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Characterization of adults of *Hodebertia testalis* (Fabricius, 1794) (Crambidae: Lepidoptera)

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ABSTRACT: *Hodebertia testalis* (Fabricius, 1794) is a medium sized moth comes under the family Crambidae and subfamily Spilomelinae. It is widespread in Africa, Australia, Southern Europe, Tropical and subtropical Asia. Morphological characterization play a significant role in identification and classification of insects. In the current study, taxonomy of *Hodebertia testalis* (Fabricius, 1794) (Crambidae: Lepidoptera) collected from medicinal plant *Calotropis procera* (Apocynaceae) was examined. The morphological characters *viz.*, antenna, labial palpi, wing venation and adult genitalia were studied. Valva has three fibula of which one is prominent and sickle shaped in male genitalia. Corpus bursae is globose, membranous with no signum in female genitalia.

Keywords: *Hodebertia testalis* (Fabricius, 1794), medicinal plant, adult characters, Coimbatore.

INTRODUCTION

Insects are the most diverse group of organisms. Lepidoptera insect pests have become the dominant group of insect pests. Crambidae (Lepidoptera) is a large family of moths with 1,018 genera and 9,654 species (van Nieukerken *et al.,* 2011). The major host families of *Hodebertia testalis* (Fabricius, 1794) are Apocynaceae and Moraceae (Hayden and Minno, 2016). As a part of study of insect pests of medicinal plants *Hodebertia testalis* (Fabricius, 1794) (Crambidae: Lepidoptera) was collected from *Calotropis procera* (Apocynaceae). Except for the initial external description, the other morphological characters of *Hodebertia testalis* (Fabricius, 1794) remains to be studied. Hence, the study on the adult morphology *viz*., antenna, labial palpi, wings, legs and genitalia was undertaken in this study.

MATERIALS AND METHODS

Insect collection was undertaken in the fields of Department of Medicinal and Aromatic Crops, Botanical garden, Tamil Nadu Agricultural University (TNAU), Coimbatore from November 2022 to second fortnight of April 2023. *Hodebertia testalis Hodebertia testalis* (Fabricius, 1794) larvae were collected from the host *Calotropis procera.* The collected larvae were reared in separate containers to adulthood. The emerged adults were killed with ethyl acetate (80 percent) and pinned as per standard procedure for further analysis.

External characters *viz*., antenna, labial palpi, forewing (FW), hindwing (HW), legs (foreleg, middle and hindleg), female (♀) and male genitalia (♂) were examined

Study of wing venation. The wing venation studies were carried out as per Zimmerman (1978). The wings were detached from adult specimen using needle by giving an upward jerk. Later, the detached wings were soaked in distilled water for five minutes and then transferred to petri dish with four per cent sodium hypochlorite solution for descaling. The scales on the wings were removed with a fine brush. The descaled wings were dipped in distilled water followed by 30 and 50 per cent alcohol and transferred to five per cent acid fuschin dye overnight. After staining, the wings were transferred to 50 per cent alcohol for even spreading of dye. The process was continued by washing the stained wings with 70, 90 and 100 per cent alcohol respectively. Finally the wings were mounted with DPX mountant on glass slides with cover slips and sealed to prevent air bubbles and air dried. The nomenclature for wing venation was followed as per Comstock and Needham (1898) and Miller (1970). The diagrams of wing venation was drawn using mirror type camera lucida attached to the microscope (Model: Leica M80). The camera lucida diagrams were finalized with rotring pen (0.3 and 0.5mm)

Study of antenna and legs. Antenna and legs were removed with forceps and kept in 10 per cent potassium hydroxide (KOH) solution overnight. After descaling using synthetic hair brush, the specimens were washed with distilled water followed by 30 and 50 per cent alcohol. Five per cent acid fuschin dye were added to the specimen and kept overnight. Then the specimens were serially washed in alcohol (50, 70, 90 and 100 per cent). Permanent slides were prepared using DPX mountant and cover slip were placed, in order to prevent air bubbles**.** Later, the slides were labeled and air dried for a day.

Study of genitalia. Genitalia dissection was done as per the standard protocol of Robinson (1976). The abdomen was detached from the adult insect using forceps. The detached abdomen was soaked in 10 per cent potassium hydroxide (KOH) solution in cavity block overnight. The scales were removed using synthetic hair brush by tapping the abdomen gently and washed in distilled water. Male genitalia were removed by gently tapping the abdomen. Further, the aedeagus was separated out from the male genitalia. To remove the female genitalia the abdomen was dissected along the lateral side using a micro syringe and dissection knife thereby all the internal contents were removed. The dissected genitalia were further cleared with 50, 70, 90 and 100 per cent alcohol and preserved in glycerol. External genitalia terminologies were followed as per Klots (1970).

The specimens were examined using stereo microscope (Leica EZ4), photograph were taken using image analyser (LAS V4.12) attached to the stereo zoom microscope (Leica M205 A; Leica M205 C) and DSLR camera (Cannon EOS 7D Mark).

RESULT

Adult: Male: Body size 16.69-18.5 mm length; Wingspan 26 – 27 mm. Head whitish above antenna, brownish orange below antenna, compound eye well developed globular brownish black (Fig. 4.) Antenna filiform, brown in colour on dorsal side and white in colour on ventral side (Fig. 3). Labial palpi pointed straight brownish orange on anterior side and pure white on posterior side, proboscis caramel brown covered with white scales (Fig. 4). In labial palpi, the segment 2>1>3. Thorax covered with white scales on both dorsal and ventral side. Patagia brownish orange (Fig. 4). FW ups (Fig. 1): Elongate, curved at apex, termen narrow, pale white. Costa region attached to thorax is brownish orange and the intensity gets reduced towards apex. Basal area white, antemedial line graphite grey arises at ⅓rd region of FW, Median line arises from ½ region of FW, split at posterior ¾th region and corner of discal cell, a spot present at costal margin between median and antemedial line. Postmedial line arises at ¾th region of FW, gets curved towards subterminal area and ends at median area, cilia creamy white. HW ups (Fig. 1): pale white, curved at apex, termen narrow, anal angle smooth curved. Costa region white, two graphite spots are present, one at ⅓rd region of HW, other at posterior corner of discal cell. Post medial line arises at ¾th region of costa margin and ends at anal margin, cilia pale white. FW uds and HW uds (Fig. 2): Pale white

Wing venation: FW (Fig. 5): Sc ends at ¾th portion of costa. R_1 arises from post mid portion of closed discal cell. $R_{2+3+4+5}$ originates from apical corner of discal cell. R_{3+4} stalked. M_1 emerges from anterolateral side of discal cell. M_2 runs parallel to M_1. M_{2+3} and Cu_1 are trifid at anal corner of discal cell. Cu_2 arises from ¾th ventral side of discal cell. A_{1+2} usually free and ends at anal angle of FW. A_3 curved and joins A_{1+2} at ⅓rd portion.

HW (Fig. 6): Sc+R_1 and Rs are connate and stalked. M_1 arises from anterior side of discal cell. M_{2+3} and Cu_1 arises from posterior side of discal cell. M_2 and M_3 are close compared to M_1. Cu_2 emerges from ¾th portion of discal cell. Cu_p free and ends between Cu_2 and A_{1+2}. A_{1+2} ends at anal angle, A_3 short, runs parallel to anal margin. (Fig. 6).

Leg: Covered with white scales. Foreleg with tibial epiphysis (Fig. 7); middle leg with unequal tibial spurs at distal end, length of first tibial spur half the length of basitarsus, tarsus with spine at distal end of each segment (Fig. 8); hindleg with two pairs of unequal tibial spurs, one pair at half length of tibia and other pair at distal end of tibia, length of first tibial spur is half the length of basitarsus (Fig. 9).

Abdomen: Length: 12.87mm, covered with white scales on both dorsal and ventral side

Male genitalia: Uncus dagger hilt - like from ventral side with broadened base, narrowed towards apex with curved mushroom shaped head along with spines (ventral side) and flap - like structure (dorsal side) below the head. At the centre of tegumen (Gnathos) a projection arises, sides of tegumen are pointed, juxta 'V' shape smooth curved pit with sclerotized arrow - like structure pointing towards the middle downward. Vinculum moderately sclerotized. Saccus with small projection at the bottom and two sharp arrow head - like sclerotized structure present. Sacculus base bulbous, extend narrow with hairs. Coremata hirsute. Valva elongate, apex curved with tuft of hairs, inner side in the middle with three well sclerotized fibula present. Fibula sickle shaped and curved inward with small straight fibula at base, the other fibula curved attached to a kidney shaped structure, together resembling like bullock horn (Fig. 10). Aedeagus tubular, basal end sclerotized with spicules. Cornuti absent (Fig. 11).

Female genitalia: Papillae anales narrow, weakly sclerotized and hairy, posterior apophyses and anterior apophyses are almost equal, segment 8 sclerotized. Ductus bursae narrow, sclerotized at base, gets little widen towards globular membranous corpus bursae. Signum absent (Fig. 12).

DISCUSSION

The illustration of adult genitalia of *Hodebertia testalis* (Fabricius, 1794) has been given only by Hayden and Minno (2016). The reddish orange or brown colour of forewing costa, thorax and patagia were described by Szabolcs *et al.* (2015); Hayden and Minno (2016). The forewing and hindwing wing pattern such as postmedial band and spots were discussed by Hayden and Minno (2016). Based on the external appearance, it is opined that *H. testalis* is more like the genus *Palpita.* The characters that separate *Hodebertia* from *Palpita* has been given by Leraut (2003). In *Palpita* the fibula is present in the edge of the valve in male genitalia (Leraut, 2003) while three fibula of unequal size are present in the middle of the valve. Of the three fibula, the mid fibula is sclerotized and sickle shaped. In female genitalia of the genus *Palpita,* signum consists of two thorn-like structure (Leraut, 2003) while in *H. testalis* signum is absent. *Hodebertia testalis* (Fabricius,

1794) is distributed in Tropical Asia, Australia, Croatia (Gumhalter, 2019), Italy (Durante *et al.*, 2021), India, Indonesia, North America, Saudi Arabia, Southern Europe, Spain (Garre *et al.*, 2021), Sri Lanka, Syria, Taiwan, Africa and Yemen (Hayden & Minno 2016). Within India it has been reported from Andhra Pradesh, Gujarat (Vaghela *et al.*, 2023; Patel *et al.*, 2023), Maharastra, Madhya Pradesh, Tamil Nadu (Rathikannu and Chitra, 2017), Telangana, Uttarkhand, Uttar Pradesh (Nayak and Ghosh 2020; Farooqui and Parwez 2022), West Bengal. *Hodebertia testalis* (Fabricius, 1794) has been recorded on 15 species of host plant *viz*., *Asclepias curassavica*, *Calotropis gigantea*, *C. procera*, *Caralluma europaea* ssp. *marocana*, *Citrus* sp. (Rutaceae), *Euphorbia* sp. (Euphorbiaceae) (Aguiar and Karlsholt 2006), *Gomphocarpus* sp., *Hibiscus* sp., *Leptadenia madagascariensis*, *Mammillaria heyderi* (Cactaceae), *Pergularia daemia*, *Salix* sp. (Salicaceae) (Aguiar and Karlsholt 2006), *Sida rhombifolia* (Malvaceae), *Stapelia* sp. (Apocynaceae) (Kravchenko *et al.*, 2020).

Fig. 1. Adult (Dorsal view).

Fig. 2. Adult (Ventral view).

Fig. 3. Antenna.

Fig. 4. Labial palpi, Head and Patagia.

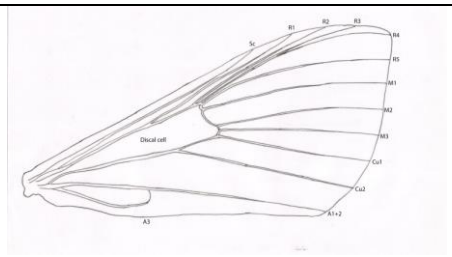

Fig. 5. Wing venation (Forewing).

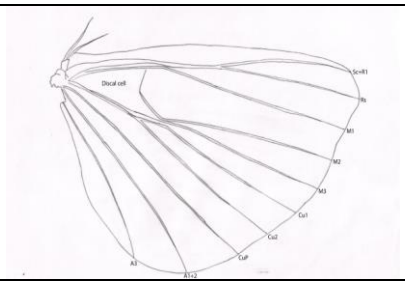

Fig. 6. Wing venation (Hindwing).

Fig. 7. Foreleg.

Fig. 8. Middleleg.

Fig. 9. Hindleg.

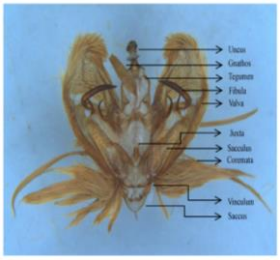

Fig. 10. *Hodebertia testalis* (Fabricius, 1794), Male genitalia.

Fig. 11. Aedeagus.

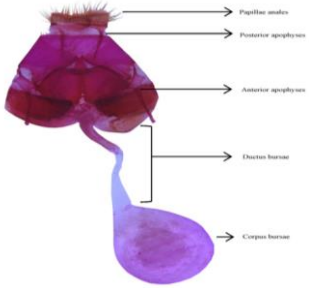

Fig. 12. *Hodebertia testalis* (Fabricius, 1794), Female genitalia.

Fig. 1-12. *Hodebertia testalis* (Fabricius, 1794) adults and its appendages.

CONCLUSIONS

This study has given information on the adult morphological characters of *Hodebertia testalis* (Fabricius, 1794). Adult identification characters confirmed based on the presence of coremata, dagger hilt - like uncus, fibula in inner side of tegumen, and absence of cornuti in aedeagus of male genitalia whereas in female genitalia the segment 8 is of well sclerotized and signum is absent in globular corpus bursae.

FUTURE SCOPE

There is scope for study of population of *Hodebertia testalis* (Fabricius, 1794) from different parts of the country to study the phylogeny and the systematic position through molecular taxonomy.

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Conflict of interest. None.

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