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SHORT COMMUNICATION

FURTHER STUDIES ON TWO SPECIES OF THE MOTH GENUS *PARALEBEDA* AURIVILLIUS (LEPIDOPTERA: BOMBYCOIDEA: LASIOCAMPIDAE) FROM NORTHWESTERN INDIA

Amritpal Singh Kaleka, Devinder Singh & Sujata Saini

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FURTHER STUDIES ON TWO SPECIES OF THE MOTH GENUS *PARALEBEDA* AURIVILLIUS (LEPIDOPTERA: BOMBYCOIDEA: LASIOCAMPIDAE) FROM NORTHWESTERN INDIA

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Abstract: The known Indian species of the moth genus *Paralebeda* Aurivillius namely *femorata* (Menetries) and the type species *plagifera* (Walker) have been taxonomically treated. The external morphological characters particularly species specific features such as wing venation and genitalic characters have been studied and illustrated. The genus diagnosis has been updated and a key has also been formulated.

Keywords: Genitalia, *femorata*, Lasiocampidae, *Paralebeda*, *plagifera*, taxonomy.

Abbreviations: 1A—First anal vein | 2A—Second anal vein | 3A—Third anal vein | AED—Aedeagus | ANT. APO—Anterior apophyses | AP.S—Apical spur | CRP. BU—Corpus Bursae | CRN—Cornuti | CU₁—First cubital vein | CU₂—Second cubital vein | CU.A—Cubital arms | DU.BU—Ductus Bursae | DU.EJ—Ductus Ejaculatorius | HM—Humeral Cell | HM.V—Humeral Vein | JX—Juxta | JX.P—Juxtal process | M₁—First median vein | M₂—Second median vein | M₃—Third median vein | PAPA—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 | RS—Radial Sector | SA—Saccus | SC—Subcosta | SC+R₁—Subcosta+ First Radial vein | SIG—Signum | SOC—Socii | TG—Tegumen | UN—Uncus | VIN—Vinculum | VLV—Valva.

Aurivillius (1894) established the genus *Paralebeda* with *plagifera* (Walker) as its type species. This genus is represented by large sized moths with elongated wings having a pointed apex. The medial dark coloured loop in its forewing is its diagnostic feature. This genus is known from Palaearctic and Indo-Australian regions.

Lajonquière (1980) and Holloway (1982) reviewed this genus. Holloway (1987) included two species, i.e., *uniformis* Holloway and *lucifuga* (Swinhoe) of this genus in the *Moths of Borneo*. Chang (1989) and Kishida (1992) listed its species namely *femorata* (Menetries) from Taiwan and Nepal, respectively. While giving short taxonomic notes on four Asiatic species of this genus, Zolotuhin (1996) described three new subspecies, viz., *femorata*, *armata*, and *crinodes paos*. He considered *uniformis* Holloway as a subspecies of *crinodes* (Felder). Zolotuhin *et al.* (1997) reported three new species, namely, *lagua*, *achillesi*, and *pluto* along with one subspecies *achillesi mindoroensis* of this genus from the Philippines. Recently, Irungbam (2017) and Shah *et al.* (2018) reported *femorata* (Menetries) and *plagifera* (Walker) from Manipur and West Bengal whereas

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Irungbam & Irungbam (2018) listed *plagifera* (Walker) from Bhutan.

At present, this genus is represented by seven species namely *achillesi* Zolotuhin et al., *crinodes* (Felder), *femorata* (Menetries), *lagua* Zolotuhin et al., *lucifuga* (Swinhoe), *plagifera* (Walker), and *pluto* Zolotuhin et al. Out of these, only two species, *plagifera* (Walker) and *femorata* (Menetries), are known from India.

MATERIAL AND METHODS

While undertaking surveys, 14 adult representatives of the genus *Paralebeda* had been collected from Himachal Pradesh and Uttarakhand and identified with the help of relevant literature. The method proposed by Zimmerman (1978) was followed for the preparation of permanent slides of forewings and hindwings. The genitalia had been dissected out as per the method proposed by Robinson (1976). The terminology for naming genitalic parts is after Klots (1970).

RESULTS AND DISCUSSION

In the present study, the external morphological characters including the wing maculation, wing venation and particularly the external genitalic features of two species namely *plagifera* (Walker) and *femorata* (Menetries) of the genus *Paralebeda* Aurivillius have been studied on a uniform pattern. These characteristics have been included in the diagnosis and differentiation of these two species.

Genus *Paralebeda* Aurivillius

Aurivillius, 1894, Dt. Ent. Z. Iris. 7: 178; Holloway, 1987, *Moths Borneo*, 3: 13; Zolotuhin et al., 1997, *Lasiocampidae Philippines*, 17: 150; Zolotuhin & Witt, 2000, *Lasiocampidae Vietnam*, 3(11): 71; Zolotuhin & Pinratana, 2005, *Lasiocampidae Thailand*, 4: 83; Youqiao & Chunsheng, 2006, *Fauna Sinica*, 47: 303–304.

Type species: *Lebeda plagifera* Walker

Distribution: India, China, Korea, Nepal, Pakistan, Philippines, Russia, Taiwan, Thailand, Vietnam.

Diagnosis: Labial palpus long, upturned. Antennae bipectinate, well developed in males, shorter in females. Thorax dressed with scales. Forewing broad, elongated, apex pointed, medial dark colored loop prominent; discal cell closed; vein 1A+2A fused, without forming a basal fork; 3A present; M_3 from lower angle of cell; M_1 stalked with R_5 and R_4 ; R_3 and R_2 highly stalked; Sc from base of wing not reaching up to apex, conjoined with costa and R_1 . Hindwing with discal cell closed; vein 1A and 2A present; 3A present; veins M_3 and M_2 stalked; Sc+ R_1 anastomosing with Rs to form a short humeral

cell, humeral veins obsolete. Legs clothed with scales; foreleg with epiphysis; mid-tibia and hind-tibia with a pair of minute tibial spurs; claws distinct. Abdomen clothed with scales. Male genitalia indistinct uncus; socii distinct; valva weak; cubile arms of vinculum flattened, without any tooth-like serrations; aedeagus tubular with diagnostic shape of apical spur. Female genitalia with corpus bursae globular, with or without signum; papilla analis prominent, armed with setae.

Key to the Indian species of genus *Paralebeda* Aurivillius

1. General colouration darker; forewing with medial loop broader, tornus with spot; vein R_4 from middle of common stalk of M_1 and R_5 ; hindwing with vein Rs beyond middle of cell; male genitalia with saccus rounded; cubile arms broader, petiolate; aedeagus of moderate size with two apical spurs *femorata* (Menetries)
 - General colouration paler; forewing with medial loop narrower, tornus without any spot; vein R_4 from before middle of common stalk of M_1 and R_5 ; hindwing with vein Rs before middle of cell; male genitalia with prominent, cone-shaped saccus; cubile arms narrow, not petiolate; aedeagus short with one apical spur *plagifera* (Walker).

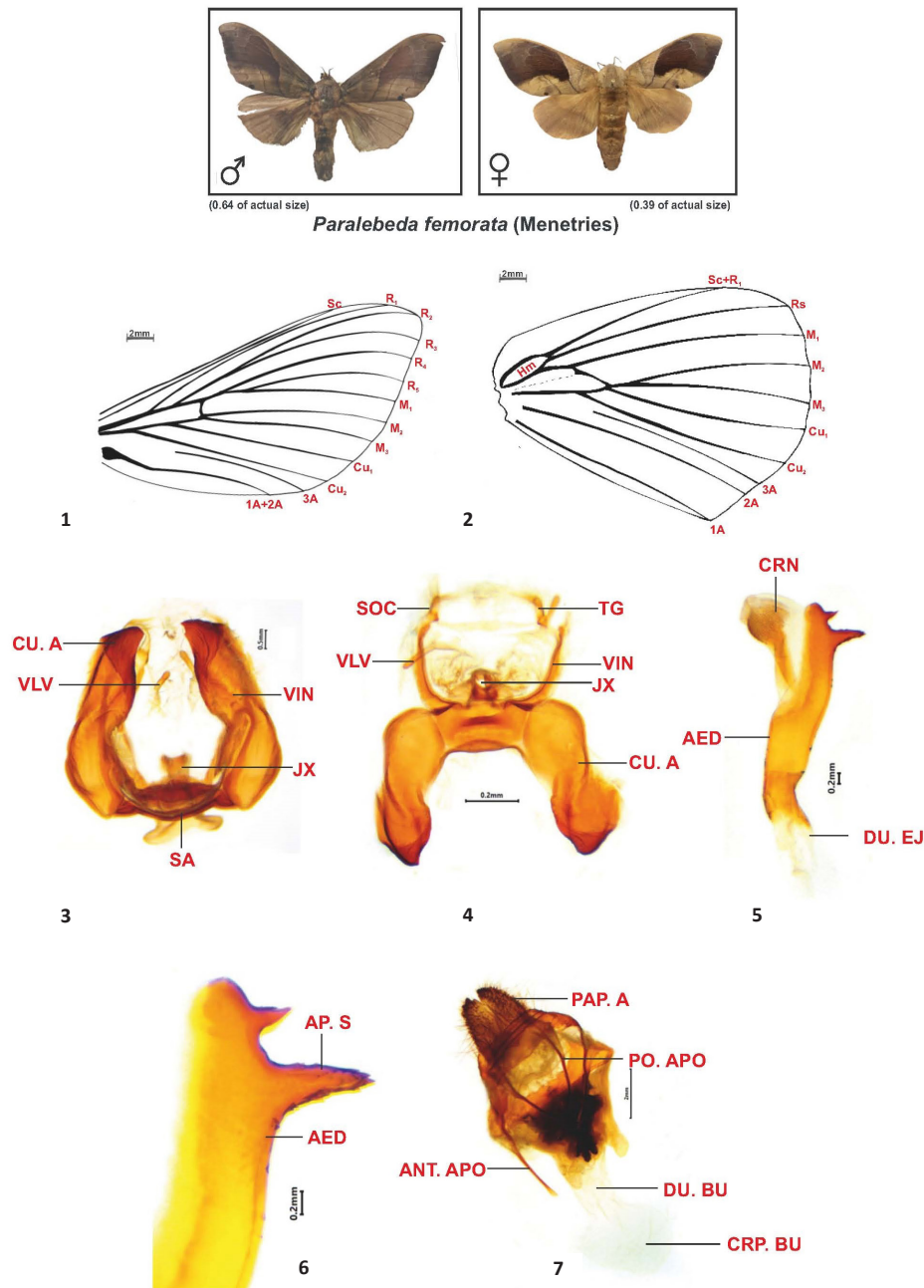
Paralebeda femorata (Menetries) (Images 1–7)

Lasiocampa femorata Menetries, 1855, Bull. Acad. Imp. Sci. St. Petersburg, 17(24): 218.

Paralebeda femorata Menetries: Zolotuhin, 1996, *Asiatic Lasiocampidae*, 13(17): 247; Hauenstein et al., 2011; *Lasiocampidae Bhutan*, 67: 32.

Diagnosis: Head with vertex and frons clothed with fuscous scales. Labial palpus with fuscous scales. Antennae with scape and shaft fuscous. Thorax, collar and tegula clothed with fuscous scales; underside fuscous. Legs with fuscous scales. Abdomen covered with fuscous scales; underside fuscous.

Wing maculation: Forewing with ground colour fuscous, females brown; markings black; antemedial line distinct; medial loop broader, medial portion prominent with hump starting from inner margin, reaching below costa, upper zone of loop darker and reddish-brown; loop broader and less humped in females; a prominent dark black spot on tornus; postmedial line indistinct; submarginal dotted line present; underside fuscous, loop and tornal spot distinct. Hindwing with ground colour fuscous without any distinct pattern; antemedial and



Images 1–7. *Paralebeda femorata* (Menetries): 1—forewing | 2—hindwing | 3–4—male genitalia-ventral view | 5—aedeagus | 6—aedeagus-distal end | 7—female genitalia.

postmedial lines obsolete; medial line paler; underside fuscous.

Wing venation: Forewing with apex pointed; one-thirds length of wing; 3A present, basal half obsolete; 1A+2A from base of wing, basal area swollen; Cu₂ from one-thirds of cell; Cu₁ from just beyond two-thirds of cell; M₂ just above lower angle of cell; M₁, R₅ and R₄ stalked, R₄ from middle of common stalk of M₁ and R₅; R₃ and R₂ stalked from three-fourths of cell; R₁ from beyond

middle of cell. Hindwing rounded; discal cell one-thirds length of wing; 3A present, basal area obsolete; Cu₂ from three-fourths of cell; Cu₁ from lower angle of cell; M₃ and M₂ well stalked from lower angle of cell; M₁ from upper angle of cell; Rs from beyond middle of discal cell; Sc+R₁ anastomosing with Rs to form a narrow humeral cell, shorter than discal cell, humeral veins absent.

Wing Expanse: male: 72–78 mm; female: 98mm

Body Length: male: 38–40 mm; female: 55mm

Male genitalia: Uncus absent; tegumen weakly developed, nearly membranous, lateral sides having setosed pads representing socii, slightly knobbed near vinculum; vinculum 'U' shaped, both arms narrow, medially dilated, oval, ending into rounded saccus; cubile arms larger, broader and petiolate, well sclerotized; juxta well developed, well sclerotized, dilated proximally, constricted in the middle, notched at distal end. Valva reduced, nearly membranous, basal one-third portion setosed; distally ending into finger-like projection with rounded apex. Aedeagus of moderate size, moderately sclerotized, constricted near proximal end; ductus ejaculatorius entering directly into proximal end; distal end having two apical spur, distal one shorter, both spur with dentate walls; vesica armed with minute denticles representing cornuti.

Female genitalia: Corpus bursae short, oblong, membranous without any signum; ductus bursae of moderate length, membranous, slightly dilated towards distal end; ductus seminalis originating from its middle; apophyses narrow with their apices dilated, posterior ones slightly longer than anterior ones; papilla analis well developed, long, setosed with micro and macro setae.

Material Examined: Himachal Pradesh: PUP-LA-78a-c, Basantpur, 9.vii.2013, 3 females (31.208° N, 77.174° E); PUP-LA-78d-e, Habban, 7.vii.2014, 2 males (30.915° N, 77.325° E); PUP-LA-78f-j, Jhumar, 10.vii.2015, 4 males, 1 female (32.560° N, 76.161° E).

Distribution: India (Himachal Pradesh, Jammu & Kashmir, Punjab, Uttarakhand); Bhutan; northeastern and eastern China; Nepal; northeastern Pakistan; northern Vietnam; Russia; Taiwan.

Remarks: The present species can be easily differentiated from *plagifera* (Walker) on the basis of general colouration, wing expanse and genitalic features.

Paralebeda plagifera (Walker)

(Images 8–13)

Lebeda palgifera Walker, 1855, List Spec. Lepid. Insects Colln. Br. Mus., 6: 1459.

Paralebeda plagifera Walker: Zolotuhin & Witt, 2000, Lasiocampidae Vietnam, 3(11): 72; Zolotuhin & Pinratana, 2005, Lasiocampidae Thailand, 4: 83-84; Youqiao & Chunsheng, 2006, Fauna Sinica, 47: 305; Zolotuhin & Ihle, 2008, Lasiocampidae Laos, 20(4): 14; Hauenstein et al., 2011; *Lasiocampidae* Bhutan, 67: 31.

Odonestis plagifera Walker: Grunberg, 1911, In Seitz, Pal. Schmett., 2: 175; Hampson, 1892, Moths India, 1: 427.

Odonestis urda Swinhoe, 1915, Ann. Mus. Nat. Hist.

London, 16(8): 178.

Parlebeda urdabacki de Lajonquiere, 1980, Z. Arbeitsg. Osterr. Entomol., 32(1/2): 25.

Diagnosis: Head with vertex and frons clothed with brown scales. Labial palpus with brown scales. Antennae with scape and shaft brown. Thorax, collar and tegula furnished with brown scales; underside brown. Legs with brown scales. Abdomen covered with brown scales; underside brown.

Wing maculation: Forewing with ground colour brown suffused with reddish; antemedial line indistinct; medial loop narrow, short hump starting from inner margin, reaching just below costa, upper zone of loop darker and reddish-brown; postmedial line indistinct; dotted submarginal line distinct; cilia brown; underside brown, loop paler. Hindwing with ground colour brown; medial line distinct; postmedial and submarginal lines indistinct; cilia brown; underside brown.

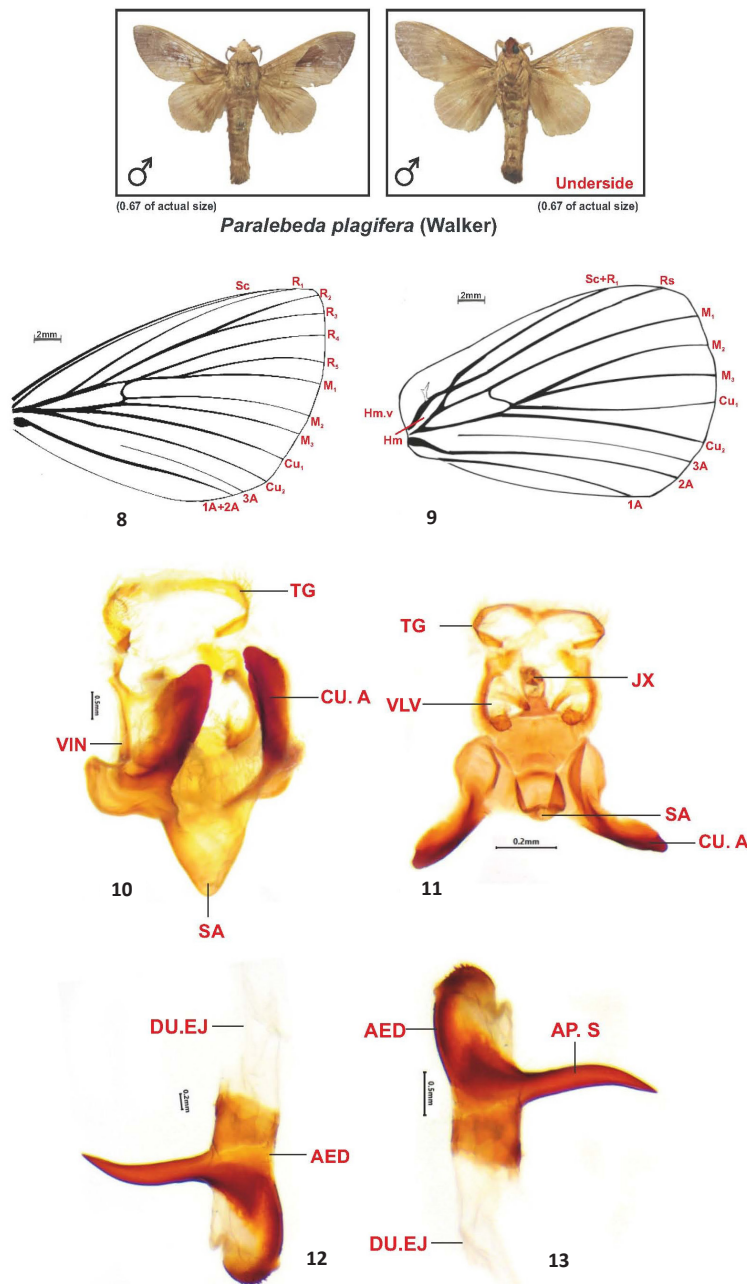
Wing venation: Forewing with apex pointed; discal cell one-thirds length of wing; 3A present, basal half obsolete; 1A+2A from base, basal area swollen; Cu₂ from one-thirds of cell; Cu₁ from two-thirds of cell; M₂ from above lower angle of cell; M₁, R₅ and R₄ well stalked, R₄ just before middle of common stalk of M₁ and R₅; R₃ and R₂ highly stalked from before upper angle of cell; R₁ from beyond middle of cell. Hindwing rounded; discal cell one-thirds length of wing; 1A present, 2A with basal area swollen; 3A present, basal area obsolete; Cu₂ from well before lower angle of cell; Cu₁ from lower angle of cell; M₃ and M₂ well stalked from lower angle of cell; M₁ from upper angle of cell; Rs before middle of cell; Sc+R₁ anastomosing with Rs to form narrow humeral cell, shorter than discal cell, humeral veins obsolete.

Wing Expanse: male: 62–64 mm; female: not examined

Body Length: male: 39–40 mm; female: not examined

Male genitalia: Uncus absent; tegumen weakly developed, 'C' shaped, lateral sides having minute setosed pads representing socii; vinculum well developed, triangular, ending into cone-shaped saccus with rounded end; cubile arms flattened, not petiolate, well sclerotized; juxta semi-sclerotized, oblong. Valva reduced, lower lobe triangular, setosed with rounded ending; upper lobe narrow with rounded apex, medial area membranous. Aedeagus short, moderately sclerotized; ductus ejaculatorius entering directly into proximal end; distal end rounded, armed with prominent dentations; medially having a prominent, long well sclerotized spur almost of same size of aedeagus; vesica without any distinct armature.

Material Examined: Himachal Pradesh: PUP-LL-



Images 8–13. *Paralebeda plagifera* (Walker): 8—forewing | 9—hindwing | 10–11—male genitalia-ventral view | 12–13—aedeagus.

77a-b, Sangla, 22.vi.2014, 2 males (31.425° N, 78.265° E); PUP-LA-77c, Serighat, 11.viii.2013, 1 male (31.050° N, 77.069° E); Uttarakhand: PUP-LA-77d, Kandikhal, 21.v.2014, 1 male (30.433° N, 78.405° E).

Distribution: Northern and central India; Bhutan; Laos; northern Myanmar; northern Thailand; northern Vietnam; southern and southeastern China.

Remarks: Its caterpillars are polyphagous in nature and feed on *Cupressus funebris* Endlicher, *Ginkgo biloba* Linnaeus, *Phoebe nanmu* Gamble, *Morus alba* Linnaeus,

Morus nigra Linnaeus, *Quercus acutissima* Carruthers, *Quercus dentate* Thunberg, *Maesa chisia* Hamilton, *Citrus reticulata* Blanco, *Citrus maxima* Merrill, and *Theobroma cacao* Linnaeus (Robinson et al. 2001).

The external genitalic features in insects are highly species specific in general and of high relevance particularly in Lepidoptera. In the present study, these characters such as indistinct uncus; distinct socii; reduced valva; distinct cubile arms and tubular aedeagus with diagnostic shape of apical spur in male

genitalia and globular corpus bursae, with or without signum and prominent papilla analis in female genitalia proved as important features of taxonomic significance for diagnosis and differentiation of these taxa.

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– John T.D. Caleb, Pp. 14629–14630

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