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Lappet Moths (Lepidoptera : Lasiocampidae) of north-west India- brief notes on some frequently occurring species

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ABSTRACT: Four species, i.e, *Trabala vishnou* Lefebvre (Lasiocampinae), *Suana concolor* Walker, *Euthrix laeta* Walker and *Gastropacha pardalis* (Walker) (Gastropachinae) of Lasiocampidae moths were collected from north-west India, and are here described and illustrated. Besides an illustrated account of their genitalia, diagnostics of these subfamilies, genera and species are also provided.

Key words: Lappet Moths, Lasiocampidae, Lepidoptera, North-West India

INTRODUCTION

This family of the Eggar or Lappet moths is most diverse in the Old World tropics, with about 2,200 species so far known worldwide, but absent from New Zealand (Holloway , 1987). The moths are medium to large, and of a robust and hairy appearance. They are generally cryptically coloured and patterned. Both forewings and hindwings are usually broad, but however there are some Old World genera in which the forewings are relatively narrow, the hindwings relatively small, and with abdomen extending well beyond the wings when at rest. Sometimes the female is brachypterous. Sexual dimorphism is typical (Scoble, 1992).

The eggs are laid singly, in small clusters, or in compact masses. They may be covered by scales from the terminal tuft of the female or, in some groups, by spumaline – a frothy substance released from the accessory glands of the female. The female is generally sluggish, and in some species may be apterous. The resting posture of many lappet moths is characteristic, with the hindwings extended beyond the front margin of the forewing (e.g., *Gastropacha quercifolia*). The larvae may be solitary or colonial. The best known colonial species are the Tent caterpillars of the temperate genus *Malacosoma* in which larvae spin large webs or tents in which they feed gregariously (Stehr & Cook, 1968). These tent caterpillars may cause serious damage to forest trees. In a number of species, the secondary hairs on the larvae are urticating. Pupation occurs within a dense, silken cocoon. (Scoble, 1992).

The classic work of Maxwell-Lefroy & Howlett, 1909) on our "Indian insect life" mentions that "Over 50 Indian species are listed by Hampson of which about six are to be found commonly in the plains." Four of these are described in some detail. He goes on to write that "most are of moderate size, thick bodied, of light colour, cryptic in design. Their resemblance when in the resting attitude to a leaf is sometimes very marked and beautiful. The antennae are short and bipectinate, the palpi small and porrect. The legs are hairy with minute spurs, the females usually with an anal tuft of hair. Males and females differ in little but size, colour and the extent of pectination of the antennae. The life-history is known in some species; the eggs are laid in irregular clusters and covered in hair; the larvae are hairy without upright tufts but with long hair tufts projecting in front and short tufts laterally. They are all herbivorous and sometimes destructive. Pupation takes place in a cocoon of mingled silk and hair, usually on the soil among leaves, etc. So far as known, hibernation takes place in the pupa stage and the insects breed freely in the rains." The taxonomic account of 54 Indian species of 20 genera of Lasiocampidae, including those from Burma, Bhutan and Ceylon (Sri Lanka) was given by Hampson (1893) in a volume of the FAUNA OF BRITISH INDIA. This first ever FAUNA volume published on insects, that on moths by G.F. Hampson, is dated "Jan, 10, 1893" as indicated in the List of Volumes published and in preparation (March, 1940) printed at the end of volume VI of Diptera (Senior-White *et al.,* 1940), and this is taken as the correct year of publication, not "1892" as is generally copied by authors.

Out of these 20 genera, 16 genera *viz.*, *Bhima* Moore (1 species), *Taragama* Moore (2 spp.), *Suana* Walker (1 sp.), *Lebeda* Walker (1 sp.), *Metanastria* Hübner (4 spp.), *Arguda* Moore (1 sp.), *Chilena* Walker (2 spp.), *Clisiocampa* Curtis (2 spp.), *Alompra* Moore (1 sp.), *Kosala* Moore (1 sp.), *Trichiura* Stephens (1 sp.), *Trabala* Walker (1 sp.), *Lenodora* Moore (2 spp.), *Estigena* Moore (1 sp.), *Odonestis* Germar (2 spp.), and *Gastropacha* Ochsenheimer (2 spp.), have been reported from the North-West Himalaya. In Fletcher's (1925) Catalogue, note that the following 24 species of 15 genera were documented from NW. India and Pakistan : *Bhima undulosa* (Walker), *Taragama dorsalis* (Walker), *T. siva* (Lefebvre), *Suana concolor* (Walker), *Paralebeda plagifera* (Walker), *Lebeda nobilis* Walker, *Metanastria ampla* (Walker), *M. fia* (Swinhoe), *M. hyrtaca* (Cramer), *M. latipennis* (Walker), *Arguda flavovittata* (Moore), *Syrastrena minor* (Moore), *Chilena similis* Walker, *C. strigula* (Walker), *Clisiocampa indica* Walker, *C. vulpes* Hampson, *Trabala vischnou* [*sic* !] (Lefebvre), *Lenodora signata* Moore, *L. vittata* (Walker), *Estigena pardalis* (Walker) [transferred to *Gastropacha* here], *Cosmotriche laeta* (Walker), *C. pyriformis* (Moore) [transferred to *Euthrix* here], *Gastropacha undulifera* Walker, and *G. encausta* (Hampson). Ghosh *et al.* (1991: 424) stated that there were 49 species of Lasiocampidae in India, the political area, in a Zoological Survey of India "State of the Art" analysis of the animal resources of India. However note that Fletcher (1925) 65+ years ago had catalogued 75 species of 22 genera from our subcontinent, including the neighboring countries. In the present work, a large number of survey-cum-collection tours were undertaken to northwestern India during different seasons/monsoons. Four genera *i.e.*, *Trabala* Walker, *Suana* Walker, *Euthrix* Meigen and *Gastropacha* Ochsenheimer of the family Lasiocampidae were collected. Morphological details, particularly of the external genitalia, were worked out and diagnostic characters determined for identification of their species.

TAXONOMY

The Lasiocampoidea comprise 2 families, 158 genera, and 1586 described species. They are defined by larvae without fused forecoxae and adults with forewings having the base of vein M_2 usually closer to M_3 than to M_1 (Pogue, 2009: 346). The family was divided into seven subfamilies by Aurivillius (1927) based on details of wing venation. This classification was questioned by Franclemont (1973) who suggested that the North American species, at least, are more apparently divided into two groups. In one group, the male genitalia appear generalized and the humeral cell of the hind wing is small or very small. In the other, the male genitalia are strongly modified, with the reduction or loss of some components, with a hook-like aedeagus, and a small to very large humeral cell in the hindwing (Scoble, 1992). Information pertaining to the morphology and distribution of various species recorded in this study are given below:

SUBFAMILY: LASIOCAMPINAE

Labial palpi relatively much shorter; hindwing with accessory costal veinlet wanting; male genitalia with cubile absent or reduced.

***TRABALA* Walker**

Trabala Walker, 1856, List Specimens Lepid. Insects Colln. Br. Mus., **7** : 1785.

Type-species: *Amydon prasina* Walker, 1855, *ibid.*, **6**: 1417, by subsequent designation of Moore, (1883) 1882-3, Lepid. Ceylon, **2**: 146.

***Trabala vishnou* (Lefebvre)** (Plate 1a)

Trabala vishnou, Lep. Zool. Journ., iii, p. 207; C. & S. no. 1456; Moore, *Lep. E.I. Co*, pl. xxii, figs. 3, 3b (Larva). Fletcher (1925: 18) gives *Gastropacha vischnou* Lef., Journ. III 207 (1827).

DIAGNOSIS : Pale apple-green in colour; wings densely scaled; forewing with a dark green post- and antemedial fascia and with a dark speck at end of cell; hind wing with a single fascia, fascia dark green, a submarginal irregular row of specks on both wings; venation of forewing typical, hindwing lacks humeral veins, discal cell open.

MALE GENITALIA (Plate 2, Figs A, B): Uncus with a dentate process on the posterior edge of tegumen; the latter arc- like; vinculum broad, V-shaped; valvae complex, divided into upper and lower setosed processes, lower process setosed, leaf-like in appearance; aedeagus modified, sickle- shaped, resembles the valvae, setosed apically.

Alar expanse : Male 50 mm.

MATERIAL EXAMINED: **7**♂. **India:** Punjab: Roopnagar Dist., Nangal, 370m, 24.iv.2000, 2♂; Gurdaspur Dist., Dunera, 700m, 3.vi.2000, 2♂; Ludhiana Dist., Punjab Agricultural University campus, 245m, 12.v.2010, 1♂. Himachal Pradesh: Mandi Dist., Tanyhar, 1230m, 16.vi. 2011, 1♂; Solan Dist., University of Horticulture & Forestry, Nauni, 1275m, 15.v.2001, 1♂.

(a) (b) (c) (d)

Plate 1. Photographs of the moths. (a) *Trabala vishnou* (Lefebvre) ,(b) *Suana concolor* (Walker), (c) *Euthrix laeta* (Walker) , (d) *Gastropacha pardalis* (Walker).

KNOWN DISTRIBUTION: China, Throughout India, Ceylon, Burma (Myanmar now) and Java (Hampson, 1893). India: Assam: Dibrugarh, Bihar: Champaran, Madhya Pradesh: Balaghat, Mysore and Coorg: Tithimatti, Uttar Pradesh: Dehra Dun, Mussoorie (Sen-Sarma, 1956). These specimens are in the FRI, Dehra Dun collection (12 ♂, 5 ♀), Govind National Park **(**Sanyal et al., 2013). India, Srilanka, Verma, China, Japan, Indonesia (Ades and Kendrick, 2004).

FOOD PLANTS: Castor, Ricinus communis (Gupta and Prasad, 1996). Polygonum orientale, Ricinus communis, Eugenia jambolana, Shorea robusta, Terminalia catappa, cultivated Geranium and rose, Quisqualis, etc). (Fletcher, 1925).

REMARKS: While explaining that *Trabala* is a valid generic name, Fletcher & Nye (1982) have pointed out that *T. Vishnu* Lefebvre is an incorrect spelling of *T. vishnou* Lefebvre reported from northern India. Fletcher (1925) had spelt it *vischnou*. Earlier, Hampson (1893) has followed incorrect spelling as *T. vishnu* Lefebvre. The genus is represented by its type-species in India whose male genitalia is modified. Males of the genus (about 40 species worldwide) have all very similar ground plan of genitalia construction. The dentate processes at the posterior edge of the tegumen is presently, referred as uncus (Roepke, 1951). The valvae are highly complicated structures and can be divided into upper and lower setosed processes as it is very difficult to give any specific names i.e. costa, valvula, cucullus, sacculus, ampula and harpe (Klots, 1970; Sibatani *et al.*, 1954).

Accordingly, the separation of valvae into upper and lower processes through tegumen and vinculum is done. The aedeagus is species-specific and tergal with unique with an apical process densely setosed with fine setae. While giving the key and diagnosis of this genus, Hampson (1893) has mentioned that the discal cell is open in both the wings but the present studies shows that it is completely closed.

SUBFAMILY: GASTROPACHINAE

Labial palpi long, broad; hindwing with accessory costal veinlets varies from one to many; male genitalia with cubile always present

***SUANA* Walker**

Suana Walker, 1855, List Specimens Lepid. Insects Colln. Br. Mus., **6** : 1388 (Key), 1502. Type-species : *Suana ampla* Walker, 1855, ibidem, **6** : 1463 by monotypy. (junior subjective synonym of *Lebeda concolor* Walker).

DIAGNOSIS: Hindwing with humeral cell wanting; male genitalia with aedeagus small.

Suana concolor (Walker) (Plate 1b)

Suana concolor Walker, 1855, List Specimens Lepid. Insects Colln. Br. Mus., **6** : 1463. BUT Fletcher (1925: 3) gives "*Lebeda concolor* Walker" ! TL: [India] Silhet. ST: male (BMNH, London).

DIAGNOSIS : Dark red brown; forewing transversed by four dark wavy fasciae, a white discal spot at the end of cell, a submarginal lunulate line, with more or less prominent yellow marks in undulations; hindwing dark red brown, a small humeral vein present; abdomen elongated.

MALE GENITALIA (Plate 2, Figs. C-E) Uncus reduced to a thin sclerotised plate-like structure, joined to tegumen by a conspicuous membrane; tegumen and vinculum fused to form a complete ring; valvae much reduced, membranous structures attached to the vinculum, armed with long setae, setae few in number, saccus much developed, anteriorly modified to form a long weakly sclerotised, paired finger-like structures; posteriorly modified to form weakly sclerotised saccular pouches; anellus well developed, weakly sclerotised; aedeagus small, very hard to separate, sclerotized, vesica without cornutus. Alar expanse : Male 52-54 mm.

MATERIAL EXAMINED: **4♂. India:** Punjab: Roopnagar Dist., Roopnagar, 350m, 21.x.1999, 3♂. Himachal Pradesh: Mandi Dist., Tanyhar, 1230m, 18.vi. 2011, 1♂. Jammu & Kashmir: Jammu Dist., Jammu, 350m, 2♂.

KNOWN DISTRIBUTION**:** Throughout India, Ceylon, Java and Philippines (Hampson, 1893). Throughout India, Kashmir, Sikkim, Bhutan, Sylhet, Shillong, Cherrapunji, Pollibetta (Coorg), Shembaganur (Palnis; 6,000 ft.), Ceylon: Kandy, Matale, Nawalapitiya, Ramboda; Sumatra, Java, Philippines (Fletcher,1925).

FOOD PLANTS**:** *Schima, Carnellia, Sonneratia, Cereya, Acacia, Cassia, Eucalyptus, Gossypium, Canarium, Castanea, Embelia, Theobroma* (Gardner, 1941; Pholboon, 1965; Brown, 1968). *Careya arborea, Psidium guyava [sic !], Cajanus indicus, Hibiscus rosa-sinensis, Shorea robusta, "Daminiya" (? = Grewia tilaefolia)*, occasionally on tea (Fletcher, 1925).

REMARKS: According to Holloway (1987), Suana is represented by two species i.e., S. concolor Walker and S. sundana Holloway out of which the former is widespread in the tropics. Though Hampson (1893) has remarked that the species is available throughout India, yet it cannot be said with certainty that the collection of the present three male specimens from Roopnagar (foothills of Shivaliks) is a new record from the area. As per the known distribution given above, this species has been collected only in Kashmir from NW. India, so Roopnagar, Mandi and probably Jammu are all first records from here. The genus is conspicuous due weakly developed cubile arms forming anterior base of the saccular pouch.

EUTHRIX Meigen

Euthrix Meigen, 1830, Syst. Beschreibung eur. Schmett., **2**(4) : 191. Type-species : *Phalaena potatoria* Linnaeus, 1758, Syst. Nat. (Edn. 10), **1** : 498, by subsequent designation of Grote, 1898, Illtez. Ent., **3** : 71.

DIAGNOSIS: Hindwing with humeral cell present, formed anterior to main discal cell; male genitalia with aedeagus rather much elongated. Forewing with veins R_2 and R_3 briefly stalked; hindwing with veins M_3 and CuA_1 arising separately from the cell; female genitalia with ductus bursae not much well defined from corpus bursae.

REMARKS**:** While giving diagnosis of the genus *Euthrix* Meigen, Holloway (1987) has pointed out that the use synonymic name *Philudoria* Kirby is wrongly adopted by Lajonquière (1978). In Fletcher's (1925) Catalogue these species were placed under the genus *Odonestis* Germar,1811, of which *Cosmotriche* Hübner, 1822 is a synonym ? Twelve species of *Odonestis* were catalogued by Fletcher (1925) from our subcontinent. The species belonging to *Euthrix* have dead leaf patterned forewing with an oblique dark line running from apex to the centre or base of the dorsum where it get engaged with a paler blotch within. During the course of present studes, *E. laeta* Walker have been identified, which have earlier been listed under the genus *Odonestis* Germar by Hampson (1893). However, a critical examination of various male genitalic characters shows that they conform to the type species viz., *E. potatoria* Linnaeus of the genus *Euthrix* Meigen.

***Euthrix laeta* (Walker)** (Plate 1c)

Amydona laeta Walker, 1855, List Specimens Lepid. Insects Colln. Br. Mus., **6** : 1416. Type-loc.: Sylhet [in Fletcher, 1925: 23]

DIAGNOSIS: Forewing leaf-like, yellowish brown in colour; a large white patch at lower end of cell, a small spot above it, an oblique dark line from before apex to the centre of inner margin; hindwing with costal area slightly darker. Ground colour pale dusky yellowish brown; forewing with a small rounded spot above a large whitish patch at lower end of cell, male genitalia with inner arm of valva broad basally.

MALE GENITALIA (Plate 2, Figs F-G): Uncus reduced; tegumen weak, sclerotised, ribbon-like, a pair of setosed lobes arise from tegumen; eighth tergite more sclerotised than rest of genitalia, weakly lobed distally; vinculum rather ill defined; valvae bifid, consist of a simple sclerotised processes, arising from a broader base; juxta with two anterior juxtal processes often reflected by similar processes posteriorly from cubile; aedeagus long, curved, slender, heavily sclerotised, fused sub basally to the part of juxta, with its apex extending between juxtal processes, narrower apically, a triangular crenulated, sclerotised process on the dorsal wall of aedeagus, vesica without cornutus.

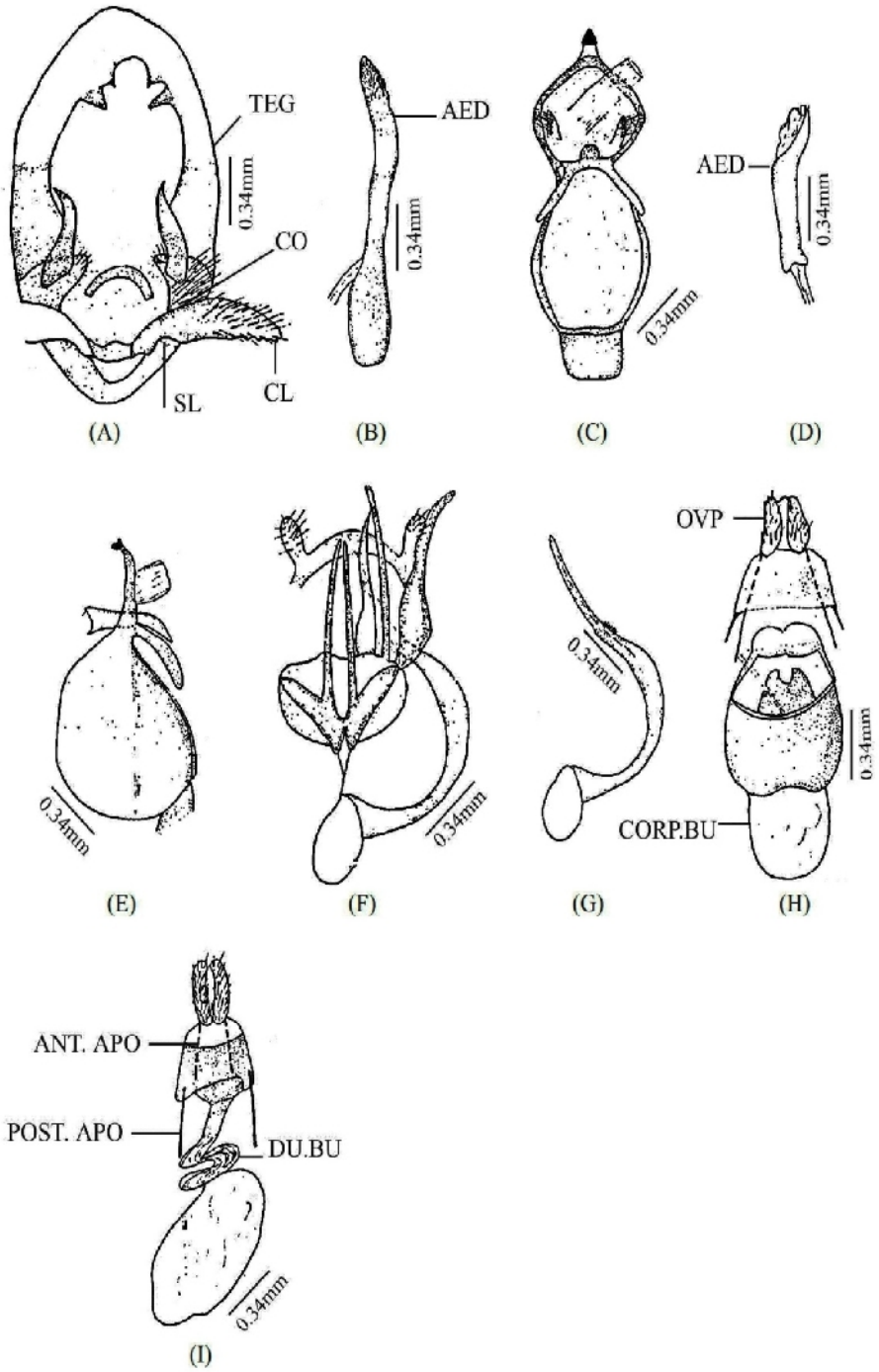
FEMALE GENITALIA (Plate 2, Fig. H*)*: Ovipositor lobes well developed, triangular, setosed; posterior apophyses longer than anterior apophyses; genital plate well developed, heavily sclerotised, broad, bilobed posteriorli; ostium bursae small, sclerotised laterally; ductus bursae weakly sclerotised, much broader; ductus seminalis originated at ductus bbursae; corpus bursae large, elongated, globular sac, signum small. Alar expanse : Male 42-44 mm; Female 64 mm.

MATERIAL EXAMINED: **3♂, 2 ♀. India:** Punjab: Gurdaspur Dist., Pathankot Tehsil, Dunera, 700m, 27.x.2001, 3♂, 2 ♀.

KNOWN DISTRIBUTION: North-West Himalayas, Sikkim, Sylhet, Burma, Sumatra, Java (Hampson, 1893), India and China (Holloway, 1987). Also Ta-tsien-lu, Chia-ting-fu (China) Korea, Japan, Siberia in (Fletcher, 1925)

FOOD PLAN : *Dalbergia* (Papilionaceae) (Brown, 1968)., Grasses (Fletcher, 1925).

Plate 2. Genitalic studies.



***Trabala vishnou* (Lefebvre)**: (A) Male genitalia-ventral view; (B) Aedeagus
***Suana concolor* (Walker):** (C) Male genitalia-ventral view; (D) Aedeagus; (E) Male genitalia with saccular pouch
***Euthrix laeta* (Walker):** (F) Male genitalia-ventral view; (G) Aedeagus; (H) Female Genitalia
***Gastropacha pardalis* (Walker):** (I) Female genitalia

***GASTROPACHA* Ochsenheimer**

Gastropacha Ochsenheimer, 1810, Schmett. Eur., **3** : 239. Type-species : *Phalaena quercifolia* Linnaeus, 1758, *Syst. Nat.* (Edn. 10), **1** : 497, by subsequent designation of Curtis, 1824, Br. Ent., **1** : 24.

DIAGNOSIS: Hindwing with humeral cell present, formed anterior to main discal cell; male genitalia with aedeagus rather much elongated. Forewing with veins R_2 and R_3 on a long stalk; hindwing with vein M_3 and CuA_1 stalked; female genitalia with ductus bursae well developed.

Gastropacha pardalis (Walker) (Plate 1d)

Megasoma pardale Walker, 1855, List Spec. Lepid. Insects Colln. Br. Mus., **6**: 1453. Type-loc.: Java.

Estigena pardalis : Fletcher, 1925, Catalog. Indian Insects, Lasiocampidae, pt. 7, p. 21.

DIAGNOSIS : Labial palpi tinged blackish; a dark stripe on vertex; both wings pale red-brown, oval in shape; forewing suffused with fuscous, erossed by four indistinct waved dark lines; hindwing with three indistinct waved lines, waved lines obsolate on oval half, veins M_2, M_3, CuA_1 stalked, vein $Sc+R_1$ curved, met by a bar from Rs, accessory costal veinlets numerous, prominent.

FEMALE GENITALIA (Plate 2, Fig. I)

Ovipositor lobes elongated, oval setosed; posteriort apophyses nearly same in length as that of anterior apophyses, both rod-like; genital plate angular; ductus bursae elongated, weakly sclerotised, coiled; corpus bursae membranous, globular.

Alar expanse : Female 56mm

MATERIAL EXAMINED: **3♀. India** : Punjab: Patiala Dist., Panjabi University, Patiala campus, 250m, 18.viii.2003, 3♀.

KNOWN DISTRIBUTION: Arabia, throughout India, Ceylon (Sri Lanka) Nagas and Andamans (Hampson, 1893). Throughout India and Ceylon, Masuri [= Mussoorie], Khatmandu [sic !], Sikkim, Bhutan, Saran, Pusa, Nagas, Burma: Mergui, Andamans, Ceylon: Pundaluoya; Java, Arabia (Fletcher, 1925). Gangotri Natioanla Park **(**Sanyal *et al.,* 2013).

FOOD PLANT**:** Polyphagous species (Zolotuhin & Pinratana, 2005).

REMARKS : Hampson (1893) reported the species pardalis Walker in the genus Estigena and Holloway (1987) synonymised the same under the genus Gastropacha Ochsenheimer because genus as well as the species typifies the characters of the subfamily Gastropachinae. The latter is unique in having an unusual development of venation in the humeral area and the stalking of veins M_2, M_3 and CuA_1 of the hindwing. Thus, owing to various taxonomic characters given by Holloway (1987), the species i.e., pardalis Walker was transferred to Gastrophacha Ochsenheimer as Gastropacha pardalis (Walker).

ABBREVIATIONS

AED – Aedeagus; ANT. APO - Anterior apophyses; CL - Cucullus, CO – Costa; CORP. BU - Corpus bursae; CuA_1 - First anterior cubital vein; DU. BU - Ductus bursae; GN – Gnathos; M_1 : First median vein; M_2 - Second median vein; M_3 - Third median vein; OVP - Ovipositor lobes; POST. APO - Posterior apophyses; PUP - Punjabi university, Patiala; R_1 - First radial vein; R_2 : Second radial vein; R_3 - Third radial vein; Rs - Radial sector; Sc - Subcostal vein; $Sc+R_1$ - Stalk of subcostal and first radial vein; SL – Sacculus; TEG – Tegumen; UN - Uncus.

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