

Review Article

FAMILY SATURNIIDAE (INSECTA: LEPIDOPTERA) OF SRI LANKA: AN OVERVIEW

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Abstract

Since the work of Moore (1880-1887) and Hampson (1892-1896) nomenclature of Sri Lankan moth fauna has remained largely unchanged. Four valid species of family Saturniidae, *Actias selene taprobanis*, *Attacus taprobanis*, *Antheraea cingalesa* and *Cricula ceylonica* are recorded. Former three species were confirmed by recent field records. *Actias selene taprobanis* and *Attacus taprobanis* are confined to Sri Lanka and wet biomes of southern India. *Antheraea cingalesa* and *Cricula ceylonica* are endemic to the island. Presence of other Saturniidae mentioned in literature requires further confirmation with field records.

Key words: Endemic, Pest, Silk moths, Silk industry, Southern India, Wet zone

Geotags: Colombo, Kandy, Yala, Anuradhapura [6.904614, 79.897213 | 7.302536, 80.616817 | 6.670064, 81.429806 | 8.314777, 80.441036]

INTRODUCTION

The Saturniidae moths are remarkable among lepidopterous insects for their economic importance as silk moths and ornamental value as well as the biological diversity. After Moore's (1882 - 1887) studies of Sri Lankan Lepidoptera, publications on moths experienced a sharp decline. Contemporary reports focus on species of moths regarded as agricultural pests (Rajapakse and Kumara, 2007; Wijesekara and Wijesinghe, 2003).

Sri Lanka does not involve in any ornamental trade, farming or collection of Lepidoptera, except the limited sericulture industry (Uragoda and Wijekoon, 1991; Datta *et al.*, 2005), leaving the importance of moth fauna to food and agriculture (Wijesekara *et al.*, 2003; Anandaraj and Devasahayam, 2004). Though scientific nomenclature of moths has extensively changed over the last century, local moth fauna lists have not been updated. Current studies on

moth species in Sri Lanka are hampered by the unavailability of updated literature (Wijesekara and Wijesinghe, 2003). This article reviews the available literature and brings the latest nomenclature to the Saturniidae of Sri Lanka.

METHODS

Valid species, descriptions, field distributions and life history records are based on published literature, personal communications to, and records of author. The Lepidoptera card index of The Natural History Museum, London (Beccaloni *et al.*, (2003) was checked for correct nomenclature. A list of Saturniidae of Sri Lanka based on the insect catalogue and specimens including the National Museum of Sri Lanka (Nandasena *et al.*, (2010) were also examined. Main references for nomenclature and valid species are Moore (1883), Jordan (1909), Peigler (1989), Paukstadt and Paukstadt (1999), Beccaloni *et al.*, (2003) and Rougerie *et al.*, (2009). All unpublished records, including personal

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communications, were confirmed by the author with specimens or identifiable photographs; other records were excluded.

RESULTS AND DISCUSSION

Tennent (1861) provides the earliest record of Saturniidae moths in Sri Lanka. He mentioned three months: Moon moth, Atlas moth and Tusser Silk moth. Moore (1882) described the same three with the names *Actias selene* Hubner, *Attacus taprobanis* Moore and *Antheraea cingalesa* Moore. Hampson (1892-1896) mentioned these three species as *Actias selene*, *Attacus atlas* and *Antheraea paphia*. He further included *Attacus ricini*. Nandasena *et al.*, (2010) mentioned *Antheraea assamensis*, *Antheraea paphia* (referring to *Antheraea cingalesa*), *Antheraea roylei*, *Samia cynthia*, and *Samia ricini* in an article about edible insects in Sri Lanka based on museum specimens and catalogues. A recent attempt to list Sri Lankan Lepidoptera (Koçak and Kemal, 2012) which is not an updated checklist and full of errors, lists *Actias selene*, *Antheraea cingalesa*, *Attacus atlas* (misidentification of *A. taproanis*), *Cricula trifenestrata* (misidentification of *C. ceylonica*), and *Samia cynthia*. An updated list of Saturniidae in most of South Asian countries has been compiled by Kitching *et al.*, (2010) including their common names, however the list does not mention the country wise distributions.

Recent phylogenetic work demonstrates the relationship between Indian Oak Tasar moth *Antheraea roylei* and Chinese Oak Tasar moth or Temperate Tasar moth *Antheraea pernyi* (Arunkumar *et al.*, 2006; Liu, Y. *et al.*, 2008; Rougerie *et al.*, 2009). Phylogenetic evidences (Arunkumar *et al.*, 2006) suggest that *Antheraea roylei* evolved after chromosomal rearrangement of *Antheraea pernyi* i.e. *Antheraea pernyi* is the ancestor. Therefore *A. roylei* is considered a subspecies, *Antheraea pernyi roylei* (Beccaloni *et al.*, 2003). Unlike most other silkmoths, hybrid

varieties of *Antheraea pernyi* used in the silk industry can survive without human caring and have been known to have some naturalized populations in India (Arunkumar *et al.*, 2006; Liu, Y. *et al.*, 2008; Ahmed, and Rajan, 2011). Therefore there is a possibility to have a naturalized population of *Antheraea pernyi* or related taxa among Sri Lankan Tasar Silkmoth *Antheraea cingalesa*. On the other hand, *Antheraea pernyi* as its common names imply, is a temperate moth which hosts on Oak (Fagaceae: *Quercus* spp.) (Liu *et al.*, 2008; Ahmed and Rajan, 2011).

These Sri Lankan references to *Attacus ricini*, *Samia cynthia*, and *Samia ricini* should be the Eri silkworm, today known as *Samia cynthia ricini*, which is a domesticated silkworm originally from the wild progenitor *Samia canningi* Hutton, distributed in the sub Himalayan forests (Pieglar and Naumann 2003). The nomenclature of such a domesticated taxon is arguable and confusing, while ‘*ricini*’ probably has a polyhybrid origin (Nässig, 2008). However Pieglar and Naumann (2003) clearly stated that genus *Samia* does not extend its range towards southern India and Sri Lanka. If the Eri silkworm (‘*ricini*’) had been introduced for sericulture in Sri Lanka, there are no records of commercial use nor is there evidence of its naturalized population known to the author. *Samia cynthia* is native to China and Korea, while it has been introduced to Japan, India, Australia, Africa and America (Pieglar and Naumann, 2003).

The Lepidoptera catalogue of BMNH also contains Sri Lankan records for *Antheraea assamensis* (Beccaloni *et al.*, 2003). Helfer (1837) first described *A. assamensis* as *Saturnia assamensis* from Assam, India and did not mention any distribution outside Assam. Today *Antheraea assamensis* is known from India, Burma, and Sundaland (Holloway, 1987). However Nässig (2002) doubt the Sundaland record of *A. assamensis* and suggest it should be

Antheraea (Antheraeopsis) youngi saying that true *A. (Ao.) assamensis* is restricted to the Himalayan area perhaps maybe including the mountains in northern Indochina or South China. Recent population genetic study of *A. assamensis* (Singh *et al.*, 2012) also considered it is endemic to Northeast India and Indo-Burma stating the failure of rearing populations outside its natural hosts, *Persea bombycina* and *Litsea monopetala* (family Lauraceae). Furthermore domesticated farm stock of *A. assamensis* crash frequently and wild populations provide new cultures (Singh *et al.*, 2012). When considered against its natural distribution and host specificity, it is hard to think *Antheraea assamensis* is native to Sri Lanka or has established introduced populations survived. *Antheraea assamensis* has been used for high quality silk production for centuries in India (Ciesla, 2002; Datta *et al.*, 2005; Singh *et al.*, 2012) but there is no record of its introduction or use in Sri Lanka.

The Moon moth in Sri Lanka and southern India was described as a new sub species *Actias selene taprobanis* by Paukstadt and Paukstadt (1999) because of the differences in the male genitalia. This sub species is clearly restricted to the tropical wet biomes of the island of Sri Lanka and southern Indian subcontinent and geographically isolated from other nominotypical *selene* and its subspecies in India (Paukstadt and Paukstadt, 1999). Peigler (1989) in his review of genus *Attacus*, continued to use *Attacus taprobanis* as a separate species. From the first description of *Attacus taprobanis* by Moore (1883) to Peigler (1989) various authors changed the taxonomic status of *Attacus taprobanis*; subspecies, or a variety, or a form of *A. Atlas* or erroneously mentioned or synonymised to *Attacus atlas* (Peigler, 1989). Though some argued this separation is not supported by strong evidence (Lemaire, 1990), recent phylogenetic studies keep *Attacus taprobanis* as a valid species (Rougerie *et al.*, 2009). *Attacus taprobanis* occurs in

wet biomes of Sri Lanka and the western coast of India, well separated from the range of *Attacus atlas* by the tropical semi-arid to arid biomes between these regions (Peigler, 1989). According to our observations (Figure 01) *Attacus taprobanis* is common in wet-zones of Sri Lanka, while it is recorded in dry-zones, showing its historical range in the island connecting to mainland India. *Attacus taprobanis* has been recorded as a pest of Cinnamon in Sri Lanka (Anandaraj and Devasahayam, 2004).

Moore (1883) described *Antheraea cingalesa* from Sri Lanka. Later, many authors misidentified it as *Antheraea mylitta* or *Antheraea paphia* (including Hampson 1892-1896; Nandasena *et al.* 2010). However, current phylogenetic studies keep *Antheraea cingalesa* as a valid species endemic to Sri Lanka (Beccaloni *et al.*, 2003; Rougerie *et al.*, 2009). Jordan (1909) in his notes on genus *Cricula*, described Sri Lankan specimens as subspecies *Cricula trifenestrata ceylonica*. This species is still referred to as *Cricula trifenestrata*, especially in agricultural pest related publications where the species is identified as pest of Cinnamon (*Cinnamomum zeylanicum* Blume Syn. *Cinnamomum verum* Presl.) in Sri Lanka (e.g. Yadav and Kumar, 2003; Anandaraj and Devasahayam, 2004). Currently, however, Rougerie *et al.*, (2009), consider *Cricula ceylonica* a valid species, probably endemic to Sri Lanka.

Three species *Actias selene taprobanis*, *Attacus taprobanis*, *Antheraea cingalesa* were confirmed with recent (post 2000) field records (Figure 01). The biology and ecology of these species, including *Cricula ceylonica*, need to be examined.

The silk moth used in Sri Lanka is the domesticated, popular mulberry moth *Bombix mori* (Wijayasinghe and Rajaguru, 1977; Dias, 1989) and no information was found about the use of other species in silk industry of the island.

Close relatives of *Antheraea cingalesa* and *Cricula ceylonica*, *Antheraea mylitta* and *Cricula trifenestrata* are widely used in India to produce native and unique 'yellow' silk and 'wild Muga' silk (Ciesla, 2002; Datta and Nanavaty, 2005; Ahmed and Rajan, 2011). Therefore investigating the economic viability of using *Antheraea cingalesa* and *Cricula ceylonica* in local silk industry would be worthwhile. The silk industry in Sri Lanka was entirely state run and limited to small production levels (Dias, 1989; Uragoda and Wijekoon, 1991; Datta and Nanavaty, 2005). But today several private enterprises manufacture silk-based products where most raw silk is imported (Dias, 1989; Datta and Nanavaty, 2005; EDB, 2012). Identification and validity of the Saturniidae specimens and catalogues in the National museum of Sri Lanka need to be verified. The presence of *Antheraea assamensis*, *Samia cynthia ricini* and *Antheraea pernyi roylei* in the island is doubtful and needs confirmation.

SPECIES DESCRIPTIONS

Actias selene taprobanis (Paukstadt and Paukstadt, 1999)

[SRI LANKAN MOON MOTH]

Expanse 12 cm to 16 cm

Adult:

Pale grey bluish-green; forewing with a dark purple-brown costal band, the extreme edge of which is much the palest; crossed by a slender sub-basal very indistinct darker green fascia, and two similar discal fasciae: hindwing with a single similar discal fascia; the tail suffused with pink across the middle. Both wings with a small rounded ocellus, which is pale pink, bordered by a yellowish line, crossed by a slender

semitransparent discocellular streak and traversed by an inner white-streaked black band. Body whitish; thorax with a purple-brown collar and a band in front; antennae yellow; legs above purple-brown. Male: can be identified by the narrower pointed forewing with curved margin of termen and rounded feathery antenna. Female: can be separated by having broader forewing with straight margin of termen. In many specimens females are paler than males.

Early stages:

Mature larva apple-green, of a semitransparent hue; each segment except the anal with, two dorsal and a sublateral spiney yellow tubercle, the tubercles also sparsely hairy, the hairs black; the back, sides, and beneath, as well as the legs, with a few very fine hairs, those on the back yellow, the others black; on the anterior segments is a smaller subdorsal and lower sublateral tubercle; the dorsal tubercles on third and fourth segments golden-yellow, with a black band. Head, forelegs, and pad of anal legs rufous brown. Cocoon large, of an irregular ovate shape, formed of coarse pale rusty brown silk closely interwoven; enclosed among the leaves of the tree.

Host plants: *Lannea coromandelica*, *Terminalia catappa*, *Terminalia arjuna*, *Annona muricata*

Distribution: The species *Actias selene* is distributed from Afghanistan, through the Indian subregion including Sri Lanka via China, southern Siberia, Korea, Japan, and the Ryukyu Islands to Taiwan and the Philippines (the islands of Luzon, Mindoro and Mindanao) the Andamans, Borneo, and the Indonesian islands of Sumatra and Java, with many subspecies (Holloway, 1987). The subspecies *Actias selene taprobanis* is distributed in Sri Lanka (Figure 01) and Southern India (Paukstadt and Paukstadt, 1999).

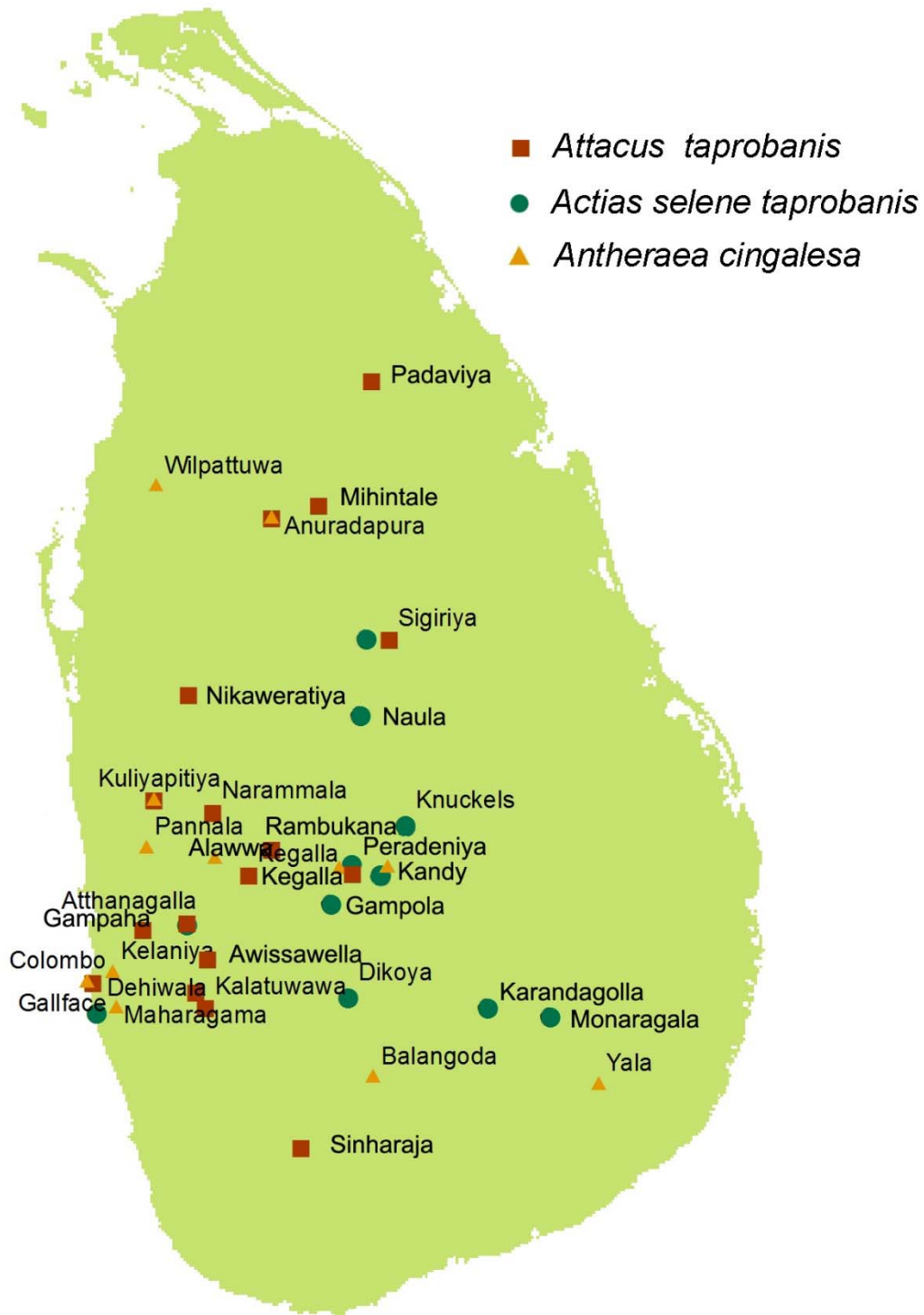


Figure 1. Recent records (post 2000) of three Saturniidae moths in Sri Lanka

***Attacus taprobanis* (Moore, 1883)**

[SRI LANKAN ATLAS MOTH]

Expanse 15 cm to 23 cm

Adult:

Purplish-ferruginous, basal and discal areas grey and black speckled, the discal area also speckled with olive-yellow scales. Both wings with a black-bordered hyaline white central triangular spot, that on the forewing elongated and with pointed angles that on the hindwing broad and with rounded inner angles. Forewing crossed by an antemedial and a postmedial red and black bordered white band, the former angulated on the median vein, the latter recurved and somewhat lunular; above the central hyaline spot is a small slender similar streak which extends to or crosses the outer white band ; the costal margin is grey and black speckled, and terminates in a black subapical spot, below which is a slender purple-red streak and a white-speckled sinuous line, the apex being paler and suffused with red and olive yellow, below which the marginal border is more or less ochreous olive-brown, and is traversed by a slender black waved line : hindwing crossed by a similar coloured subbasal band, which curves upward to the costa and returns across the disc to above anal angle ; the marginal border is ochreous olive-brown, traversed by a waved black line and an inner broken chain-like row of small blackish or purple-red spots. Body purplish-ferruginous, with white and dark grey abdominal bands above, and pale-bordered purple spots below; legs hoary; antennae ochreous yellow. However without locality data it is hard to separate *A. taprobanis* from *A. atlas* only based on the morphology due to the higher individual variations.

Early stages:

Mature larva Green, with pale brownish speckles. Head small; second, third, and fourth segments with a dorsal conical prominence; fifth to twelfth

segments with long blunt fleshy bluish-green dorsal and subdorsal spines, which project backward; a lateral blue-black slender spine on second to sixth segment, and a sublateral row of similar spines from second to twelfth segment, both rows being projected forward; spiracles blue-green; on anal segment is a red oval ring above the clasper; middle claspers black. Cocoon large, lengthened, pyriform; of a fine silken texture, pale greyish-brown, attached to a twig by a silken peduncle amongst the leaves.

Host plants: *Albizia saman*, *Cipadessa baccifera*, *Camellia sinensis*, *Cinnamomum camphora*, *Cinnamomum zeylanicum*, *Memecylon* spp., *Litsea glutinosa*, *Swietenia mahagoni*, *Symplocos cochinchinensis*.

Distribution: Sri Lanka (Figure 01) and southern India

***Antheraea cingalesa* (Moore, 1883)**

[SRI LANKAN TUSSAR SILK MOTH]

Expanse 12 cm to 16 cm

Adult:

Male: Deep yellowish-ochreous, or reddish-ochreous ; ocelli round, with black outer ring, purplish inner border and white line : forewing paler ochreous at the apex, which is speckled with purplish-white scales ; costal border hoary ; a very indistinct darker ochreous shade crossing the disc through the ocellus, and a similar outer lunular shade ; a slender slightly grey-bordered purple-brown streak crossing base of the cell, and a waved similar subbasal streak beneath; a submarginal purple brown line bordered by a slight purplish-white lunular outer line; the outer margin of the wing slightly olivaceous: hindwing with a subbasal transverse indistinct purple-brown waved streak, a very indistinct darker ochreous shade crossing the disc through the cell, and an outer discal similar lunular shade, followed by a purple brown submarginal lunular line with a very slight purplish- white outer border.

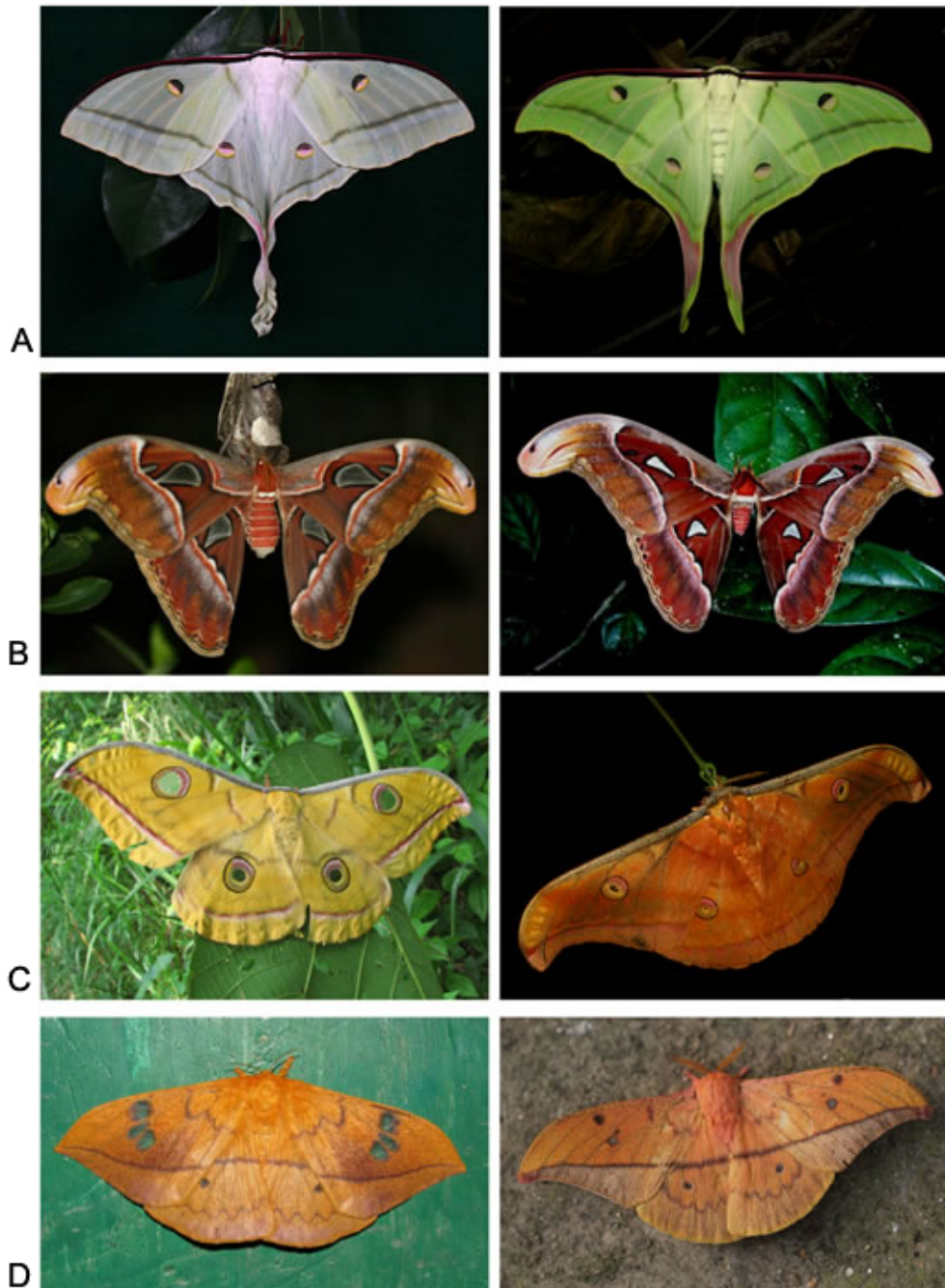


Figure 02. A. *Actias selene taprobanis* left – female, right – male. B. *Attacus taprobanis* left – female, right – male. C. *Antheraea cingalesa* left – female, right – male. D. *Cricula trifenestrata*, left – female (from Bhutan), right – male (from India). Since *C. trifenestrata* is visually close for *C. ceylonica* these figures will be helpful to identify *C. ceylonica* from other Saturnids in the island.

Female: Deep yellowish-ochreous; the ocelli larger, the subbasal streaks and submarginal purple line prominent, the latter with broad purplish-white outer border. Front of thorax, and collar, hoary; front of head, palpi, and 6 ochreous.

Early stages:

Mature larva with two dorsal rows of yellow tubercular prominences, from which radiate a few short hairs; colour green, with a yellow lateral band ending in a dilated brown band on anal segment; a lateral purple-bordered pearly-white lunate spot on sixth and seventh segment; spiracles yellow below which is a row of black dots; head small; head and forelegs purple-brown. Cocoon oval, hard, brownish-grey, attached to a twig by a short coarse silken peduncle.

Host plants: *Anacardium occidentale*, *Terminalia arjuna*, *Terminalia catappa*, *Camellia sinensis*, *Eucalyptus leucoxydon*, *Hevea brasiliensis*

Distribution: Endemic to Sri Lanka (Figure 01)

***Cricula ceylonica* (Jordan, 1909)**

[SRI LANKAN CRICULAR]

Expanse 6 cm to 10 cm

Adult: Male: Clayish ochraceous, transparent spot of forewing more heavily edged with black than usually. The process of the penis-funnel siunate; subapical lobe of clasper broad.

Female: Tawny ochraceous. The three transparent spots of forewing heavily edged with black, especially on distal side; upper spot deeply incurved, its lower angle pointed; very little purplish grey shading on forewing. Antemedian line of hindwing heavy; transparent spot with conspicuous black border; marginal area purplish grey from anal angle nearly to third radial. On underside the transparent spots of both wings more strongly edged with black, the spot of hindwing transverse, anal area of both wings densely shaded with purplish grey like the disc,

and this area more sharply defined than usually. Legs red (Jordan, 1909).

Early stages: Not recorded, known to be a pest of crops which it hosts (Yadav and Kumar, 2003).

Host plants: *Cinnamomum zeylanicum*, *Mangifera indica*

Distribution: Endemic to Sri Lanka (Figure 01)

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