

A NEW SPECIES OF GENUS *AGROTIS* OCHSENHEIMER (LEPIDOPTERA: NOCTUIDAE) IN PAKISTAN

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ABSTRACT

The family Noctuidae has most important insect pests which damage the cereal and cash crops. For proper identification and classification of these insect pests, taxonomy plays a vital role form successful management strategy. In the present study, several diagnostic characteristics were examined but typically concentration was made on genitalia for the proper identification of species. Specimens were dissected carefully and genitalia were examined under Stereo microscope. As a result, *Agrotis hirsutumus* is new to science and the first time described from Pakistan. *Agrotis* species which have been reported from Pakistan are also included in the key.

Keywords: *Agrotis: hirsutumus*, Bahawalpur, Male Genitalia, Systematic Study, Pakistan.

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INTRODUCTION

Lepidoptera is one of the most predominant terrestrial order and perform critical role in an ecosystem including nutrient cycling, decomposition, pollination and providing prey for passerine birds (Schmidt and Roland 2006; Jaroensutasinee *et al.*, 2011). This group is most suitable to quantify the evaluations between the insect faunas especially for their species richness and evenness in response to flora and climate (Nielsen and Common 1991). This order comprises of butterflies and moths that have 160000 described species belonging to 180 families (Van Nieuwerkerken *et al.*, 2011; Rabieh 2018). From these families, Noctuidae is probably the most dominating macro-lepidopteran family with more than 35000 described species belonging to 4200 genera and 29 subfamilies (Meena *et al.*, 2017). Noctuid moths are considered most dynamic component of natural and agricultural ecosystems. Most of the pest species have posed threat to the agricultural crops and forests due to their high species biodiversity, maximum reproductive rate, migratory and phytophagous feeding nature of the larvae. The crucial feeding behavior of immatures gives the damaging pest status to the members of family Noctuidae in agro-ecosystem worldwide. Subfamily Noctuidae also economically very important tribes, Agrotini and noctuini (Pogue 2006).

A systematic study of the genus *Agrotis* is very important for boosting the crop yield because members of this genus are the cutworms which are roots and foliage feeders of many economic crops such as cotton, wheat, rice, sugarcane, sunflower, and farm vegetables like ladyfinger, cabbage, potato, tomato and tobacco

(Kravchenko *et al.*, 2006). Most of the caterpillars live inside the cracks and crevices of soil during daylight hours but vigorously damage the leaves at night with high reproductive rate (Gillott 2003). For proper identification and classification of these species, genital organs are most frequently used because their genital organs are structurally species specific. Sometimes, species of the genus are morphologically similar but differ on the base of genital organs (Atay 2012). Genus *Agrotis* was first time described by (Ochsenheimer 1816) and added 46 species. Among these species, three species were new identified and 43 species have been already described but associated with other genera. *Agrotis* species were re-grouped into other genera by (Hübner 1821). (Curtis 1827) identified *Agrotis segetum* Denis & Schiffermüller as the type species and also mentions the problems associated with the characterization for grouping of variable species and make three species groups on the basis of male antenna. (Smith 1890) was first time suggested that the characteristics of the genitalia play most vital role in the identification of *Agrotis* species because morphological characters are misleading and also mention that the previous efforts have been poor and arbitrary. (Hampson 1894) exclusively used the morphological characters including spines on tibia and type of male antenna. Later on, Hampson continues his work till 1920 and classified several *Agrotis* species associated with different genera and this classification system was followed for a century. (Kitching 1984) and (Lafontaine 2004) improved the classification of Hampson on the basis of genital characters and also taking a major step toward the current classification through rearrangement of the subfamilies, genera and

reevaluates species status.(Lafontaine 2004) revised the taxonomic status of Agrotini from North American and diagnosis the genus *Agrotis* through morphology and genitalic characteristics of both sexes.(Naz 2011) reported nine species from Pakistan and (Sekhon 2015) re-described four species on the base of genitalia; *Agrotis flammata* Schiff, *A. segetum* Schiff, *A. ypsilon* Potenberg and *A. biconica* Kollar from India of the genus *Agrotis*.

For considering the significance of taxonomy and biodiversity, the current research was conducted to identify and classify the species of subfamily Noctuidae by morphological and genital characteristics of the genus *Agrotis* from district Bahawalpur, Punjab, Pakistan.

MATERIALS AND METHODS

Field collection of Noctuid moth: Moths belonging to the subfamily Noctuidae were collected by the conical iron light traps with bulb (200 watts) from different localities of the District Bahawalpur, during 2017-18. The selected localities (town level) of Bahawalpur were; Lal Suhanra National Park, Dera Bakha, Chak No. 7BC, Yazman, and Khanqah Sharif.

Examination of genitalia: Noctuid moths were killed in potassium cyanide jar. Then these killed moths were soaked in butter paper for 2 to 3 hours in glass petri dishes to soften the body appendages such as wings, antenna and legs for proper spreading. A comprehensive picture of adult along with tag was taken by digital camera (HD 1500 T Meiji). Both forewings and hind wings were detached from the body by giving gentle upward jerk to examine the venation. These wings were descaled by immersing into 70% alcohol for about 1 to 2 minutes and then transferred into sodium hypochlorite (NaOCl) solution for 20 minutes and washed 2 to 3 times by distal water. To study the genitalia, moth abdomen was cut from the body with the help of forceps and scissor and dipped for overnight in 10% potassium hydroxide (KOH) solution to relax the internal muscles. Insect abdomen was carefully dissected by sharp and fine needles under the stereomicroscope (Meiji EMZ-5TR). Genitalia was washed 2 to 3 times in distilled water to wash out the KOH residues and subsequently dipped for 15 to 20 minutes into 50%, 60%, and 70% concentration of ethanol to clean all the parts of genitalia (Triplehorn and Johnson, 2005). Photography/illustration of the diagnostic characteristics of the adult moth and genitalia were taken by a digital camera (HD 1500 T Meiji).

Permanent mounting of the genitalia: Canada balsam was used for permanent mounting of genitalia and wings on glass slides along with appropriate labeling. Slides were left in horizontal positions for 3 to 4 days for drying and then shifted into slide boxes.

RESULTS AND DISCUSSION

Genus *Agrotis* Oohsenheimer, 1816

Diagnostic characteristics: Adult of the genus *Agrotis* has a muscular proboscis with strong oblique labial palpi with scales and second segment is intensively projected in front. Frons is rounded, sometimes with small and dissimilar prominence. *Agrotis* species have smooth, naked and without lashes eyes. In male moth, half of the antenna is bipectinate and remaining half is ciliated. A tuft of hairs is present on thorax and abdomen. Forewings are non-crenulated at outer margin, while hind wings have 3 or 4 veins from the cell. Tibiae fringed with different length of spines in different genera. Spines present on all tibiae, sometimes absent in one or two tibiae but in few case spines absents in all tibia. Valva of the male genitalia is slender and sides are broad, attached with corona and clasper; clavus is hairy. Vesica of the aedeagus is unarmed or with one or two scobinate blotches.

Keys to species of the genus *Agrotis* Oohsenheimer

- from Pakistan:** In male genitalia, aedeagus is highly sclerotized, cylinder-like with coiled and membranous vesica2
- Aedeagus of the male genitalia is long, well developed while vesica nearly 2 to 6 time as long as aedeagus.....22
 - 1. Uncus very long in length, slender form and well-developedscaphium found at tuba analis.....*A. cinerea* (Denis and Schiffermüller)
 - Uncus moderate in length curved at the tip that fringed with hairs and tuba analis without scaphium.....3
 - 2. Tegumen large, broad, well-formed and slightly sclerotized.....*A. biconica*Kolar
 - Both tegumen and uncus are almost identical in length, both arms tegumen wide, inverted V-shaped and weakly sclerotized..... 4
 - 3. Juxta shield-like has highly-sclerotized transtilla. Sacculus round and has triangular shape projection*A. sicca* Guenee
 - Juxta and transtilla are membranous. Sacculus round and has a spine-like projection....5
 - 4. Vesica of the aedeagus is membranous, partly scobinate by single and large cornutus while laterally ingoing ductusejaculatorious.....*A. plecta* Linnaeus
 - Vesica is membranous, incompletely scobinate without cornuti with sub apically entering ductusejaculatorious.....6
 - 5. Valva symmetrical, well-developed and divided into parts. Costal area long and arm like.....*A. putris* Linnaeus
 - Valva is spatulate and elongated. Clavus fine and almost straight in length.....7

6. Uncus is narrow and straight, juxta shield-like and almost round shape....*A. rachingeri* Gyulai and Saldaitis
- Uncus is apically straight broader, juxta of the genitalia just look like a flower and slightly hooked8
 - 8 Clavus is large and clearly visible.....*A. kinabaluensis*Holloway
 - Clavus is short and inconspicuous.....9
 - 9 Vesica of aedeagus has single dentate ridge.....*A. infusa* (Boisduval)
 - Vesica of the genital aedeagus has numerous dentate ridges.....10
 - 10 Tip of the clasper is pointed.....*A. colossa* Gyulai and Saldaitis
 - Clasper is curved and round shape apically.....11
 - 11 In the case of female genitalia, both bursa seminalis and bursa copulatrix are equal in diameter.....*A. munda* Walker
 - The diameter of the bursa seminalis is thicker than bursa copulatrix.....12
 - 12 Valva of the male genitalia is wide at distal margin while in female genitalia, ostiumbursi is shallow, round and cup-shape.....*A. radians* Guenee
 - Valva is distally short in length. Ostium is small, round and cup shape.....13
 - 13 Female genitalia, signum is weakly sclerotized and has scobinate patches.....*A. cygnea* Common
 - Ductus copulatrix has a thick and oval shape signum.....14
 - 14 Corona has a series of well-developed marginal spines and clavus is short.....*A. interjectionis* Guenee
 - Corona has a sequence of slightly tapering spines and clavus is moderate in size.....15
 - 15 Clasper of the valva curved and slightly round apex.....*A. poliophaea* Turner
 - Clasper stout-shape with sharp apex.....16
 - 16 In male genitalia, vesica has 2 dentate patches.....*A. poliotis*Hampson
 - Dentate patches absent on vesica of the aedeagus.....17
 - 17 Tegumen without scaphium*A. porphyricollis* Guenee
 - Tegumen has well-developed scaphium ...18
 - 18 Valva is leaf-like and penicular hairs absent.....*A. benigna* Corti
 - Valva is leaf-like fringed by penicular hairs...19
 - 19. Tubular shape aedeagus that has thorn-shape thical appendage. Membranous and long conjunctival lobe, at the base it has proximally large spine shape structure and group of small spines. At inner and median margins of vesica have small ring-like cornuti.....*A. oblique* Smith
 - Aedeagus of the genital organ cylindrical that sinuated at distal margin of theca, approximately 100 membranous conjunctival lobes are large and its distal margin has membranous leaf-like processes. Cornuti found at the base of the aedeagus.....20
 - 20. Tegumen, scaphium and harps on the valva are larger in length.....*A. malefida* Guenee
 - Tegumen lack the scaphium and harps are shorter in length.....21
 - 21. Uncus is long, curve from the base and hairy. Vinculum u-shaped.....*A. ipsilon* (Hufnagel)
 - Uncus is elongate, curve nearly from the base and hairs absent. Vinculum v-shape*A. hirsutumus* Sp. Nov
 - 22. Dorsal edge of clasper is straight and smooth. Both costal and ventral borders of the valva are curved.....*A. beesoni* Kapur and Aurora
 - Ventral and costal margin of the valvais straight and clasper is slightly sharp.....23
 - 23. The wingspan of the adult is around 33–41 mm in length, forewing light brown to gray in color.....*A. psammocharis*Boursin
 - Adult wingspan is about 29-33 mm in length, usually, forewings are garish brown.....24
 - 24. In female genitalia ovipositor is small, both ductus and corpus bursi are short but equal in length.....*A. lasserrei* Oberthur
 - Ovipositor of the female genitalia is long and ductus bursi is larger than corpus bursi....25
 - 25. Antennae are intensely pectinate, light brown to light gray color forewings. light brown to light gray.....*A. obesascytha* Alpheraky
 - Simply pectinate antennae. Forewings are light brown to creamy color.....26
 - 26. Distal 1/3rd area of the valva is narrow, round apex. Clasper is short and sickle-like clasper*A. bifurcagrossi* Hacker and Kuhna
 - Costal edge of the valva is moderately arched. Clasper is long and sickle-shape.....27
 - 27. In the female copulatory organ, appendix bursae are long, curve, cylinder-shape and two times larger than corpus bursae.....*A. bigramma* Esper
 - Appendix and corpus bursi of female genitalia are long, tube-like and curve. Occasionally appendix bursi either long or almost identical in length to the corpus bursi28
 - 28. Valve are reasonable in size, its costal area is nearly straight and ventral area arched.....*A. spinifera*Hübner
 - Valva is long; the distal 1/3rd area is comparatively narrow, sharp. Its costal and ventral parts are curved.....29
 - 29. Clasper is moderate in size and round about slender like.....*A. herzogi* Rebel
 - Clasper is sickle type.....30

30. The wingspan of the adult is 28–32 mm in size, whitish creamy forewing.....*A. puta* Hübner
- Adult wingspan is 34-42 mm, forewings are gray to brown color.....31

31. Posterior apophyses of the female genitalia are larger than anterior apophyses and appendix bursae 2 times as long as the corpus bursae.....*A. sardzeana* Brandt

- In female genitalia, posterior apophyses are almost the same in size as anterior apophyses. Appendix bursae 3 times as long as corpus bursae.....32

32. Ductusbursae are short, narrow at distal half of the portion with highly sclerotized bands*A. exclamationis* (Linnaeus)

- Ductus bursae long in size. Ostium bursae well sclerotized.....33

33. Aedeagus is broad at the center, tube shape. Vesica is 4 times longer than the aedeagus.....34

- Aedeagus is wide at the medial. Vesica 5 times longer than the aedeagus..... *A. trux* Hübner

34. The sub-terminal line of the forewing is prominent and dark brown in color. Hind wings are a pearl to white color.....*A. segetum* (Denis and Schiffermüller)

- The sub-terminal line of the forewing is obsolescent. Hind wings are light cream color mixed with light gray color.....35

35. Antennae are pectinate but distally reduced this feature. *A. clavis* (Hufnagel)

- The antenna is bi-pectinate and gently tapered towards the apex.....36

36. Vesica 6 times as long as aedeagus having 1 and 1/2 wide loops, sub-triangular shape right basal diverticulum is present.....*A. propriens* Dayar

- Vesica 2 times as long as aedeagus, 1 and 1/2 wide loops without right basal diverticulum.....37

37. Patagium is slightly darker than thorax with the black medial line. Tegulum is lighter in color than thorax with black basal line.....*A. steniptera* Dognin

- Patagium of the thorax have black medial line, apex half of the thorax is slightly lighter than thorax and tegulum without basal line.....38

38. Ampulla 1/4 time as long as the valva, half of the base is long and narrow to its 1/2 wide diameter ...*A. bistrigata* Maassen

- Ampulla 1/5 time as long as the valva, basal 1/3 is elongated and narrow to its 1/3 wide diameter.....*A. dispar* Köhler

Agrotis hirsutumus Sp. Nov

Description

Head: Head and vertex of the body are concealed by brown hairy scales. Antennae bipectinate and inverted labial palpi. Golden brown eyes. **Thorax:** Thoracic area

enclosed with smoky brown scale, forewing ground with pale brown color while costal area is brown. Antemedial, postmedial and subbasal lines of the fore wings have pale area extended up to the post medial and sub marginal lines. Hind wings are the white color with brown costa. Outermost half veins and terminal line of the hind wing are brown. **Abdomen:** Abdominal segment of the body is hairy and fringed by brown scales (Fig. 2A).

Type Species

Holotype: ♂, 9.x.2017 Yazman, (M. Sajjad) District Bahawalpur, Punjab Pakistan deposited in taxonomic laboratory.

Paratype: Punjab: Bahawalpur: Yazman 03♂, 9.x.2017, Dera Bakha 02 ♂, 02. ix. 2017, Lal Suhanrah 03 ♂, 13. ix. 2017, Khanqah Sharif 03♂, 17.x. 2017, Chak No. 7BC 03♂, 21. x. 2018.

Etymology: The specific name *hirsutumus* derived from its host crop cotton (*Gossypium hirsutum*)

Male genitalia characters of *Agrotis hirsutumus* Sp. Nov:

Nov: Tegumen is long, broad, well developed and highly sclerotized. Valva is elongated and fully formed, but thin near the base and become wide apically. Valva also looks just like a leaf with long, robust and spine like harps. Saccus highly sclerotized. Costal margin of the valva is concave and somewhat hairy while ventral margin straightforward up to center and then curved. Flower-like juxta with a pointed base. Vinculum u-shaped and short highly sclerotized saccus with pointed base (Figure 2D). Aedeagus of male genitalia is stout shape, vesica coiled with small numbers of cornuti and its central area dark and thick. (Figure 2E).

Table 1. Measurement of different morphological and genital parts (mm) of *A. hirsutumus* Sp. Nov.

Characters	<i>A. hirsutumus</i> Sp. Nov.
Head	4
Antennae	7
Wingspan	25
Aedeagus	3.5
Valva	4
Saccus	0.8
Tegumen	2.2
Uncus	1.0
Juxta	1.0
Scaphium	1.4
Harp	1.2

Remarks on basis of the morphological characteristics:

This species is closely resembled to already described species i.e., *Agrotis ipsilon*. In current collection, *A. ipsilon* was also examined both species were almost similar but *A. hirsutumus* Sp. Nov. differ

from *A. ipsilon* by the following characteristics. Head and vertex of *A. ipsilon* fringed with greyish hairs while in case of *A. hirsutumus* fringed with brown hairs. (ii) Eye color is black in *A. ipsilon* but golden brown in *A. hirsutumus*. (iii) Thorax region of *A. ipsilon* is covered with light grey scales while *A. hirsutumus* shielded with smoky brown scales. (iv) Wingspan of *A. ipsilon* is 43 mm while wingspan of *A. hirsutumus* is 25 mm. (v) Forewings of the *A. ipsilon* are the pale grey color with black costal margin while in case of *A. hirsutumus* forewings are pale brown with the brown costal area. (vi) In *A. ipsilon*, sub-basal, antemedial and post medial lines are present on forewings with the black spot but in *A. hirsutumus* sub basal, antemedial and post medial lines have pale brown spot. (vii) Hind wings of the *A. ipsilon* are semi-hyaline white and transparent but in *A. hirsutumus* hind wings are yellowish white in color.

Remarks on the basis of Physiological characteristics:

This species also differ from *A. ipsilon* on base of reproductive system (i) Uncus of *A. ipsilon* is fringed by penicular hairs while lacking in case of *A. hirsutumus* Sp. Nov. (ii) Tegumen of *A. ipsilon* is thin but long and broad in *A. hirsutumus*. (iii) Uncus base of *A. ipsilon* has circle-like structure while in case of *A. hirsutumus* absent the ring like structure at uncus base. (iv) Aedeagus of *A. ipsilon* has maximum numbers of cornuti but in case of *A. hirsutumus*, aedeagus has minimum numbers of cornuti. (v) Uncus of *A. ipsilon* is slim, straight and short in length with pointed tip but in *A. hirsutumus* uncus is broad and curved with rounded tip. (vi) Harps short in length in *A. ipsilon* but in *A. hirsutumus* almost long in length.

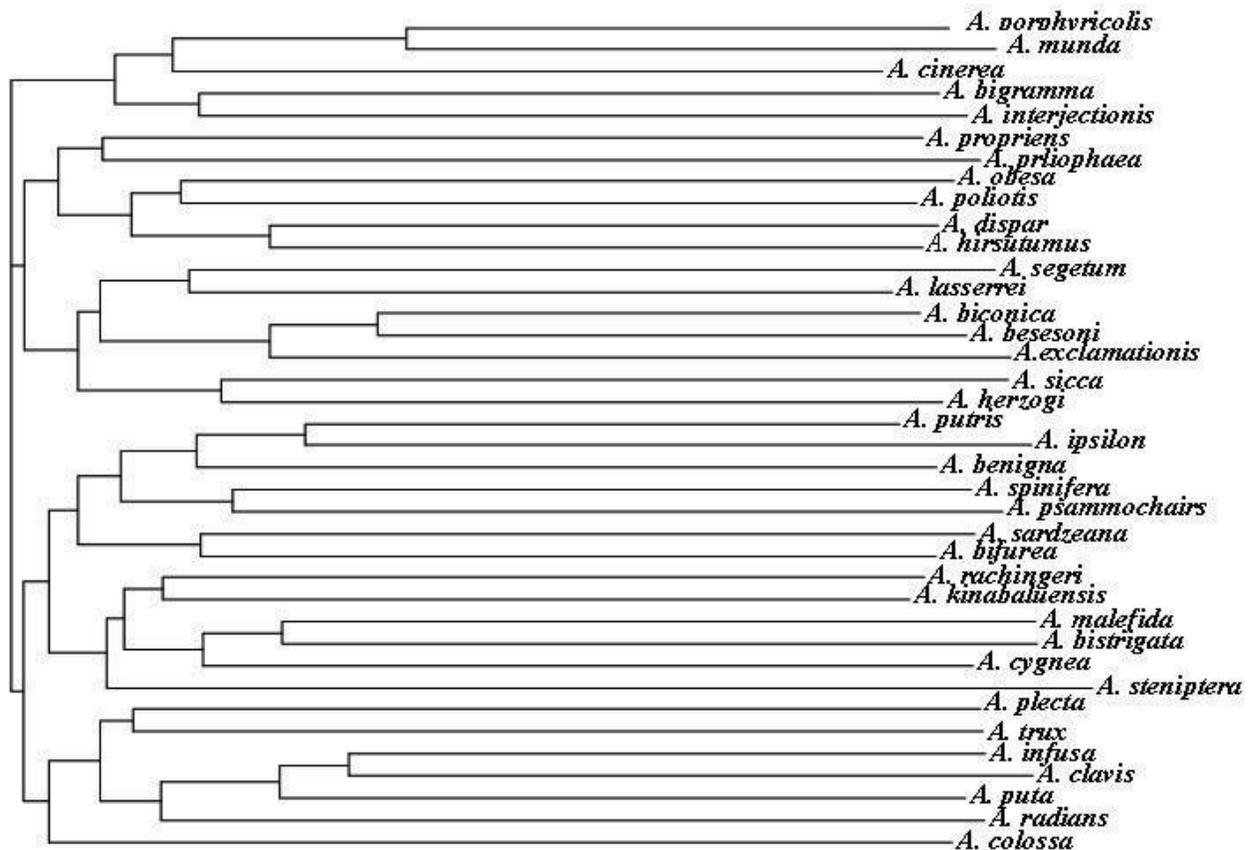


Figure 1. Dendrogram of different species of genus *AgroDescription of Dendrogram*.

Tegumen: Short and broad was found in *Agrotis cinerea*, *A. ipsilon*, *A. colossa*, *A. rachingeri*, *A. spinifera*, *A. clavis* and *A. benigna* species. Tegumen is long and broad in *A. biconica*, *A. sicca*, *A. plecta*, *A. kinabaluensis*, *A. putris*, *A. infusa*, *A. hirsutumus*, *A. psammochairs*, *A. obesa*, *A. bifurea*, *A. bigramma*, *A. sardzeana*, *A. exclamations*, *A. propriens*, *A. bistrigata* and *A. dispar*. Narrow and short tegumen was found in *A. munda*, *A.*

radians, *A. cygnea*, *A. prliophaea*, *A. interjectionis*, *A. poliotis*, *A. porphyricolis*, *A. lasserrei*, *A. herzogi* and *A. puta* while, narrow and long tegumen was present in *A. besesoni*, *A. obliqua*, *A. trux*, *A. segetum* and *A. steniptera*. Tegumen of the *A. malefida* is long, narrow and highly covered with penicular hairs.

Uncus: Short and curved without penicular hairs were observed in *Agrotis cinerea*, *A. colossa*, *A. rachingeri* and *A. bistrigata* while in some species uncus has short and curved that fringed with penicular hairs including *A. munda*, *A. radians*, *A. cygnea*, *A. prliophaea*, *A. interjectionis*, *A. poliotis*, *A. porphyricolis* and *A. lasserrei*. Uncus long, broad and curved without penicular hairs were found in *A. ipsilon*, *A. sicca*, *A. plecta*, *A. putris*, *A. hirsutumus*, *A. besesoni*, *A. obesa*, *A. bifurea*, *A. spinifera*, *A. sardzeana*, *A. exclamations*, *A. segetum*, *A. trux*, *A. propriens*, *A. steniptera* and *A. dispar*. Uncus long, broad and curve that covered with penicular hairs were present in *A. infusa*, *A. obliqua*, *A. bigramma*, *A. herzogi*, *A. kinabaluensis*, *A. puta*, *A. malefida* and *A. clavis*. In *A. psammochairs*, uncus was short and straight without penicular hairs on the other hand in *A. benigna*, uncus was short, straight that clothed with hairs. *A. biconica*, uncus long and straight that fringed with penicular hairs.

Valva: Elongate and cover with compact hairs in several species of *Agrotis* such as *A. cinerea*, *A. ipsilon*, *A. biconica*, *A. puta*, *A. colossa*, *A. obliqua*, *A. rachingeri*, *A. infusa*, *A. hirsutumus*, *A. besesoni*, *A. malefida*, *A. psammochairs*, *A. herzogi*, *A. obesa*, *A. bifurea*, *A. spinifera*, *A. sardzeana*, *A. exclamations*, *A. trux*, *A. segetum*, *A. clavis*, *A. benigna*, *A. propriens*, *A. steniptera*, *A. bistrigata* and *A. dispar* while in other species i.e., *A. sicca*, *A. plecta*, *A. putris*, *A. munda*, *A. radians*, *A. cygnea*, *A. prliophaea*, *A. interjectionis*, *A. poliotis*, *A. porphyricolis*, *A. lasserrei* and *A. bigramma* that have elongated and non-hairy valva. Valva leaf-like and non-hairy in *A. kinabaluensis*.

Juxta: In different species juxta pointed at the base in *Agrotis cinerea*, *A. obliqua*, *A. ipsilon* and *A. lasserrei*. Juxta is flower like and membranous in *A. puta*, *A. biconica*, *A. malefida*, *A. plecta*, *A. colossa*, *A. rachingeri*, *A. hirsutumus*, *A. psammochairs*, *A. obesa*, *A. bifurea*, *A. kinabaluensis*, *A. bigramma*, *A. spinifera*, *A. sardzeana*, *A. exclamations*, *A. trux*, *A. segetum*, *A. clavis*, *A. herzogi*, *A. benigna*, *A. propriens*, *A. steniptera*, *A. bistrigata* and *A. dispar*. Some species have shield-like juxta such as *A. sicca*, *A. putris*, *A. infusa*, *A. radians*, *A. cygnea*, *A. prliophaea*, *A. interjectionis*, *A. poliotis* and *A. porphyricolis*, while in other species including *A. munda* and *A. besesoni* that have triangular shape juxta.

Scaphium: Usually most of the species have well developed scaphium including: *Agrotis cinerea*, *A. obesa*, *A. bigramma*, *A. spinifera*, *A. herzogi*, *A. obliqua*, *A. puta*, *A. sardzeana*, *A. kinabaluensis*, *A. exclamations*, *A. trux*, *A. segetum*, *A. malefida*, *A. clavis*, *A. benigna*, *A. propriens* and *A. dispar*. Other species like *A. ipsilon*, *A. biconica*, *A. sicca*, *A. plecta*, *A. putris*, *A. colossa*, *A. rachingeri*, *A. infusa*, *A. munda*, *A. hirsutumus*, *A. radians*, *A. cygnea*, *A. prliophaea*, *A. interjectionis*, *A.*

poliotis, *A. porphyricolis*, *A. besesoni*, *A. psammochairs*, *A. lasserrei*, *A. bifurea*, *A. steniptera* and *A. bistrigata* in which scaphium absent.

Harp: Harp short in *Agrotis ipsilon*, *A. biconica*, *A. sicca*, *A. plecta*, *A. putris*, *A. obliqua*, *A. rachingeri*, *A. infusa*, *A. munda*, *A. kinabaluensis*, *A. radians*, *A. cygnea*, *A. prliophaea*, *A. interjectionis*, *A. poliotis*, *A. herzogi*, *A. porphyricolis*, *A. bifurea*, *A. spinifera*, *A. lasserrei*, *A. puta*, *A. exclamations*, *A. trux*, *A. segetum*, *A. clavis*, *A. benigna*, *A. propriens*, *A. steniptera*, *A. bistrigata*, *A. sardzeana*, and *A. dispar*. While in other species that have the long HRP including *A. cinerea*, *A. malefida*, *A. colossa*, *A. hirsutumus*, *A. besesoni*, *A. psammochairs*, *A. obesa* and *A. bigramma*.

Vinculum and saccus: Both vinculum and saccus are long with pointed tip of the saccus in *Agrotis cinerea*, *A. malefida* and *A. infusa*. Another species have both vinculum and saccus are short with rounded base saccus such as *A. biconica*, *A. sicca*, *A. munda*, *A. radians*, *A. cygnea*, *A. prliophaea*, *A. interjectionis*, *A. poliotis*, *A. porphyricolis*, *A. besesoni*, *A. psammochairs*, *A. lasserrei*, *A. obesa*, *A. exclamations*, *A. clavis*, *A. benigna*, *A. rachingeri*, *A. steniptera*, *A. kinabaluensis*, *A. bistrigata* and *A. dispar*. Some species i.e., *A. bifurea*, *A. plecta* and *A. putris* that have long vinculum and short saccus with rounded base. Vinculum short and saccus short with pointed base located in *A. herzogi*, *A. ipsilon*, *A. colossa*, *A. hirsutumus*, *A. bigramma*, *A. spinifera*, *A. sardzeana*, *A. trux*, *A. segetum*, *A. puta*, *A. propriens* and *A. obliqua*.

Aedeagus: In male genitalia, short and tube aedeagus found in most of the species including *Agrotis ipsilon*, *A. biconica*, *A. sicca*, *A. plecta*, *A. putris*, *A. rachingeri*, *A. infusa*, *A. munda*, *A. radians*, *A. cygnea*, *A. prliophaea*, *A. herzogi*, *A. interjectionis*, *A. poliotis*, *A. porphyricolis*, *A. besesoni*, *A. sardzeana*, *A. psammochairs*, *A. lasserrei*, *A. obesa*, *A. bifurea*, *A. bigramma*, *A. spinifera*, *A. puta*, *A. exclamations*, *A. trux*, *A. segetum*, *A. clavis*, *A. benigna*, *A. propriens*, *A. steniptera*, *A. kinabaluensis*, *A. bistrigata* and *A. dispar*. While other species have long and cylindrical aedeagus found in *A. obliqua*, *A. malefida*, *A. cinerea*, *A. colossa* and *A. hirsutumus*.

Vesica: Dense dark in color, broad and short in length with cornuti observed in *Agrotis cinerea*, *A. ipsilon*, *A. biconica*, *A. colossa*, *A. rachingeri* and *A. hirsutumus*. But in *A. kinabaluensis* and *A. benigna* have vesica dense dark in color, broad and short in length without cornuti. Some species i.e., *A. sicca* and *A. lasserrei* have vesical membranous, narrow and differ in length without cornuti. On the other hand, most of the species such as *A. plecta*, *A. putris*, *A. psammochairs*, *A. obesa*, *A. herzogi*, *A. bifurea*, *A. bigramma*, *A. spinifera*, *A. puta*, *A. exclamations*, *A. trux*, *A. segetum*, *A. clavis*, *A. propriens*, *A. obliqua*, *A. steniptera*, *A. sardzeana*, *A. malefida*, *A.*

bistrigata and *A. dispar* that have vesical membranous, narrow and differ in length with cornuti. Vesica of the *A. infusa* has dentate tip and also located the cornuti while other species including *A. munda*, *A. radians*, *A. cygnea*,

A. prliophaea, *A. interjectionis* and *A. poliotis*. In *A. porphyricolis* and *A. besesoni* have both dentate bars and cornuti absent.

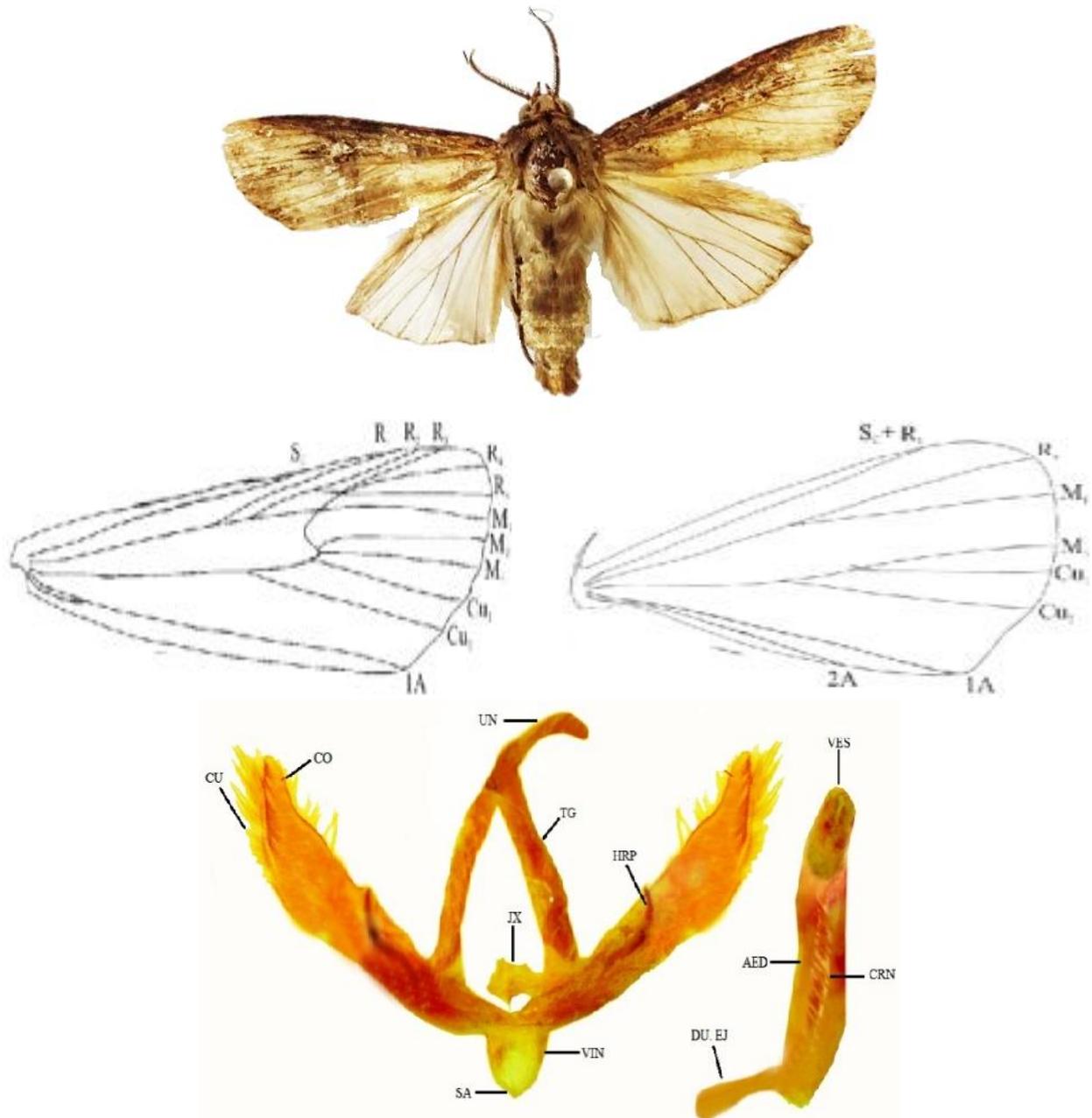


Figure2. *Agrotis hirsutumus* Sp. Nov. ♂ (A) adult dorsal view (B) Forewing (C) Hind wing (D) genitalia of (E) Aedeagus.

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