abdomen slender, clothed with scales; distinct yellow anal tuft in females. Male genitalia with uncus robust; saccus long; juxta ring-like; valva simple, slightly upcurved; aedeagus with a hook or reversed spine at the apex. Female genitalia with papilla analis relatively short, extending ventrally in a quadrate manner like the head of manta-ray; corpus bursae may be with bicornute signum.

***Sphrageidus similis* (Fuessly, 1775)**

(Image 1–10)

Phalaena similis Fuessly, 1775, *Verz. Schweiz. Ins.*, 1775: 35.

Sphrageidus similis: Maes, 1984, *Nota. Lepid.*, 7(1): 55–58; Holloway, 1999, *Moths Borneo*, 5: 59.

Euproctis similis: Inoue et al., 1957, *Journ. Med. Sci and Biol.*, 10: 198.

Porthesia similis: Chao, 2003, *Fauna Sinica*, 30: 321.

Type locality: Europe

Diagnosis: Head with vertex and frons clothed with white scales, an orangish-yellow line behind the head. Labial palpi fringed with white scales. Antennae with scape and flagellum studded with white scales. Thorax with collar and tegula covered with white scales. Legs dressed with white scales. Abdomen furnished with white scales; anal segment fringed with orangish-yellow scales.

Wing maculation: Forewing with ground colour white, a small black or brown tornal mark, absent in females; fringe white; underside with costal area irrorated with greyish scales. Hindwing white.

Wing venation: Forewing with Cu_2 from middle of cell; Cu_1 from well before lower angle of cell; M_3 from lower angle of cell; M_2 from above lower angle of cell; M_1 from upper angle of cell; R_5-R_2 highly stalked from before upper angle of cell; R_1 from well before upper angle of cell. Hindwing with Cu_2 from beyond middle of cell; Cu_1 just before lower angle of cell; M_3 from lower angle of cell; M_2 absent; M_1 and Rs stalked from upper angle of cell; $Sc+R_1$ from base of wing anastomosing with discal

cell beyond middle.

Wingspan: Male: 50–52 mm; female: 26–40 mm.

Body length: Male: 12–14 mm; female: 4–12 mm.

Male genitalia: Uncus well developed, moderately sclerotized, basal half triangular, distal half laterally compressed, narrow with blunt apex; tegumen broad, U-shaped, narrow towards vinculum; vinculum moderately sclerotized, narrow ending into long, narrow saccus with blunt apex which is slightly emarginate giving minute knob-like appearance on lateral side, appears slightly bifid in lateral view; juxta ring-like, well sclerotized, without any backwardly directed projection. Valva simple; narrow, without any demarcation; semi-sclerotized; setosed; gradually narrowing towards distal end, having a slight protrusion on saccular side near one-third of valva, valva ending well above the level of uncus. Aedeagus of moderate size; proximal end flap-like; moderately sclerotized; distal end armed with backwardly directed spine, distal end circumferenced with fine denticles.

Female genitalia: Corpus bursae wedge-shaped, membranous without any distinct signum; ductus bursae from one side of the corpus bursae, narrow, almost half the length of corpus bursae, membranous; ductus seminalis originating from the junction of ductus bursae and corpus bursae; apophysis well-sclerotized, posterior apophysis narrower than anterior ones having tapering apices; papilla analis relatively short; rectangular, produced on one side, setosed with small setae; pseudo-papillae small, triangular, setosed with small setae.

Material examined: India: Himachal Pradesh: PUP-LYM-30i-ii, 09.x.2013, 2 females, Baijnath (32.052°N & 76.648°E, 998m), coll. Gagan Bali; PUP-LYM-30iii, 07.ix.2013, 1 male, Chamunda Devi (32.051°N & 76.643°E, 996m), coll. Gagan Bali; PUP-LYM-30iv, 14.v.2015, 1 female, Janitri (31.834°N & 76.777°E, 760m), coll. Gagan Bali; PUP-LYM-30v-vi, 14.ix.2014, 1 male, 1 female, Ropa (31.795°N & 78.421°E, 2086m), coll. Gagan Bali; PUP-LYM-30vii, 11.ix.2013, 1 male, Lamberi (33.077°N & 74.324°E, 336m), Jammu & Kashmir, coll. Gagan Bali.



1.07 of Actual Size



1.5 of Actual Size

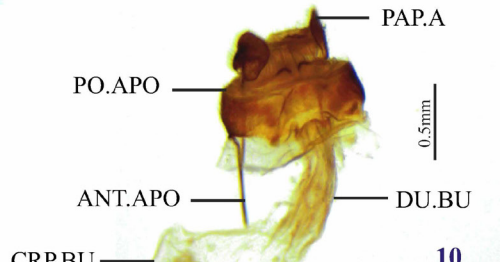
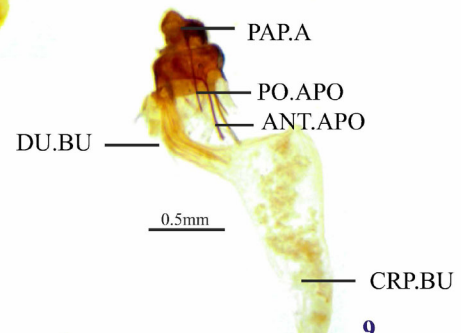
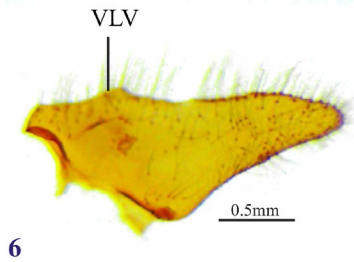
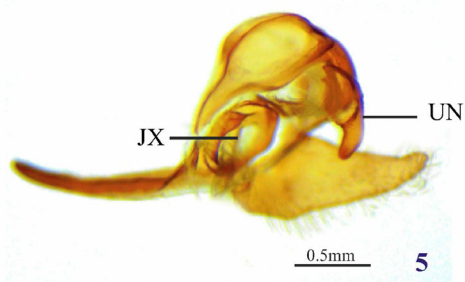
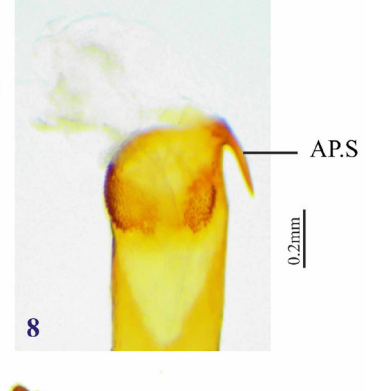
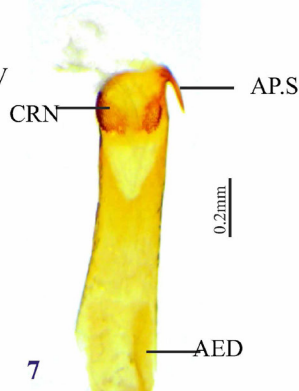
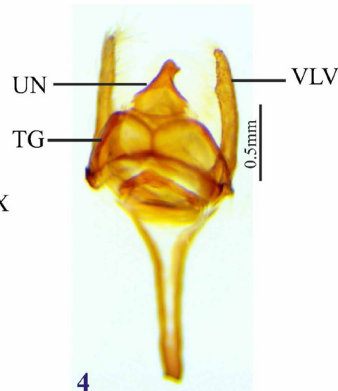
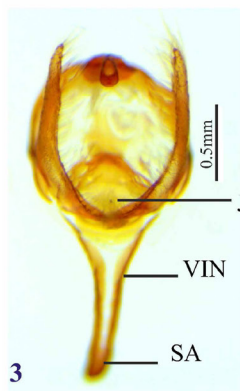
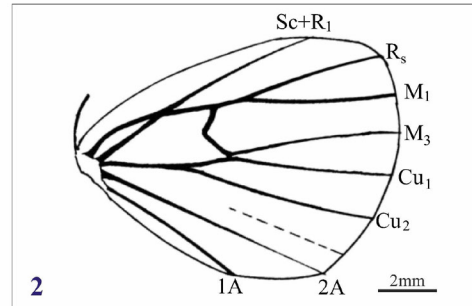
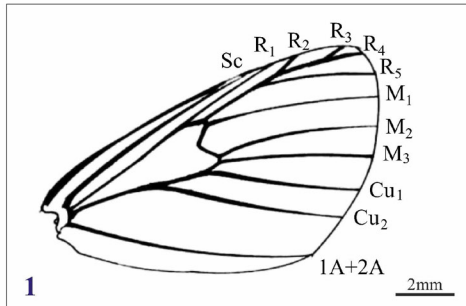


Image 1–10. *Sphrageidus similis* (Fuessly): 1—Forewing | 2—Hindwing | 3—Male genitalia - ventral view | 4—Dorsal view | 5—Lateral view | 6—Valva | 7–8—Aedeagus | 9–10—Female genitalia.

Distribution: Europe; India (Jammu & Kashmir, Himachal Pradesh); China; Sri Lanka; Korea; Siberia; Japan.

Remarks: Fussely (1775) originally described this species under genus *Phalaena* Linnaeus, 1758 from Europe. Inoue et al. (1957) transferred it to genus *Euproctis* Hübner, 1819. Maes (1984) proposed a new genus, *Sphrageidus* for its proper placement. Holloway (1999) followed the same nomenclature. Chao (2003) included it under another genus, *Porthesia* Stephens, 1829. In the present studies, the male and female genitalia of the present species have been studied in detail and it has been concluded that it completely conforms the characterization of *Sphrageidus* and the nomenclature proposed by Maes (1984) has been adopted.

***Sphrageidus simlensis* (Gupta) comb. nov.**
(Image 11–20)

Porthesia simlensis Gupta, 1986, *Reichenbachia*, 24: 107–108.

Type Locality: India (Shimla)

Diagnosis: Head with vertex and frons clothed with white scales. Labial palpi fringed with white scales. Antennae with scape and flagellum studded with white scales. Thorax, collar and tegula dressed with white scales. Legs covered with white scales. Abdomen furnished with white scales; distal segment fringed with orangish-yellow scales.

Wing maculation: Forewing with ground colour white; marginal area irrorated with yellow scales; underside white, costal half fuscous-grey. Hindwing white, costal area smoky; fringe white; underside fuscous-grey.

Wing venation: Forewing with Cu_2 from middle of cell; Cu_1 from beyond three-fourth of cell; M_3 from lower angle of cell; M_2 from above lower angle of cell; M_1 shortly stalked with common stalk of R_5-R_2 ; R_5-R_2 well stalked from upper angle of cell; R_1 from well before upper angle of cell. Hindwing with Cu_2 from beyond middle of cell; Cu_1 before lower angle of cell; M_3 from lower angle of cell; M_2 absent; M_1 and Rs highly stalked from upper angle of cell; $Sc+R_1$ from base of wing anastomosing with discal cell beyond its middle.

Wing expanse: Male: 26–44 mm; female: not examined.

Body Length: Male: 11–21 mm; female: not examined.

Male genitalia: Uncus of moderate size, well sclerotized, broad at base, dorsally setosed with small setae, gradually narrowing towards blunt apex; tegumen broad, U-shaped, medially dilated, narrow, quite narrow towards vinculum; vinculum semi-sclerotized, narrow, ending into long saccus with rounded end; juxta well

sclerotized forming a circular ring and having a long backwardly projected projection. Valva simple; semi-sclerotized; setosed; without any demarcation; distal end narrow, rounded, reaching upto the level of uncus. Aedeagus of moderate size, moderately sclerotized; proximal end flap-like; ductus ejaculatorius entering directly under this flap; distal end armed with backwardly directed long spine and circumference with two patches of fine denticles.

Material examined: India: PUP-LYM-29A i-iii, 11.ix.2013, 3 males, Lamberi (33.077°N & 74.324°E, 336m), Jammu & Kashmir, coll. Gagan Bali.

Distribution: India (Jammu & Kashmir, Himachal Pradesh).

Remarks: Gupta (1986) described the present species as a new species under genus *Porthesia* from Shimla (Himachal Pradesh). During the present studies, the external morphological structures including the wing venation and genitalia have been studied in detail. On the basis of characters such as absence of vein M_2 in hindwing and robust uncus; long saccus; simple, slightly upcurved valva; ring-like juxta and reversed spine at the apex of aedeagus in male genitalia, it has been concluded that it completely conforms to the characterization of the present genus. Thus, it has been placed under the present genus *Sphrageidus* making a new combination as *Sphrageidus simlensis* (Gupta, 1986). Its collection from Lamberi is its first record from Jammu & Kashmir.

***Sphrageidus xanthorrhoea* (Kollar)**
(Image 21–29)

Liparis xanthorrhoea Kollar, 1848, in *Hugel, Kaschmir und das Reich der Siek*, 4(2): 470.

Sphrageidus xanthorrhoea: Holloway, 1999, *Moths Borneo*, 5: 59; Shah et al. 2018, *Bionotes* 20(1): 28.

Porthesia xanthorrhoea: Hampson, 1892, *Moths India*: 1: 485; Chao 2003, *Fauna Sinica* 30: 318.

Arctornis xanthorrhoea: Swinhoe, 1922, *Ann. Mag. Nat. Hist.* (9) 10 (58): 479.

Euproctis xanthorrhoea: Kishida, 1993, in *Haruta, Moths Nepal*, Part 2, 13(3): 88.

Type locality: Sri Lanka

Diagnosis: Head with vertex and frons clothed with white scales. Labial palpi fringed with white scales. Antennae with scape and flagellum studded with white scales. Thorax, collar and tegula dressed with white scales. Legs furnished with white scales. Abdomen covered with white scales; distal segment fringed with orangish-yellow scales.

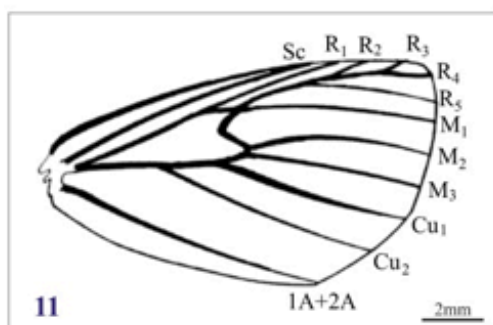
Wing maculation: Forewing with ground colour white, marginal area irrorated with yellow scales;



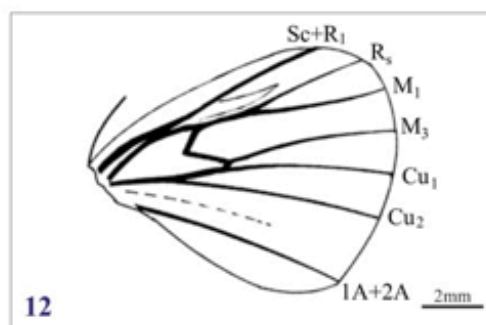
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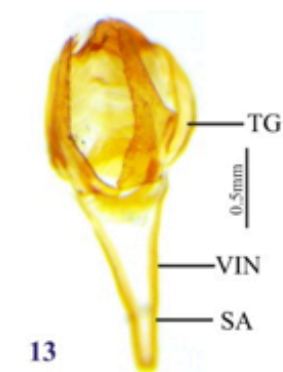
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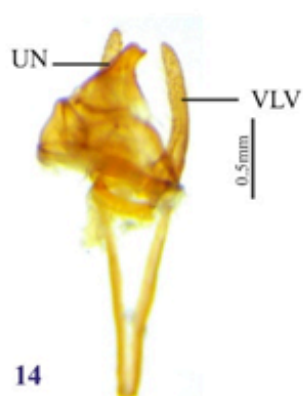
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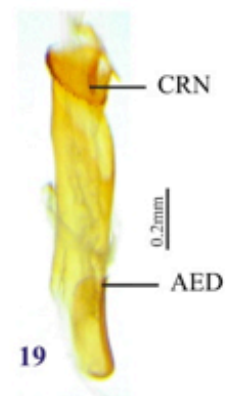
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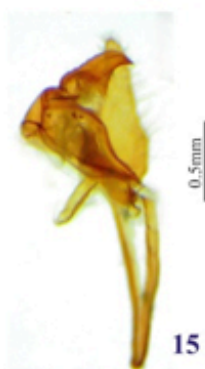
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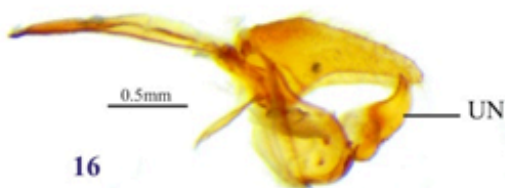
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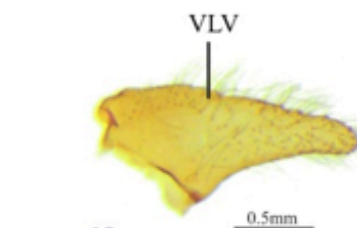
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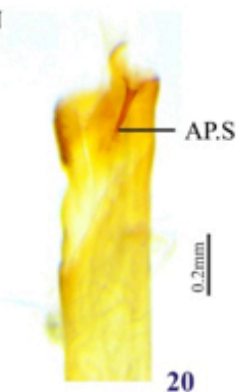
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Image 11–20. *Sphrageidus similensis* (Gupta) comb. nov.: 11—Forewing | 12—Hindwing | 13—Male genitalia - ventral view | 14—Dorsal view | 15–17—Lateral view | 18—Valva | 19–20—Aedeagus.



1.6 of Actual Size



Underside

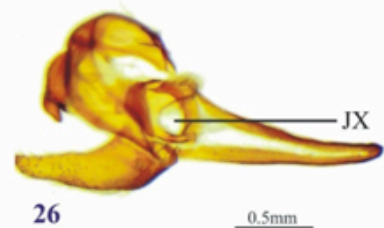
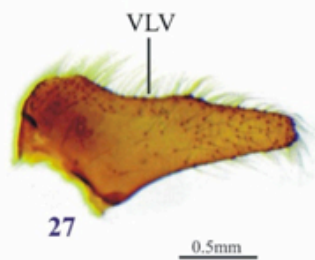
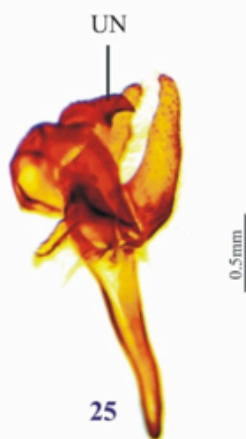
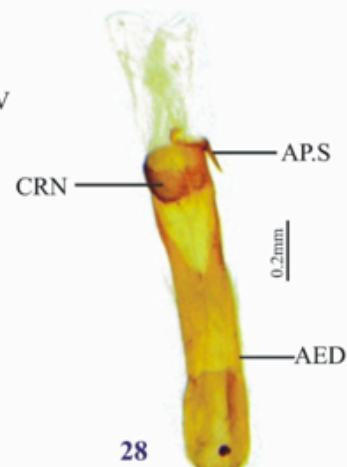
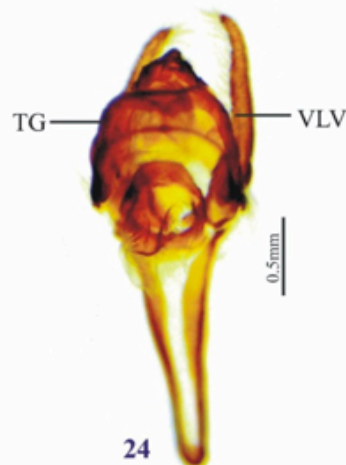
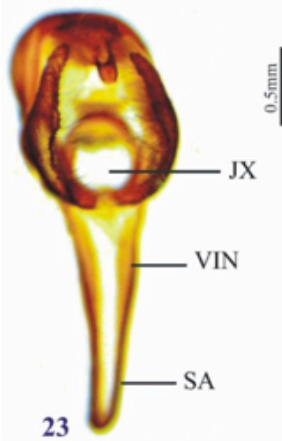
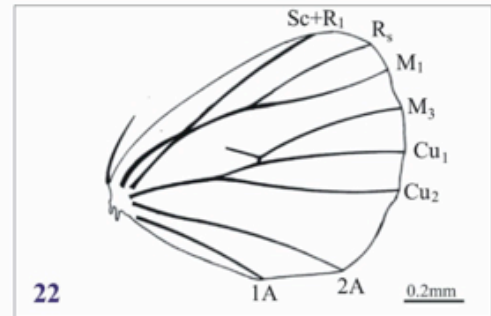
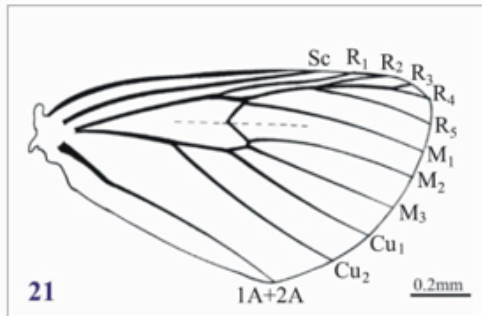


Image 21–29. *Sphrageidus xanthorrhoea* (Kollar): 21—Forewing | 22—Hindwing | 23—Male genitalia - ventral view | 24—Dorsal view | 25—Lateral view | 26—Lateral view | 27—Valva | 28—Aedeagus.

underside blackish-grey, outlined with pure white; fringe white. Hindwing with ground colour blackish-grey; basal area white; fringe white; underside blackish-grey, outlined with pure white.

Wing Venation: Forewing with Cu_2 from well before two-third of lower angle of cell; Cu_1 from well before lower angle of cell; M_3 from lower angle of cell; M_2 from above lower angle of cell; M_1 from upper angle of cell; R_5-R_2 highly stalked just before upper angle of cell. Hindwing with Cu_2 from two-third of lower angle of cell; Cu_1 from just before lower angle of cell; M_3 from lower angle of cell; M_2 absent; M_1 and Rs stalked from upper angle of cell; $Sc+R_1$ from base of wing anastomosing with discal cell beyond its middle.

Wingspan: Male: 24–32 mm; female: not examined.

Body length: Male: 12–13 mm; female: not examined.

Male genitalia: Uncus of moderate size, well sclerotized, basal half triangular, distal half laterally compressed with blunt apex, appears pointed in lateral view; tegumen quite broad, U-shaped, quite narrow towards vinculum; vinculum narrow, moderately sclerotized ending into quite long, narrow saccus with rounded end; juxta well developed, well sclerotized, ring-like, a backwardly directed projection from inner side of distal end. Valva simple, semi-sclerotized; setosed; saccular area broad; distal end narrow, round having a slight protrusion/hump on saccular margin; valva ending well above the level of uncus. Aedeagus of moderate size; proximal end flap-like; slightly more sclerotized; ductus ejaculatorius entering directly from proximal end; distal end armed with backwardly directed spine, circumferenced with fine denticles; vesica without any distinct cornuti.

Material examined: PUP-LYM-29i, 09.x.2013, 1 male, Baijnath (32.052°N & 76.648°E, 998m), Himachal Pradesh, coll. Gagan Bali; PUP-LYM-29ii, 11.ix.2013, 1 female, Lamberi (33.077°N & 74.324°E, 336m), Jammu & Kashmir, coll. Gagan Bali; PUP-LYM-29iii, 22.vi.2015, 1 female, Berinag (29.775°N & 80.055°E, 1,860m), Uttarakhand, coll. Gagan Bali.

Distribution: India (Jammu & Kashmir, Himachal Pradesh, Uttarakhand); China; Nepal; Sri Lanka; Indonesia; Java.

Remarks: Kollar (1848) originally described the present species, *xanthorrhoea* under *Liparis* Ochsenheimer, 1810 from Sri Lanka. Hampson (1892) transferred it to genus *Porthesia* Stephens. Swinhoe (1922) studied it under *Arctornis* Gremar, 1810. Kishida (1993) considered it as *Euproctis xanthorrhoea* Kollar 1848 and described its male genitalic features. Holloway (1999) placed it under *Sphrageidus* Maes on the basis of

its definitive male genitalic features which completely conforms the characterization of the genus. Though Chao (2003) followed Hampson's nomenclature but its placement proposed by Holloway (1999) has been followed. The species under reference closely resembles with *Sphrageidus simlensis* Gupta in general appearance. The morphological features such as black hindwings with white basal area; underside of both wings uniformly black outlined by white and distally narrow valva with a slight protrusion/hump on saccular margin in male genitalia further makes it a distinct species.

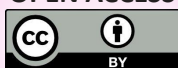
In insects, genitalic features are highly species-specific (particularly in Lepidoptera) and play a significant role in species identification and delimitation. In the present study, the external morphological characters including wing maculation, venation and particularly the genitalic features proved significant from taxonomic point of view. The male genitalic features of all the three species such as robust uncus; long saccus; simple, slightly upcurved valva; ring-like juxta and reversed spine at the apex of aedeagus in male genitalia and distinct wing venation, i.e., absence of vein M_2 in hindwing completely conforms the characterization of the present genus.

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