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by
G. S. ARORA
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I. INTRODUCTION

The species of non-mulberry silkmoths, also known as Emperor moths, Giant silkworms, Wild-silkworms, etc. mostly belong to the family Saturniidae. Of the 1,100 species listed from the world only about 40 species are known to occur in INDIA.

The Saturniidae includes medium to very large sized, brightly and strikingly coloured moths, some of these having the largest wing area of all the Lepidoptera. The adults are mostly nocturnal and short lived. The males are smaller than the females about which they assemble in large numbers. The species are univoltine to multivoltine depending upon the climatic conditions.

The family Saturniidae is of great economic importance, for it includes species which produce silk of commercial value. Whereas Andre (1907) reported only five species of Saturniidae, Cotes (1888, 1891) referred to about 30 species, and Cooper (1942) mentioned about 60 species of wild silkmoths. At present, nearly 80 species of insects are known to produce wild silks of economic value (Jolly *et al.*, 1975), the majority of which occur in the wild state where they feed upon various plant species.

Of all these non-mulberry moths, the most important three species, exploited for yielding wild silk of commercial value, are : *Antheraea paphia* (L.) commonly known as the 'Indian Tasar Moth', which yields brownish tasar, *A. assamensis* (Helfer) called 'Indian Muga Moth', which produces golden muga silk, and *Samia cynthia* (Drury) popularly referred as the 'Indian Eri Moth' or 'Arindi Moth', which yields white or brick-red eri silk. Thus, INDIA is the only country in the world producing all the three commercial varieties of non-mulberry silks on a large scale. INDIA also occupies second position in the world as far as the total yield of tasar is concerned and first in respect of eri and muga silks. The muga silk is produced only in INDIA in the North-Eastern States, particularly Assam.

Besides, *Antheraea roylei* Moore has recently heen exploited by Jolly (1973) for the commercial production of wild silk by crossing it with Chinese species *Antheraea pernyi* Guérin-Méneville ; the hybrid being named *Antheraea proylei**. These experiments of breeding were conducted as early as 1882 by Wailly who in 1896 reported "that the moths of these two allied species paired together as if they were the same species and the hybrid was robust."

The studies on the improvement of types of silk-producing insects have been neglected so far. The importance of their studies, in the world, realised only recently, is evident in the holding of the First International Seminar on Non-Mulberry Silks, in 1974, at Ranchi (INDIA). Further, "Wild silkworms are easier to exploit than the *B. mori* for it is a simplet, more natural work ; the only matter capital though, is harvest" as expressed by Rarimanpianina (1970) is significant.

The descriptions of the Indian species of wild silkmoths given by earlier workers are inadequate, as revealed in the literature, and the information on host plants scattered. Moreover, in the light of increasing knowledge about these insects, the family Saturniidae has undergone a considerable change as far as its classification is concerned. At present, seven

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* Tutt (1902) named these hybrids as *Antheraea kirbyi* from ♂ *A. pernyi* X ♀ *A. roylei*, and *A. moorei* from ♂ *A. roylei* X ♀ *A. pernyi*. As such, these old names viz., *A. kirbyi* and *A. moorei* have precedence over *A. proylei* Jolly (1973).

subfamilies, Rhescyntinae, Citheroniinae, Saturniinae, Agliinae, Ludiinae, Hemileucinae and Salassinae, are recognised in the world under this family against three subfamilies, recognised earlier, *viz.* Saturniinae, Attacinae and Ludiinae (Aurivillus, 1904). Of these seven subfamilies, Saturniinae and Salassinae are known from INDIA.

It is in view of this that an attempt has been made to study Indian non-mulberry silkmoths, taxonomically. Accordingly, 17 species distributed over 10 genera, including *Proactias* gen. nov., belonging to the subfamily Saturniinae, have been redescribed on the basis of morphological characters, including male genitalia, the need of which was felt as early as 1928 by Seitz. The distribution of the species includes the localities cited in literature as well as those of which the material was available for study. The information about the host plants of these species has also been incorporated (*vide* Wardle, 1881 ; Cotes, 1888, 1891 ; Watt, 1908 ; Lefroy, 1909 ; Fletcher, 1914 ; Klaue, 1931-32 ; Ayyar, 1940 ; Cooper, 1942 ; Roonwal, 1954 ; Bhasin and Roonwal, 1954 ; Bhasin, Roonwal and Singh, 1958 ; and Mathur and Singh, 1959, 1960 and 1961).

II. HISTORICAL REVIEW

Linnaeus (1758) was the first to describe two of the present day 'Wild-silkworms' under the group "Bombyx" of *Phalaena*, as *Phalaena Bombyx atlas* and *Phalaena Bombyx paphia*. Although he stopped using the word "*Bombyx*" after having erected the genus *Attacus* and included the two species under the group *Phalaena Attacus*, the name Bombyx was constantly being used nearly till the beginning of the 19th century when Hübner (1820) erected *Antheraea* to include *paphia* of Linnaeus (*loc. cit.*). In the meantime Drury (1773) described *cynthia* under *Phalaena Attacus* as *Phalaena Attacus cynthia*.

The next century brought to light several species of wild silkmoths, some of which have been synonymised with the present day fauna. Whereas Hübner (1806), Doubleday (1847), Westwood (1848) and White (1859) added one species each viz., *selene*, *maenas*, *katinka* and *edwardsii* respectively, Helfer (1837) added two species, *assamensis* and *trifenestrata* before Moore (1859, 1877) who added as many as five species which are recognised good and valid species even to-day : these are *Antheraea frithi*, *A. roylei*, *A. andamana*, *A. helferi* and *Rhodinia newara*. At the end of 19th century one species was added by Hampson (1892), *Antheraea knyvetti*, and another by Rothschild (1899), *Antheraea compta*.

Although Boisduval (1834, 1840) proposed the term 'Tribus Saturnides', Duponchel (1846) treated the Saturniid fauna under 'Attacidae', and Herrich-Schäffer (1850) under the family 'Saturniidae'. Later, Smith (1886) classified the family into two distinct subfamilies *viz.*, Attacinae and Saturniinae which was, however, not followed by Hampson (1892) who maintained *status quo* so far as the Indian Saturniid fauna was concerned. The opinions differed as to the practical applicability of the proposed systems and till the middle of 20th century several classifications were proposed, such as by Aurivillus (1904) who subdivided Saturniidae into three subfamilies *viz.*, Saturniinae, Attacinae and Ludiinae, which was followed by Gaede (1927) and Schüssler (1933-36). The latter catalogued the world species under Saturniidae except the genera *Actias* Macleay and *Sonthonnaxia* Watson which were treated separately under the family Syssphingidae (Ceratocampidae or Citheroniidae of others). Jordan (1922) proposed three subfamilies *viz.*, Saturniinae, Agliinae and Ludiinae, obviously including all the Indian species of Attacinae and Saturniinae (of Smith *loc. cit.*) under the single subfamily

Saturniinae and included one more family Ceratocampidae with two subfamilies *viz.*, Ceratocampinae and Rhescyntinae under his superfamily Saturnioidea. Michener (1952), however, sub-divided Saturniidae into seven subfamilies *viz.*, Saturniinae, Agliinae, Ludiinae, Salassinae, Citheroniinae, Hemileucinae and Rhescyntinae and has been followed, as such, by Ferguson (1971-72), and in the present work.

The whole of the Indian Saturniid fauna, including about 40 species, is represented by two subfamilies *viz.*, Saturniinae and Salassinae.

In the present work 17 species distributed over ten genera belonging to subfamily Saturniinae have been dealt with here for taxonomic studies.

III. MATERIAL AND METHOD OF STUDY

The material before us consists of some 400 specimens belonging to 17 species distributed over ten genera namely *Actias* (1 sp.), *Sonthonnaxia* (1 sp.), *Proactias* (1 sp.), *Rhodinia* (1 sp.), *Cricula* (2 spp.), *Loepa* (1 sp.), *Antheraea* (7 spp.), *Attacus* (1 sp.), *Archaeoattacus* (1 sp.) and *Samia* (1 sp.). The material is deposited in the National Zoological Collections at Zoological Survey of India, Calcutta.

The wing venation was studied by applying toluene with the help of a fine sable-hair brush without damaging the scales. Similarly, toluene was employed for studying antennae, tibial spurs, tarsal spines, etc. Other morphological structures were studied after treating with 10% Potassium hydroxide solution. For this the head, legs and apical half of the abdomen were kept in 10% KOH solution for the necessary treatment ; then the material was washed thoroughly with distilled water, dissected for study, and sketches made. The material was later passed through various grades of alcohol and preserved in 90% alcohol.

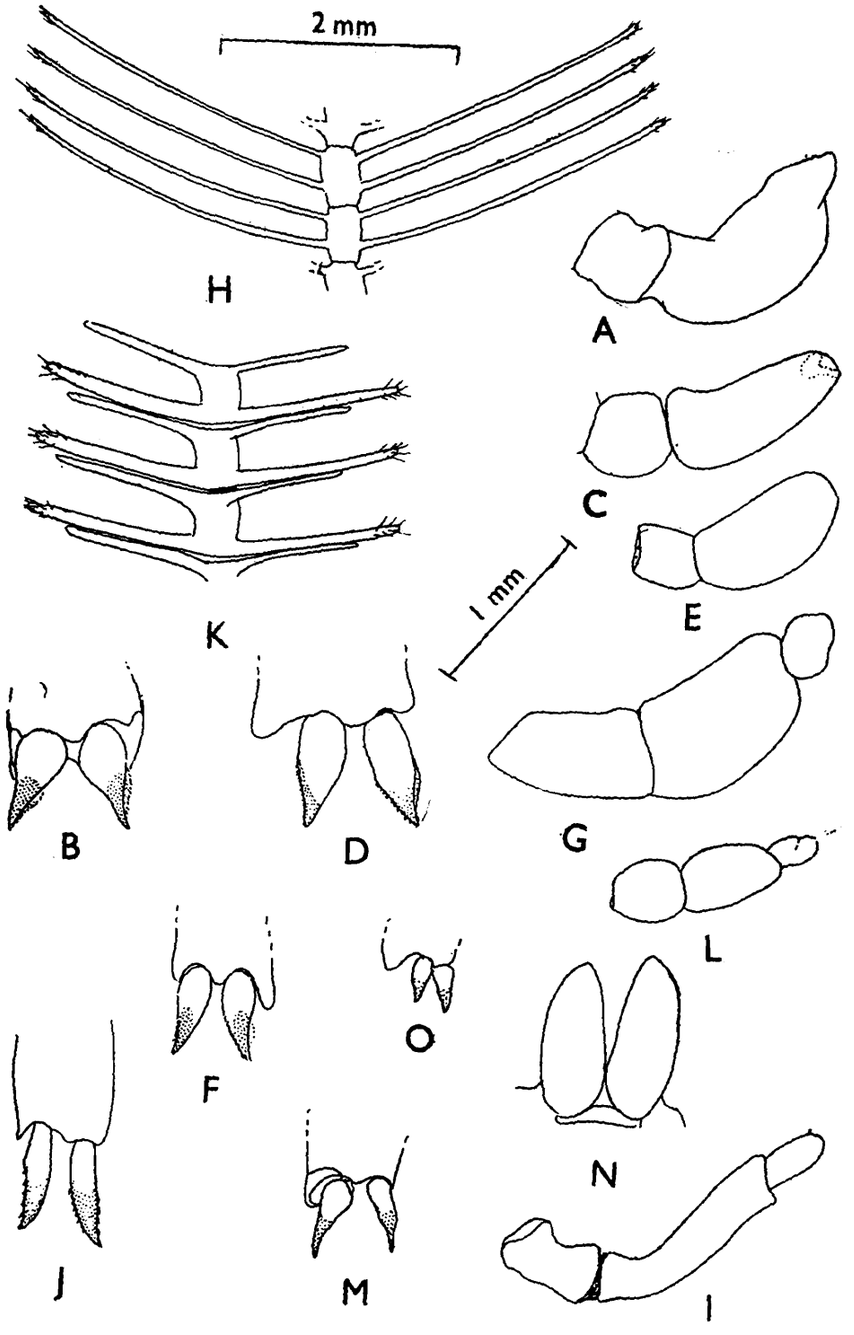
The morphological characters including those of male genitalia which were considered of taxonomic importance during the present studies are as follows :—

Frons : The frons may be flat or convex next to eyes or rarely convex throughout as in *Samia* and *Archaeoattacus* ; laterofrontal suture may or may not be distinct.

Antennae : The antennae are quadripectinate both in male as well as in female except for a few apical segments. However, the ramii in males are invariably long and equal as compared to those of female which are shorter and generally unequal. In majority of the cases the ramii are beset with a few terminal and subterminal bristles. In majority of the genera distal ramii of one segment are quite apart from the basal ramii of the subsequent segment (Text-fig. 1, H). However, in *Loepa* these ramii are close to each other and form a very good distinguishing character (Text-fig. 1, K).

Mouth parts : The labial palpi were found to be quite variable, being large and one-segmented as in *Attacus* (Text-fig. 2, A), small and one-segmented as in *Cricula* (Text-fig. 1, H) ; two-segmented as in *Sonthonnaxia*, *Actias* and *Proactias* (Text-fig. 1, A, C & E), and three segmented in others. Similarly, reduced proboscis is also important taxonomically since it is present in a few genera like *Antheraea*, *Samia* etc. It is completely absent in *Attacus*. It may exhibit sexual dimorphism as in *Samia*, being fringed in male, annular and not fringed in female.

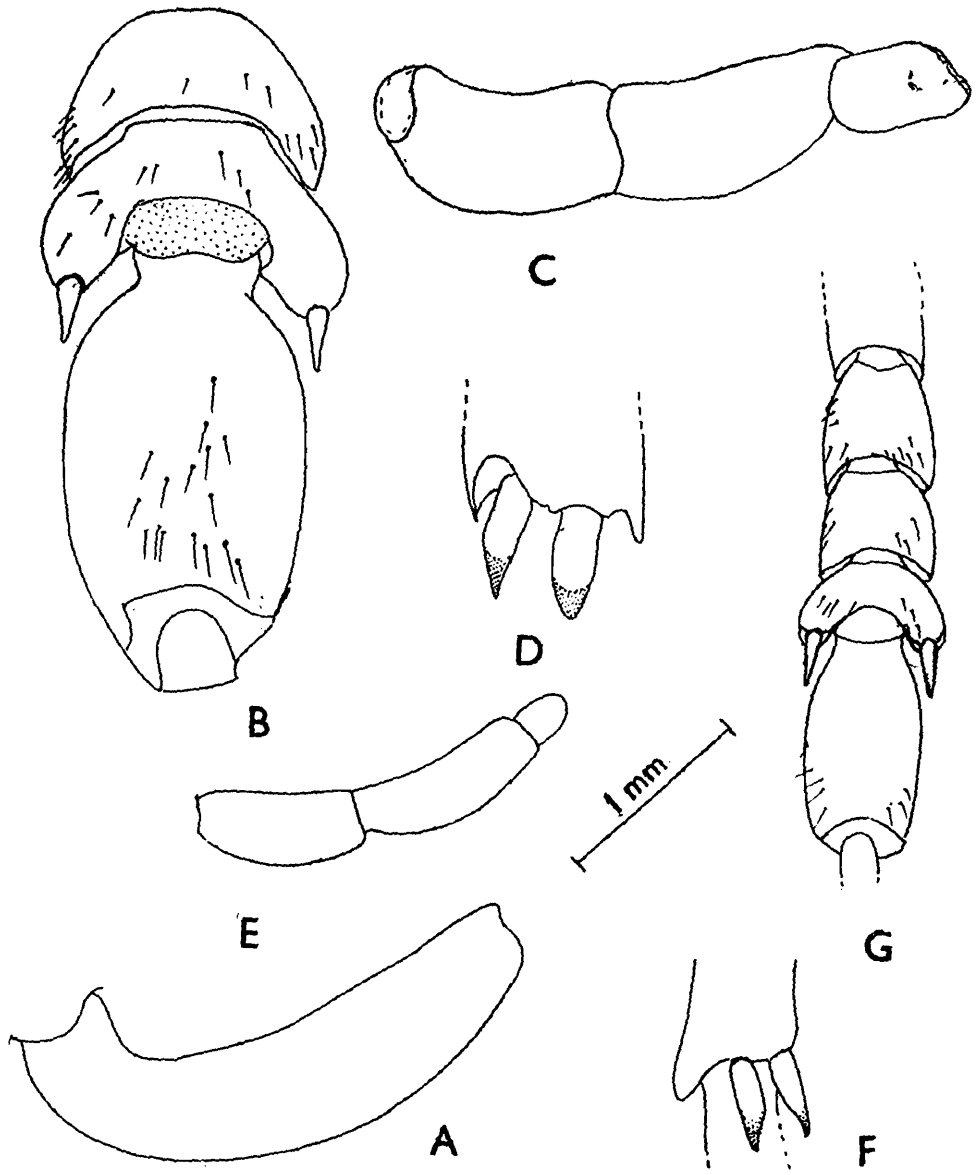
Wing venation : This is fairly constant except for the radials which are reduced to four as in *Antheraea* and *Sonthonnaxia* because of the coincidence of veins R_4 and R_3. The cell of the fore wing may be completely closed as in Saturniini, except in *Rhodinia* where it is only



Text-fig. 1. Labial palpi and hind tibial spurs of *Sonthonnaxia maenas* (A and B), *Actias selene* (C and D), *Proactias sinensis* (E and F) ; (G) Labial palpus of *Rhodinia newara* ; (H) antenna, (I) labial palpus, (J) hind tibial spurs of *Antheraea paphia* ; (K) antenna, (L) labial palpus, (M) hind tibial spurs of *Loepa katinka* ; (N) labial palpi of *Cricula andrei* (all except H of the same mag.).

partly closed, or completely open as in the *Attacini*. The vein M_2 has been considered as absent in accordance with the studies made by Turner (1946). The outline of both the wings is also variable *i.e.*, fore wings are falcate in *Antheraea*, *Attacus*, *Archaeoattacus* and *Samia* ; and hind wings are produced into tails as in *Actias*, *Sonthonnaxia* and *Proactias*.

Legs : The epiphysis of the fore tibia is quite variable. There is a single pair of short terminal spurs on mid and hind tibia except in the genus *Attacus*. Although the spurs are short with the margins partly but minutely serrate, the shape is variable, being generally narrow and gradually tapering, or bulbous basally (Text-fig. 1, B) as in *Sonthonnaxia*. The tarsal spines are, usually, present, sparsely on 1-4 segments, rarely absent on 4th segment, however the tarsi are without spines in *Loepa* and *Cricula*. The fourth tarsal segment of females of *Antheraea*, *Attacus* (Text-fig. 2, B) and *Samia* (Text-fig. 2, G) is produced laterally and ends in a spine. The claws are usually with a well-developed arolium and pulvilli.



Text-fig. 2. (A) labial palpus, (B) female fore tarsal segments (3rd to 5th) of *Attacus atlas* ; (C) labial palpus, (D) hind tibial spurs of *Archaeoatlacus edwardsii* ; (E) labial palpus, (F) hind tibial spurs, (G) female fore tarsal segments (2nd to 5th) of *Samia cynthia* (all of same mag.).

Male genitalia : The uncus is quite useful in differentiating various genera. Although it is usually bifid apically, it assumes various shapes ; as for example it may be elevated mid-dorsally and serrated as in *Actias selene*. The gnathos may be absent or present, the gnathal arms may be free as in *Loepa* and *Cricula*, or united mid-ventrally in others. The presence of labides in *Antheraea* is a very characteristic feature not noticed in any other genera presently

studied. The shape of the valvae, juxta, transtilla, and aedeagus with vesica are helpful in distinguishing genera as well as species. Mehta (1933) and Klots (1956) have been consulted for the studies on male genitalia.

IV. Taxonomic Account

Family Saturniidae

The family Saturniidae is characterised by the absence of a tympanum, frenulum, and in the hind wing of a bar between veins Sc and Rs. The fore wing may or may not possess all the radials ; M_1 arises from the upper angle of cell ; M_2 absent (*vide* Turner, 1946) ; M_3 from the lower angle of cell ; Cu_2 absent ; and 2nd anal forming a fork with 1st anal. In the hind wing Cu_2 is absent and usally one anal vein is present. The mouth parts are reduced, proboscis lacking, or, if present, very short. Ocelli absent. Antennae heavily scaled at the base but with the shaft and ramii unscaled or sparsely scaled ; the antennae are quadripectinate in all the Indian genera with the ramii generally longer in the male than those in the female. The epiphysis on the fore tibia long, rarely reaching as far as the apex of the fore tibia ; mid and hind tibia usually with a pair of short terminal spurs (except in *Attacus*). The tarsal spines may or may not be present ; the last tarsal segment bearing claws, with well-developed arolium pad and paired pulvilli. In the male genitalia the uncus is usually bifid apically, the gnathos may be absent, or, if present, the gnathal arms may be free or meet mid-ventrally. The transtilla may be absent or strongly developed, sometimes bearing a large median plate, or it may also be produced into large lobe-like structures, labelled here as labides.

Michener (1952) subdivided the family Saturniidae into seven subfamilies, four of which, *viz.*, Saturniinae (World-wide), Agliinae (Eurasia), Ludiinae (Africa) and Salassinae (Asia) are confined mainly to the Old World whereas the other three, Rhescyntinae, Hemileucinae and Citheroniinae, belong to the New World mainly America, and can be separated from one another on the basis of the adults by the following key (adapted from Michener *loc. cit.*) (page 372) :—

Key to the seven Subfamilies of Saturniidae based on Adults

1.	Pilifers with strong bristles, or, if absent, bristles are present on clypeal margin between pilifers (America)	*Rhescyntinae*
—	Pilifers and clypeal margin without bristles	2
2.	Frons convex at sides so that laterofrontal sutures are completely hidden from front view ; antennal cones simple (America)	*Citheroniinae*
—	Frons flat at sides, or, if convex, the antennal cones are multiple ...	3
3.	Frontal protuberance present, though often a mere transverse ridge (absent in *Polythysania* and a few *Hylesia*) ; tarsal spines usually absent except those of penultimate fore tarsal segment of female ; anepisternal suture usually not slanting downward posteriorly	6
—	Frontal protuberance absent (sometimes there is a superficially similar clypeal protuberance) ; tarsal spines usually present ; anepisternal suture variable	4
4.	Anepisternal suture slanting down posteriorly ; Rs of fore wing usually arising from anterior apical angle of discal cell	5
—	Anepisternal suture horizontal or slanting upward posteriorly ; Rs of fore wing leaving discal cell well before apex of latter (world-wide) ...	*Saturniinae*

5. Vein M_1 [M_1] of fore wing arising in front of middle of apex of discal cell ; antennal cones simple (EURASIA) ... ... *Agliinae*

— Vein M_1 [M_1] of fore wing arising near middle of apex of discal cell ; antennal cones sometimes multiple (AFRICA) ... ... *Ludiinae*

6. Antennal cones present, simple, rarely (*Polythysania*) reduced to blunt projections ; Rs of fore wing usually arising from anterior apical angle of discal cell (AMERICA) ... ... *Hemileucinae*

— Antennal cones absent ; fore wing with Rs leaving discal cell well before apex of latter (ASIA) ... ... *Salassinae*

Subfamily *SATURNIINAE*

The characteristics given below are based primarily on the Indian material : Frons convex or flat laterally ; the laterofrontal suture may or may not be visible ; frontal protuberance generally absent. Antennae quadripectinate in both the sexes, with the bases of ramii (*i. e.* distal ramii of one segment and basal ramii of the next segment) usually well separated with the exception of *Loepa* in which they are adjacent to each other, ramii shorter in female, antennal cones always multiple. Mid and hind tibiae with terminal spurs usually short and not longer than diameter of the tibia, except in *Attacus* where tibial spurs are absent ; hind tibiae without subapical spurs. Ferguson (1972) refers to the presence of characteristic patches of colour near the apex of fore wing "the marking may be in the form of a nearly apical patch or streak (Saturniini tribe), or as a more definite, subcircular ocellate spot (Attacini tribe). These marks are modified remnants of the submarginal band. Only *Actias* lacks such marks entirely, and in *Rothschildia* the ocellate spot may by reduced or broken up. In some Attacini both kinds of markings may be present. The apical patch or streak in Saturniini consists of various combinations of black, white, red or pink ; the ocellate spot of Attacini is black, or blue and black. Old world members of these two tribes have the same markings".

Distribution.—Worldwide in distribution.

Remarks.—The Indian species of the wild silkmoths, referable to Saturniinae have been further classified into two tribes *viz.*, Saturniini and Attacini, and have been dealt with under seven and three genera, respectively.

The first group of 'tailed' saturniins includes *Sonthonnaxia maenas* (Doubleday), *Actias selene* (Hübner) and *Proactias sinensis* (Walker), the second group includes the remaining 11 species, seven of which belong to *Antheraea*, one species each to *Rhodinia* and *Loepa*, and two to *Cricula*. All the three species of 'tailed group', till 1912, were included in the genus *Actias* when *maenas* was treated separately under a new genus *Sonthonnaxia* by Watson (1912). The present study has revealed that *sinensis* neither belongs to *Actias* nor to the genus *Sonthonnaxia* and has been separated under yet another new genus *viz.*, *Proactias*. Of the remaining four genera of Saturniini, the genus *Rhodinia* is of considerable taxonomic importance, almost functioning as a link between the two tribes because of partly closed cell (also *vide* Watson, 1913) in both wings which have a completely closed cell in the Saturniini and open cell in the Attacini.

The remaining three genera, *Attacus*, *Archaeoattacus* and *Samia*, belong to Attacini, each represented by a single species. Although the genus *Archaeoattacus* was erected as early as 1914 by Watson, the species *Archaeoattacus edwardsii* (White) is still usually placed in the

genus *Attacus* along with *atlas* (Linn.) (*vide* Seitz, 1926 : Pruthi, 1969 ; Nayyar *et al.*, 1976 ; Richards & Davies, 1977 etc.). The present studies differentiate these three genera from each other taxonomically.

Key to the Tribes of the Subfamily *SATURNIINAE.*

Fore and hind wings with the cell completely or partly closed	SATURNIINI
Fore and hind wings with the cell completely open	ATTACINI

Tribe SATURNIINI

Key to the Genera of the Tribe SATURNIINI

1.	Hind wing tailed	2
—	Hind wing not tailed	4
2.	Hindwing tail longer than costa of fore wing in male ; fore wing with four radials only. Saccus in male genitalia long	*Sonthonnaxia* Watson
—	Hindwing tail shorter than costa of fore wing in male ; fore wing with five radials. Saccus in male genitalia short	3
3.	Frons convex at sides next to eyes. Antennae in male as long as thorax. Uncus in male genitalia elevated	*Actias* Macleay
—	Frons flat at sides next to eyes. Antennae in male longer than thorax. Uncus in male genitalia not elevated	*Proactias* gen. nov.
4.	Fore wing with the discocellulars incurved and not closing the discocellular cell ; R_5 stalked with M_1 beyond the upper angle of cell ; hind wing with only lower discocellular present	*Rhodinia* Staudinger
—	Fore and hind wings with the discocellulars completely closing the cell ; R_5 arising before the upper angle of cell	5
5.	Fore wing with four radials. Gnathos in male genitalia only rudimentary ; transtilla absent ; labides well developed ; aedeagus without cornuti on vesica	*Antheraea* Hübner
—	Fore wing with five radials. Gnathos and transtilla present ; labides absent ; aedeagus with cornuti on vesica	6
6.	Frons convex and raised above the level of eyes ; antennae with distal ramii of one segment close to basal ramii of the succeeding segment ...	*Loepa* Moore
—	Frons flat at sides next to eyes ; antennae with ramii of one segment well separated from ramii of the succeeding segment	*Cricula* Walker

Genus **Sonthonnaxia** Watson

1912. *Sonthonnaxia* Watson, *The Wild Silkmoths of the World.*
1928. *Sonthonnaxia,* Bouvier, *Bull. Hill Mus.,* 2 : 138
1936. *Sonthonnaxia,* Schüssler, *Lepid. Cat.,* **70** : 48.

Type-species.—Actias maenas Doubleday (1847).

Frons convex at sides next to eyes. Eyes large. Antennae in male slightly shorter than the thorax, quadripectinate to a little before the apex, cones simple, with the ramii equal, beset with a few terminal and subterminal bristles ; shaft with scales on the upper side ; antennae in female with ramii unequal, basal ramii beset with terminal and subterminal bristles and distal ramii without such bristles. Labial palpi short and two segmented. Hindwing tail narrow, longer than the length of fore wing in male but shorter than the length of fore wing in female. Legs with the fore tibia having a well developed epiphysis in both sexes, reaching apically three-fourths of tibia ; mid and hind tibial spurs with their basal

halves dilated and tapering distally, with the margins sclerotised and minutely serrated ; tarsi with spines except on the fifth segment of the fore tarsus in the female ; claws with arolium and pulvilli well developed.

Fore wing with four radials ; R_1 very short ; R_2 and R_3 coincident ; R_5 arising before angle of cell ; M_1 from upper angle of cell and discocellulars excurved.

Uncus produced at the apex into a pair of processes, dorsally as well as ventrally. Gnathal arms meeting to form a small rectangular plate. Saccus very long. Anellus with straight and backwardly directed processes. Valva with a well developed spine. Aedeagus very long (not cylinderical and funnel like).

Distribution.—INDIA ; BHUTAN ; BANGLADESH ; BURMA ; THAILAND ; N. VIETNAM ; INDONESIA ; and CHINA.

Remarks.—Schüssler (1936) recorded three species under this genus, including '*Sonthonnaxia sinensis*' which has since been separated presently to *Proactias* gen. nov., thus leaving only two species. This genus comes under the tailed group of Saturniini along with other two genera viz., *Actias* and *Proactias*, from which it differs in the presence of four radials in the fore wing, having a hindwing tail longer than costa of fore wing and in a longer saccus in the male genitalia.

1. **Sonthonnaxia maenas** (Doubleday)

(Pl. I, nos. 1-4 ; Text-figs. 1, A-B ; 3, A-I)

1847. *Actias maenas* Doubleday, *Ann. Mag. nat. Hist.*, **19** : 95, pl. 7, fig. 1 (*Type locality.* —Sylhet).
1848. *Saturnia leto* Doubleday, *Trans. ent. Soc. Lond.*, **5** : 51, pl. 15 (Syn. *vide* Hampson 1892).
1855. *Tropaea maenas*, Walker, *Cat. Lep. Het. Brit. Mus.*, **6** : 1263.
1862. *Actias leto*, Moore, *Trans. ent. Soc. Lond.*, (3) **1** (4) : 317.
1877. *Actias ignescens* Moore, *Proc. zool. Soc. Lond.* : 602.
1892. *Argema maenas*, Kirby, *Syn. Cat. Lep. Het.*, **1** : 767.
1912. *Sonthonnaxia maenas*, Watson, *The Wild Silkmoths of the World.*
1928. *Sonthonnaxia maenas*, Bouvier, *Bull. Hill Mus.*, **2** : 138.
1936. *Sonthonnaxia maenas*, Schüssler, *Lepid. Cat.*, **70** : 49-50.
1954. *Actias maenas*, Roepke, *Tijdschr. Ent.*, **97** (4) : 257.

"Anterior wings pale greenish yellow, the costa, except at the apex, ferruginous, sprinkled with cinereous ; outer margin rufescent : near the base of transverse narrow band of the same colour, and beyond the middle a not very distinct flexuous streak : a large lunule at the end of the cell connected with the costal vitta, of the same colour with this at its origin, then much paler externally, nearly black internally, marked with a very delicate white line. Posterior wings of the same colour as the anterior, tailed, the tails very long, wrinkled at the extremity, sprinkled with ferruginous from the base nearly to the middle, the outer margin of the wing and of the basal half of the tail ferruginous ; disc with a small black lunule divided by a white line resting on a faint cloud, darkest on the inner side : between this and the margin a very obsolete waved striga.

Below, the anterior wings want the basal striga, the costa is paler, the lunule wants the black, and the flexuous band is more distinct, as it also is on the posterior wings.

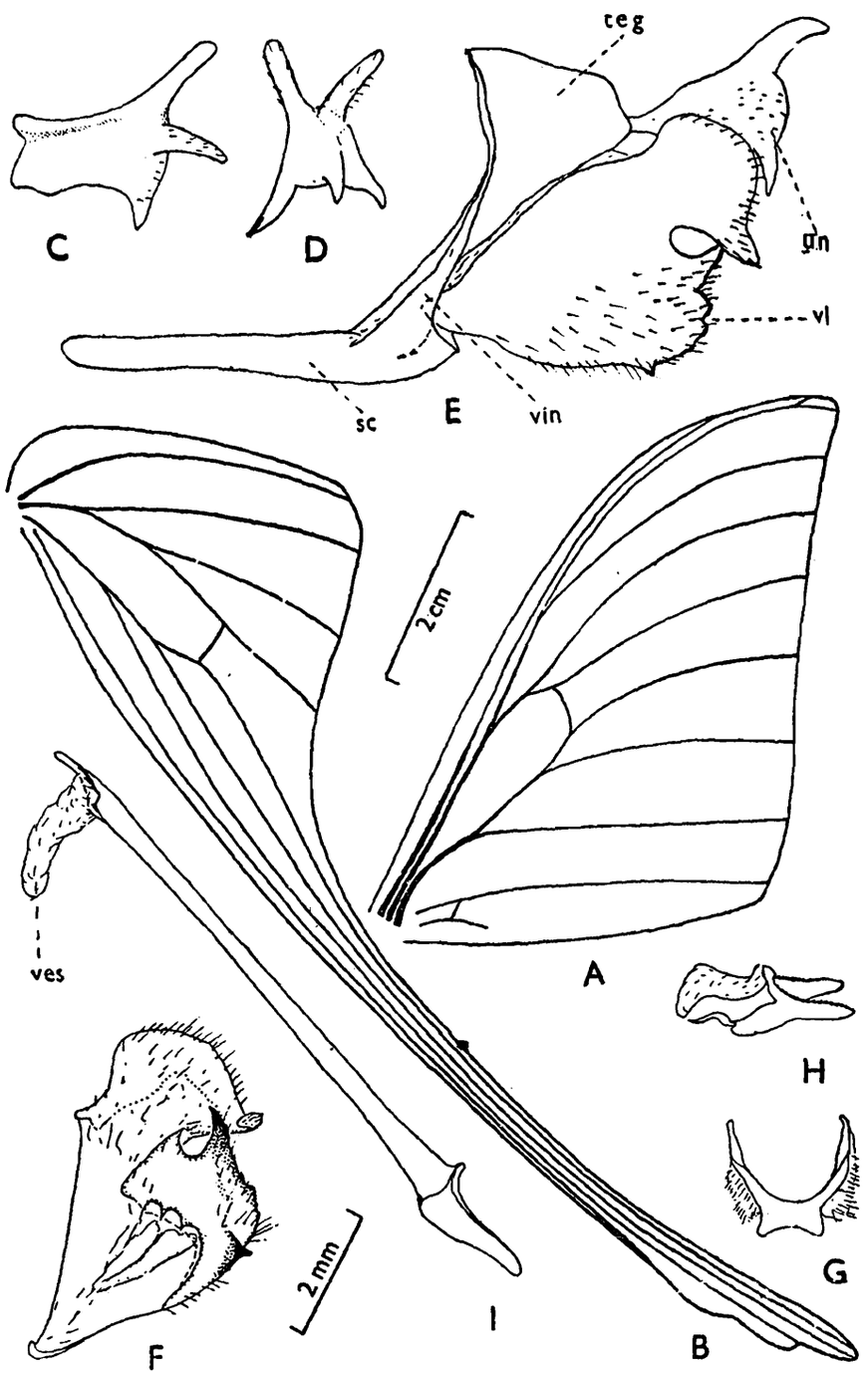
Head and antennae pale.

Thorax greenish yellow, the front part broadly ferruginous, sprinkled with cinereous, legs vinous red, with pale spots.

Abdomen pale greenish yellow.

In the Collections of the British Museum and W. W. Saunders Esq.

This fine insect is easily distinguished from *Act. Selene* by its peculiar greenish colour, the flexuous external striga, the want of the white band on the prothorax, the great length of the tails, and the more rounded anterior wings". (original quoted *vide* Doubleday, 1847).



Text-fig. 3. *Sonthonnaxia maenas*: A, fore wing venation ; B, hind wing venation ; C, lateral view and D, disto-dorsal view of uncus ; E, lateral view of male genitalia ; F, inner view of right valva ; G, gnathos ; H, lateral view of anellus ; I, aedeagus (A and B of same mag. ; C-I of same mag.)

Venation.—(Text-fig. 3, A–B). Fore wing with vein R_1 very short ending just a little before the apex ; veins R_2 and R_3 coincident, ending just below the apex ; and vein R_4 long, ending in between veins R_{2+3} and R_5.

Male Genitalia.—(Text-fig. 3, C – I). Uncus narrow at base compared with apical part, the latter broad, rounded and produced into a pair of processes, dorsally as well as ventrally, the ventral processes gradually narrowing, whereas apical ones almost of uniform width throughout. Gnathal arms meeting midventrally through a small rectangular plate, the latter emarginate. Tegumen short and broad, continuing without demarcation into vinculum and saccus, the latter very long and cylinderical. Valva short and broad, slightly depressed mid-dorsally, distally rounded and produced mesally into a short valvular prolongation, ventral margin from base to near subapex sclerotised, serrated, beyond which incised, two prominent inwardly directed processes present, process of sacculus shorter than the process of harpe. Anellus with a very slightly sclerotised bridge dorsally connecting the two lateral juxtal plates, the latter narrow, produced apically into highly sclerotised and conical serrated processes. Aedeagus well differentiated into short basal and the very long and slender apical part ; the apical margin toothed.

Wing expanse.—Males, 112-172 mm ; females, 134-185 mm.

Material examined.—53 examples (36 ♂ ♂ and 17 ♀ ♀) : INDIA : Sikkim, 1 ♂ (no further data), 3 ♂ ♂ (*J. C. Jordan* coll.), 1 ♀, 3. iii. 1888, 1 ♂. 7. iii. 1888 (*O. Möller* coll.), 1 ♀ (*G. C. Jordan* coll.) ; Assam, 1 ♂ ,—i. 1918 (no coll.) ; Meghalaya, Shillong, 1 ♂, (no further data) ; West Bengal, Darjeeling, 28 ♂ ♂, 15 ♀ ♀ (no date of colln.) (*F. Moller* coll.), 1 ♂ (no further data).

Distribution.—INDIA (Sikkim, Assam, Meghalaya, West Bengal, South Andamans) ; BANGLADESH (Sylhet) ; BHUTAN ; BURMA ; THAILAND ; N. VIETNAM ; CHINA (Tongking) ; and INDONESIA (Java, Sumatra, Sulawesi and Amboina).

Host plants.—*Schinea wallichii* Choisy and *Turpina pomifera.*

Genus **Actias** Macleay

1807. *Echidna* Hübner (*non* Forster), *Samml. exot. Schmett.*, **1**: pl. 173.
1815. *Actias* Macleay, In Leach, *Zool. Miscell.*, **2** : 25.
1820. *Tropaea* Hübner, *Verz. bek. Schmett.* : 152 (Type-species.—*Echidna selene* Hübner).
1846. *Plectropteron* Hutton, *Ann. Mag. nat. Hist.*, (1) **17** : 60 (Type-species.—*Plectropteron diana* Hutton).
1850. *Saturnia (Actias)*, Westwood, *Ann. Mag. nat. Hist.* (2) **5** : 304.
1936. *Actias*, Schüssler, *Lepid. Cat.*, **70** : 55-56.
1976. *Actias*, Nayar *et al.*, *General and Applied Entomology* : 254.

Type-species.—*Phalaena Bombyx luna* L. (1758) from AMERICA—(Designated by Grote, 1874).

Frons convex at sides, next to eyes, particularly in males. Eyes large. Antennae in male as long as thorax ; quadripectinate nearly up to apex ; cones multiple, with the ramii equal and beset with terminal and subterminal bristles ; in female antennae sometimes shorter than thorax, ramii unequal and without long setae which are characteristic of males, the distal ramii tend to reduce in apical segments ; the distal ramii in each segment without bristles, the basal ramii with terminal and subterminal bristles. Labial palpi short, two segmented, the 2nd segment as long as the basal one. Legs with the fore tibia having well developed epiphysis in both sexes, reaching apical third ; mid and hind tibia each with a pair of short terminal spurs, not exceeding the tibial diameter, the apical two-third margin serrated ; 1st to 4th tarsal sements on mid and hind leg with spines ; 5th fore-tarsal segment without scales in female ; tarsal claws with arolium well developed, pulvilli moderately developed.

Venation.—Fore wing with veins R_1 to R_4 stalked ; R_5 arising before angle of cell from radio-median ; M_1 from upper angle of cell ; discocellulars incurved. Hind wing with the tail two-thirds the length of costa of fore wing. Other features as given in family characters.

Genitalia.—Uncus well developed ; elevated mid-dorsally, sometimes serrated, with the apex bifid. Gnathal arms meeting mid ventrally. Valva with a well developed horn ; anellus well developed, with two posteriorly produced lobes. Aedeagus broad and funnel-like.

Distribution.—INDIA ; NEPAL ; BHUTAN ; BANGLADESH ; BURMA ; SRI LANKA ; INDONESIA ; CHINA ; JAPAN ; USSR ; and USA.

Remarks.—The genus *Actias*, including *A. selene* popularly known as the 'Indian Moon-Moth', is close to *Sonthonnaxia*, on one hand, in having a tailed hind wing, frons convex at sides, in the presence of mid and hind tibial spurs, and in the well developed uncus in male genitalia ; and on the other hand, to *Proactias* gen. nov. in respect of the presence of five radials in fore wing, in the hindwing tail being shorter than forewing costa, and in the saccus being shorter. It differs from the preceding genus in the frons being convex at sides (*vs* flat) ; in the antennae being as long as the thorax (*vs* longer than thorax) ; and in the uncus being elevated mid-dorsally (*vs* not elevated).

There is a single species known from India which is described here.

2. **Actias selene** (Hübner)

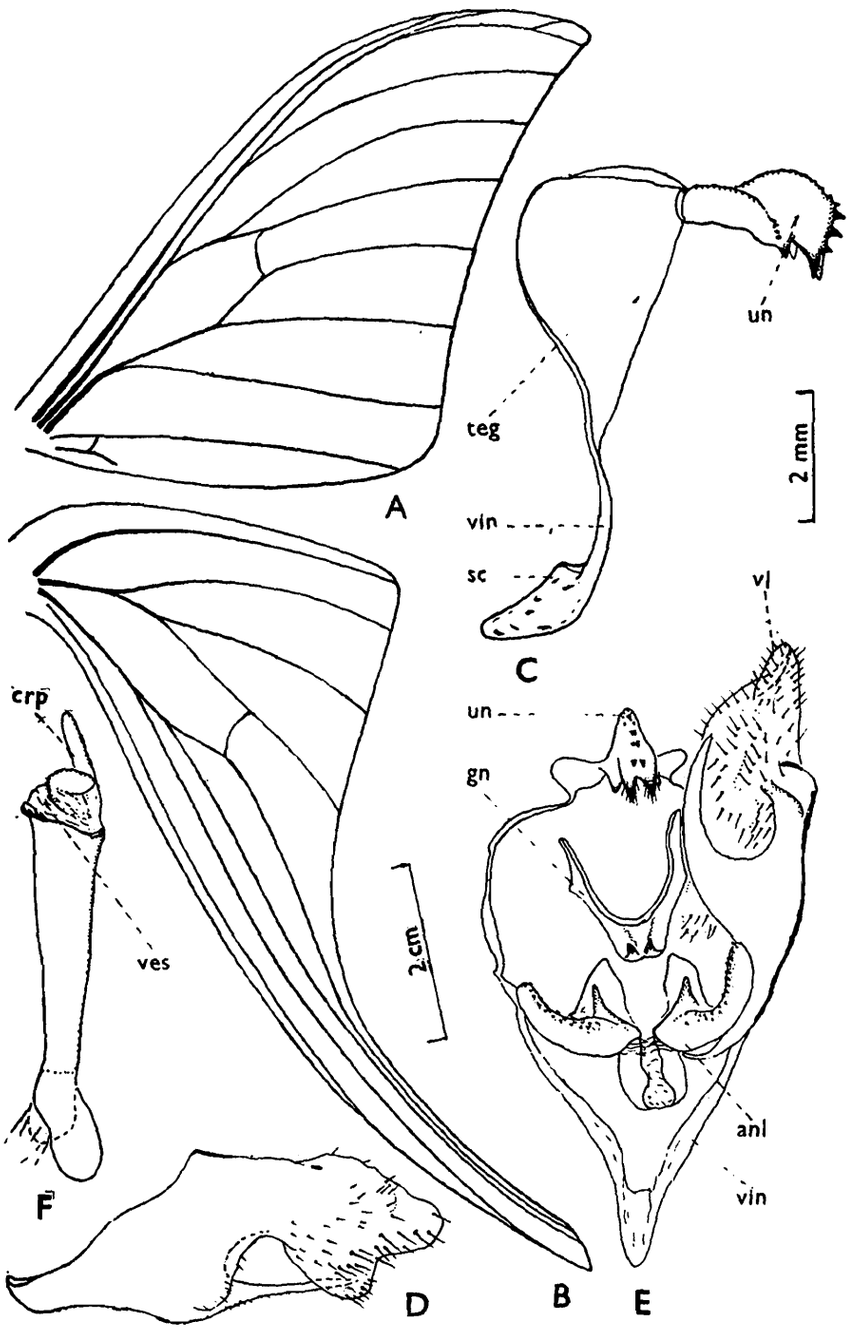
(INDIAN MOON-MOTH)

(Pl. II, nos. 5—8 ; Text-figs. 1, C—D ; 4, A—F)

1806. *Echidna caudata selene* Hübner, *Samml. exot. Schmett.*, **1** : 3, pl. 172 ♂, pl. 174, ♀
1815. *Actias selene*, Macleay : In Leach, *Zool. Misc.*, 2 : 26.
1816. *Tropaea selene*, Hübner, *Verz. bek. Schmett.* : 152, No. 1588.
1846. *Plectropteron diane*, Hutton, *Ann. Mag. nat. Hist.*, (1) **17** : 60.
1846. *Bombyx (Actias) selene*, Hutton, *Trans. ent. Soc. Lond.*, **4** (3) : 221-223.
1847. *Saturnia selene*, Hutton, *Trans. ent. Soc. Lond.*, **5** (2) : 45.
1848. *Plectropteron selene*, Hutton, *Trans. ent. Soc. Lond.*, **5** (4) : 85.
1868. *Actias selene*, Baden-H. Powell, *Handb. prod. Punjab*, **1** : 162.
1872. *Actias astarte* Maassen & Weymer, *Beitr. Schmett.*, **2** : fig. 16 ♂.
1892. *Tropaea mandschurica* Staudinger : In Rom., *Mem. sur les Lep.*, **6** : 331.
1936. *Actias selene*, Schüssler, *Lepid. Cat.*, **70** : 60-68.
1976. *Actias selene*, Nayar *et al.*, *General and Applied Entomology* : 254.

Upperside : Frontal tuft whitish. Antennae pale brown, with the antennal bases whitish. Labial palpi pinkish. Collar white. Prothorax with a pink band, the latter continuous with the costal fascia. Meso and metathorax whitish to pale-yellowish. Fore wing pale green ; costal fascia pinkish from base to a little before apex, with a dark brown below the costal fascia ; antemedial line oblique from below the costal fascia to inner margin ; postmedial line pale yellow, slightly inwardly curved, from costal fascia to the inner margin ; submarginal line indistinctly running parallel to the postmedial line ; margin bordered narrowly, pale yellow in colour ; ocellus pale yellowish at the discocellulars, with a dark brown lunule, with white and pink streak on it before discocellulars. Hindwing colouration as on fore wing except at the middle part of the tail which is suffused with pink. *Underside* : General colour whitish. Fore wing as on upperside except the costal fascia which is paler and without dark brown below it. Ocelli also paler. Legs pinkish on the upper side, pale yellowish on the underside.

Frons simple and flat. Antennae quadripectinate in both sexes ; ramii long and equal in male, longest ramii being about the length of five segments of shaft taken together ; the apical segments unipectinate, with their branches shorter ; in female the ramii shorter than in male, unequal nearly up to apical 6th or 7th segment, the remaining apical segments unipectinate, with their branches shorter, the longest basal ramii being about the length of three



Text-fig. 4. *Actias selene* : A, fore wing venation ; B, hind wing venation ; C, lateral view of the genitalia (without valvae) ; D, outer view of left valva ; E, inner view of genitalia (without left valva) ; F, aedeagus (A and B, of same mag. ; C-F, of same mag.).

segments of shaft as compared to apical ramii, which are two-thirds of basal ones and twice as long as one segment of shaft. Labial palpi very short, the tip obliquely upturned but not projecting beyond the frontal tufts. Mid and hind tibiae with a pair each of short terminal spurs ; tarsal spines present on 1st-4th segments ; tarsal claws with pulvilli and arolium.

Venation. —Fore wing (Text-fig. 4, A) : Veins R_1-R_4 stalked, R_1 arising from near the origin of R_2 than R_4 ; R_2 ending just above the apex, R_3 ending a little below the apex, R_4 close to the common stalk of R_5-M_1 ; other features as given in family characters. Hind wing (Text-fig. 4, B) : Mainly as given in family characters, except that the tornus is produced into a tail with M_3, cubital and anal veins extending into it.

Male Genitalia (Text-fig. 4, C-F).—Uncus broadest in the basal half, with the sides slanting upwards ; the mid-dorsal area highly elevated and toothed ; bifid apically ; a ventro-lateral tooth on each side just beyond the middle. Gnathal arms unite mid-ventrally, with backwardly produced two minute teeth. Tegumen short and broad ; vinculum short and ending into a conical saccus. Valva short and narrow, dorso-distal margin and mesal side beset with short setae, the apical margin slightly notched and also beset with short setae ; the ventral margin deeply incised in the middle, with the sacculus produced into a well defined long and narrow process ; anellus membranous both dorsally as well as ventrally, the sides sclerotised and produced posteriorly into two outwardly directed curved lobes, the latter beset with very fine spines. Aedeagus about seven times as long as its width in the middle, apex produced into a carinal process, margin opposite to carina slightly serrated.

Wing expanse.—Males, 123-166 mm ; females, 128-173 mm.

Material examined. —40 ♂♂, 16 ♀♀ : INDIA : Sikkim, 1 ♂, no date (*G. C. Dudgeon* coll.), 1 ♂, 31. iii. 1888 (no. coll.), 1 ♀, no date (*O. Moller* coll.) ; Assam, 1 ♂, –. 1935 (*A. H. Lancaster* coll.), Lakhimpur, 1 ♀, Sibsagar, 1 ♂, 1 ♀ (no further data) ; Meghalaya, Shillong, 1 ♂, 17. viii. 1959 (no coll.), 4 ♂♂, 4 ♀♀ (no further data), 1 ♂, 29. vii. 1963 (*S. N. P* coll.), 1 ♂, 10. iv. 1969 (*A. P Kapur* coll.), 1 ♀, 23. viii. 1976 (*M. S. Jyrwa* coll.) ; Khasi Hills, 1 ♂, 1 ♀, 29. iv. 1880 (no coll.) ; Manipur, on Burma Road near Kanchinjom, 1 ♂ (no further data) ; West Bengal, Calcutta, 1 ♂, (*Holland* coll.), Darjeeling, 13 ♂♂, 2 ♀♀ (*F. Moller* coll.), 3 ♂♂, 1 ♀, 17. ii. 1917 (*Capt. Dracot* coll.) ; Bihar, Gobindpur, 3 ♂♂, 3 ♀♀, (no further data) ; Orissa, Manbhum, 1 ♂, (*Campbell* coll.) ; Himachal Pradesh, Kangra Valley, 1372 m., 1 ♀, --. iv. 1889, 1 ♂, –. ix. 1889 (*G. C. Dudgeon* coll.) ; Uttar Pradesh, Mussoorie, 2 ♂♂, (no further data).

BANGLADESH : Sylhet, 2 ♂♂, 28, ii. 1880 (no coll.).

NEPAL : Residence garden, 1 ♂, 24. vii. 1906 (no. coll.).

Host plants. —*Andromeda ovalifolia* Wall., *Azadirachta indica* A. Juss (Persian Lilac), *Cedrela paniculata*, *Coriaria nepalensis* Wall. (Masuri, Makola), *Corylus colurna* L. (Turkish Hazel), *Crataegus* sp. (Hawthorn), *Hibiscus* sp., *Juglans regia* L. (Walnut), *Lannea coromandelica* (Houtt.) Merr., *Lawsonia alba* Lamk. (Indian Privet), *Ligustrum robustrum* Blume (Privet), *Moringa oleifera* Lam. (Moringa or Stick), *Prunus amygdalus* Baill. (Almond tree), *P. cerasus* L. (Morello, or Sour Cherry), *P domestica* L. (Plum), *P padus* L. (Bird Cherry), *P. puddum* Roxb. (Wild Cherry), *Pyrus communis* L. (Pear), *P. malus* L. (Apple), *Quercus* sp. (oak), *Rhamnus frangula* (Allder buckthorn), *Salix babylonica* L. (Weeping willow) *S. elegans* Wall. (Willow), *Zanthoxylum acanthopodium* and *Z. alatum*.

Distribution.—INDIA (Sikkim, Assam, Meghalaya, Manipur, West Bengal, Bihar, Orissa, Himachal Pradesh, Uttar Pradesh, Maharashtra, Karnataka, Tamil Nadu and Andamans) ; NEPAL ; BHUTAN ; BANGLADESH ; BURMA ; SRI LANKA ; INDONESIA (Borneo) ; CHINA (Tibet) ; JAPAN ; and USSR.

Remarks.—For remarks see under the genus *Actias*.

Genus **Proactias** gen. nov.

Type-species.—*Tropaea sinensis* Walker (1855) from North CHINA.

Male : Frons not convex at sides next to eyes. Eyes moderately large. Antennae longer than thorax, quadripectinate up to a little before apex, cones multiple, ramii equal and beset with a few terminal and subterminal bristles ; shaft without scales on upper side. Legs with the fore tibia having a well developed epiphysis, reaching about three fourths from base ; mid and hind tibiae with a pair of short terminal spurs, not longer than the tibial diameter ; the spurs tapering abruptly beyond the middle, tapering part sclerotised and serrated ; tarsal spines on 1st-4th segments present ; claws with arolium well developed and pulvilli weak.

Venation.—Fore wing : All the radials present ; R_1 to R_4 stalked ; R_5 well separated at base, from M_1, the latter from below the upper angle of cell ; discocellulars incurved ; other features as given in family characters. Hind wing : Discocellulars straight ; tail shorter than the costal length of fore wing and narrow in middle.

Male Genitalia.—Uncus broader basally than at the apical end which is narrow and bifid, neither elevated, nor serrated mid dorsally. Gnathal arms meet mid ventrally into 'V' shape, with the base slightly notched. Valva simple, with outer margin rounded, ventral margin produced into a process ; anellus simple and without lobes. Aedeagus broadly cylindrical.

Distribution.—INDIA ; BHUTAN ; and N. CHINA.

Remarks.—*Proactias* gen. nov. is closely allied to both *Actias* Macleay as well as *Sonthonnaxia* Watson in having a tailed hind wing and in general appearance which led the previous workers to place *sinensis* in the genus *Actias*. Schüssler (1933), however, catalogued the species under the genus *Sonthonnaxia* in family Syssphingidae without assigning any reason. The present studies, however, show that the species possesses characters which differ in all respects from those of *Actias* and *Sonthonnaxia*. Some of the important characteristic features which differentiate the new genus, are as follows : Frons simple and flat next to eyes (*vs* convex on sides next to eyes) ; the antennae longer than thorax (*vs* shorter than thorax or as long as thorax) ; the discocellulars incurved in fore wing, straight in hind wing (*vs* incurved in both wings in *Actias* and excurved in both wings in *Sonthonnaxia*) ; uncus in male genitalia neither elevated nor serrated middorsally (*vs* serrated and elevated in *Actias*), without additional lobes distodorsally (*vs* with lobes in *Sonthonnaxia*) ; valva with the apical margin rounded (*vs* not rounded) ; anellus simple and without lobes (*vs* with lobes) ; and aedeagus short and cylindrical (*vs* funnel like in *Actias*, and long and cylindrical in *Sonthonnaxia*).

Phylogenetically, the new genus *Proactias* is more closely allied to *Actias* than *Sonthonnaxia* in having the discocellulars in the fore wings being incurved ; in retaining five radials in fore wings as compared to four in *Sonthonnaxia* ; and in respect of hindwing tail which is shorter than costa of fore wing unlike in *Sonthonnaxia* where it is much longer especially in male, and the valva in having a single process as compared to two in *Sonthonnaxia*.

The genus *Proactias* includes only one species.

3. **Proactias sinensis** (Walker) comb. nov.

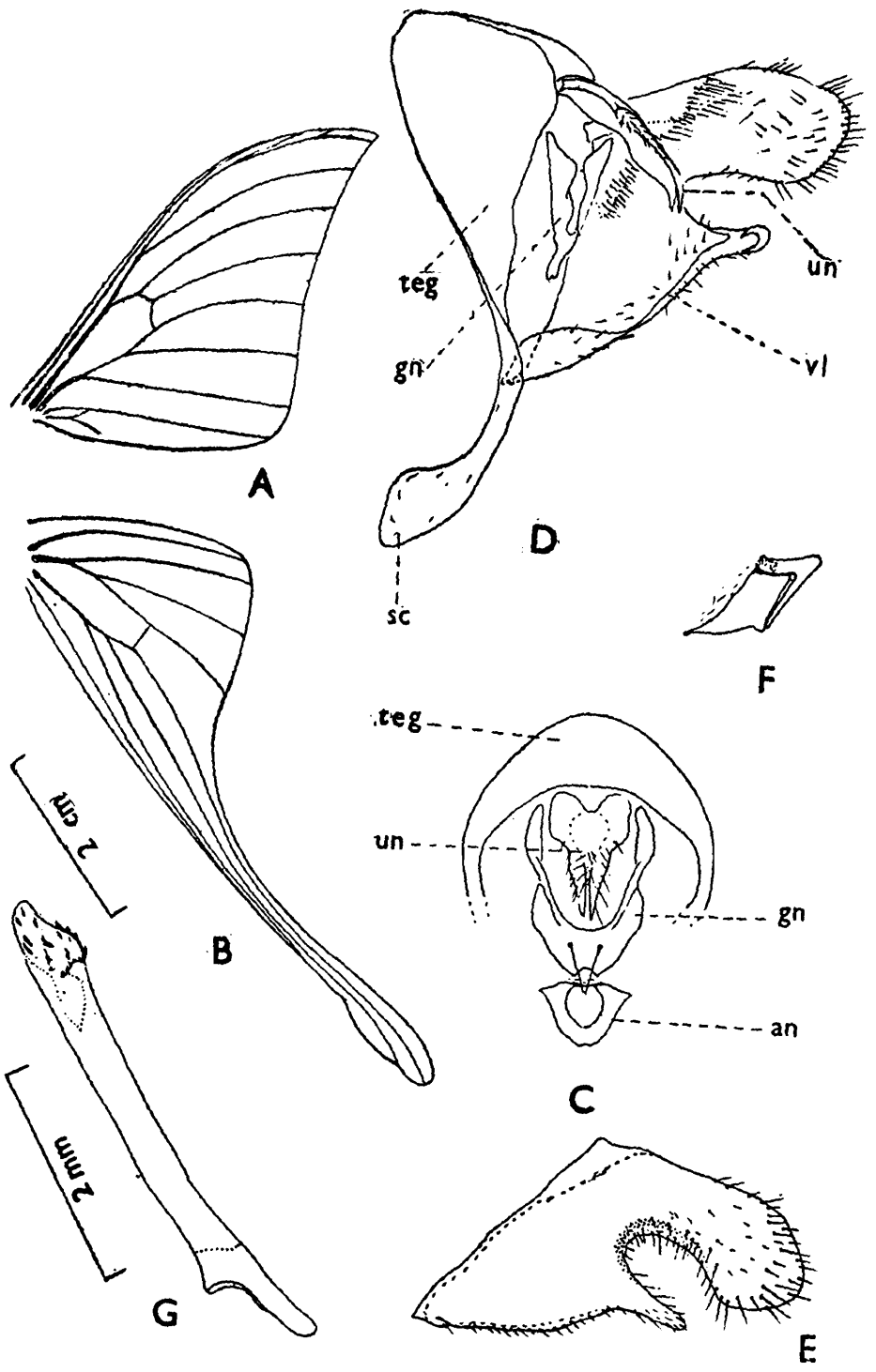
(Pl. II, nos. 9-10 ; Text-figs. 1, E-F ; 5, A-G)

1853. *Tropaea sinensis* Walker, *Cat. Lep. Het. Brit. Mus.*, **6** : 1264 No. 7 ♂ (*Type-locality.*—N. China),

1859. *Actias sinensis*, Moore, *Proc. zool. Soc. Lond.*, **27** : 274, ♂.

1936. *Sonthonnaxia sinensis*, Schüssler, *Lepid. Cat.*, **70** : 53-54,

Male.—Upperside : Frontal tufts pale yellow. Antennae pale brown, with their bases pale yellow. Labial palpi dark brown. Collar greyish-brown. Thorax and abdomen from pale yellowish to yellowish. Fore wings yellowish ; costal fascia brown, irrorated with grey up to basal two-thirds ; antemedial line indistinct, with only traces present across the middle of cell ; ocellus present on the discocellulars, the latter with black lunule, bluish scaling on inner side and pinkish suffused with fuscous on the outer side ; a reddish pink triangular spot



Text-fig. 5. *Proactias sinensis* : A, fore wing venation ; B, hind wing venation ; C, inner view of genitalia showing uncus, gnathos and anellus ; D, lateral view of genitalia (without left valva) ; E, outer view of left valva ; F, lateral view of anellus ; G, aedeagus (A and B, of same mag ; C-F of same mag.).

below the costal fascia is continued with the outer line of ocellus ; postmedial line highly angulated, brown from costa to inner margin ; submarginal line faintly marked from subapical area to vein M_3 beyond which it is prominent and irrorated with grey and fuscous up to inner

margin ; margin dark brown. Hind wing with the markings as on fore wing except for the absence of costal fascia, triangular spot and postmedial line ; submarginal line well developed from below subcosta to M_2 beyond which it is running close to margin up to the base of tail and irrorated with fuscous grey and pinkish scales. *Underside* : Thorax and abdomen as on upper side. Legs greyish fuscous, tinged with pink on the upper side.

Frons smooth. Antennae quadripectinate from base to apical seven segments which are bipectinate with shorter ramii ; ramii in general long and equal, the longest being equal to the length of six segments of the shaft at the middle. Labial palpi short and not projecting beyond the frontal tuft. Fore wing acute at apex, with the outer margin nearly straight. Legs with spurs, spines, claws and pulvilli as given in genus.

Venation.—Fore wing (Text-fig. 5, A) and hind wing (Text-fig. 5, B) mainly as given in *Actias selene*.

Male Genitalia (Text-fig. 5, C—G).—Uncus broadest at the base, gradually narrowing towards apex, the latter pointed and bifid ; the dorsal part only slightly raised and membranous. Gnathal arms narrow and incurved, meeting midventrally with a notch at the base. Tegumen broad and short, continued with vinculum, the latter narrow, ending in a moderately long saccus. Valva short and narrow, beset with setae, rather densely at the middle and sparsely near the ventral margin ; the mid ventral part deeply incised and produced outwardly into a well defined short and incurved sclerotised process ; anellus membranous mid-dorsally, the sides sclerotised. Aedeagus cylindrical throughout except at the apical area which is slightly broader, about twelve times as long as its width at the middle ; apical margin serrated on one side.

Wing expanse.—Males, 103-111 mm.

Material examined.—Two ♂♂ : INDIA : Arunachal Pradesh, Lohit Dist., Roing, 300m., 1 ♂, 6. iii. 1969, 1 ♂, 7. iii. 1969 (*S. K. Tandon* coll.).

Distribution.—INDIA ; BHUTAN ; and N. CHINA.

Remarks.—For remarks see under the genus *Proactias*.

Genus **Rhodinia** Staudinger

1872. *Rhodia* Moore, *Proc. zool. Soc. Lond.* : 578 (*nom.* preoccup.).
1892. *Rhodinia* Staudinger, In Rom., *Mem. sur les Lep.*, **6** : 327.
1933. *Rhodinia.* Schüssler, *Lepid. Cat.*, **56** : 87-88.

Type-species.—*Rhodia newara* Moore (1872) from NEPAL.

Frons flat at sides next to eyes, so that laterofrontal sutures distinct. Eyes small. Antennae quadripectinate in male, basal and distal ramii long and equal ; in female ramii unequal. Labial palpi three segmented, with the third segment being shortest. Fore tibia with the epiphysis reaching nearly three-fourths apically ; mid and hind tibiae with a pair of short terminal spurs, the latter bulbous or dilated basally, with the apical half chitinised and outer margins serrated ; tarsi with spines on 1-4 segments ; claws with well developed arolium and pulvilli.

Venation. —Fore wings with all the radials present ; vein R_5 stalked with M_1 and arising from beyond the upper angle of cell ; discocellulars incurved, obsolescent in middle. Hind wing with the upper discocellular absent, lower discocellular partly developed and incurved,

Genitalia.—Uncus strongly bifid apically. Gnathal arms narrow, meeting mid-ventrally. Transtilla well developed into a notched plate. Valva with a ventral process ; anellus without lobes. Aedeagus with cornutal spines.

Distribution. —INDIA ; NEPAL ; JAPAN ; and USSR.

Remarks.—The genus *Rhodinia* Staudinger is the most interesting genus amongst all the 'Wild Silkmoths' of India because of its venation, since it is in this genus that the discocellulars start disappearing so much so that in the hind wing only lower discocellular is present, leaving cell completely open in the upper half. In fore wings these are incurved and 'Weakening' in the middle a stage leading to the genus *Solus* Watson (1912-13), whocomments (p.181) "……In *Rhodia* they have commenced to atrophy ; in *Solus* they have disappeared altogether with the discals, so completely as to leave no trace of ever having been there." He further opines (p. 182) "If we relied only on neuration it [*Solus*] would fall into the Attacinae proper." Besides, the genus is characterised by the stalk of veins R_5 and M_1 extending beyond the upper angle of cell in fore wing, a character not observed in any of the genera studied presently, and distinctly differentiates *Rhodinia* from *Antheraea*, *Cricula* and *Loepa*.

Only one species, *Rhodinia newara* (Moore), known to occur in INDIA, is described here.

4. **Rhodinia newara** (Moore)

(Pl. III, nos. 11-14 ; Text-figs. 1, G ; 6, A-H)

1872. *Rhodia newara* Moore, *Proc. zool. Soc. Lond.* : 578. (*Type-locality.*—Kathmandu, NEPAL).

1892. *Loepa newara*, Hampson, *Fauna Brit. India*, Moths, **1** : 26, No. 27.

1928. *Loepa newara*, Seitz, *Macrolepidoptera of the World*, **10** : 506, pl. 53a ("already inclined to the genus *Rhodinia*").

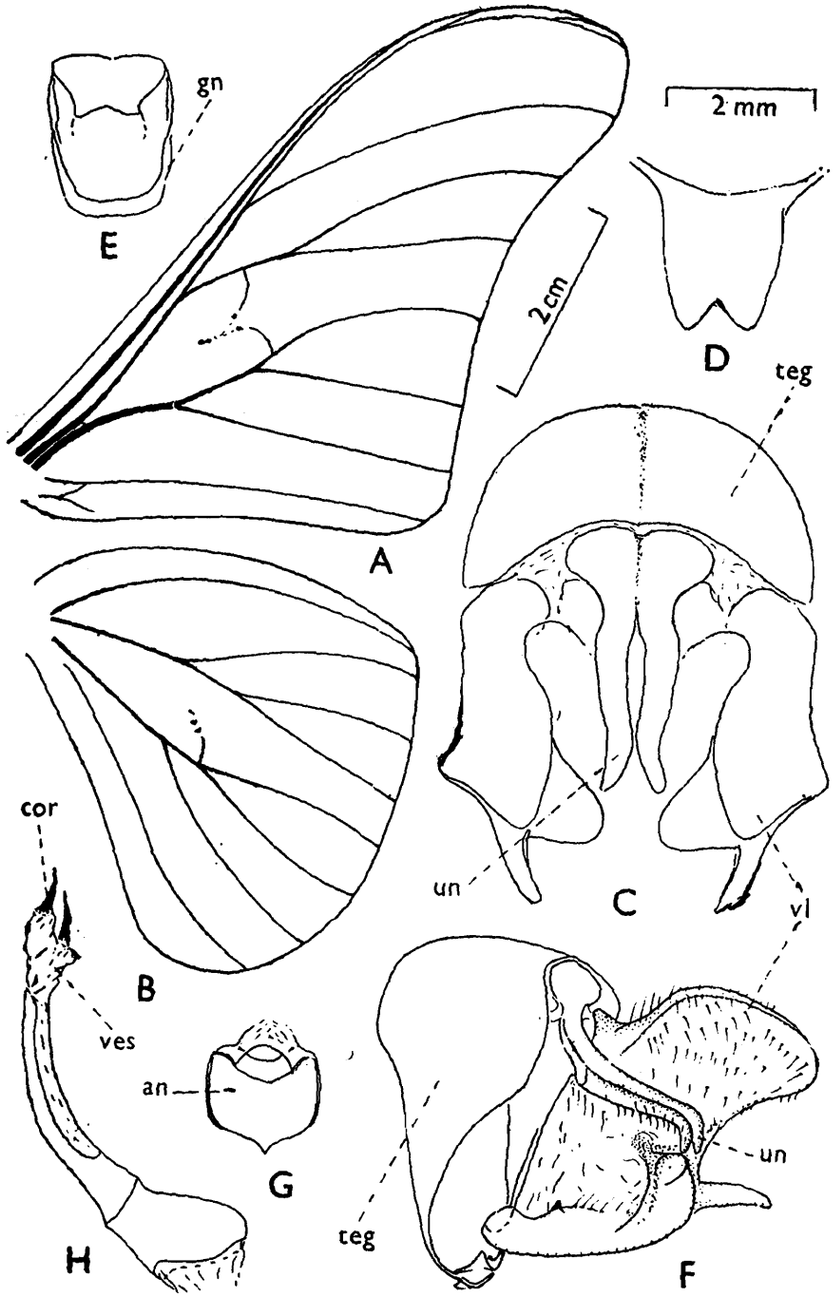
1933. *Rhodinia newara*, Schüssler, *Lepid. Cat.*, **56** : 89-90.

1935. *Rhodinia newara nissori* Watson, *Entomologist*, **68** : 62-64.

1976. *Loepa newara*, Nayar *et al.*, *General and Applied Entomology* : 254.

Upperside : Frontal tuft bright yellow except at sides, the latter with reddish brown scales. Antennae pale brown, their bases covered with pale yellowish scales. Labial palpi dark reddish-brown. Collar grey, fringed with dark reddish brown. Thorax bright yellow, sometimes mixed with reddish brown. Fore wings yellow and irrorated with grey, fuscous and pink scales ; antemedial band wavy and fuscous, suffused with pinkish and grey scales on the inner side ; hyaline spot at the discocellulars elongate, with fuscous scaling on either side ; postmedial band wavy, coloured as antemedial band, broader at inner margin ; a sickle shaped white subapical mark with a crescent spot above it and a pink streak below it, present ; from the latter run two highly angulated submarginal lines, terminating at the postmedial band below vein Cu_{1b} ; marginal band olive except at the apex, the latter bright yellow. Hind wings yellowish ; antemedial band dark pinkish from below costa to inner margin ; hyaline spot edged with fuscous to dark-pink scales ; postmedial band wavy, broadening from subcosta to inner margin, suffused with pink and fuscous ; submarginal area and margin as in fore wing but without spots. Abdomen pale yellowish at the tip. *Underside* : Markings as on the upper side except that both pair of wings uniformly irrorated with fuscous, grey and pink from base to postmedial band except middle of the inner area. Legs yellowish, mixed with crimson scales at sides ; tarsi crimson, marked with narrow white bands on first four segments,

Antennae quadripectinate, in both sexes, nearly up to apical 5-6 segments, ramii short and unequal in female, long and equal in male ; the longest ramii being as long as about five segments in males in the middle of shaft and three in females ; the longer ramii in females also about twice the length of shorter ones, decreasing in length both at the basal as well as at the apical area of antennae where these look like minute serrations. Labial palpi short (Text-fig. 1, G), hardly projecting beyond frontal tuft. Legs with spurs, spines and claws as given in genus.



Text-fig. 6. *Rhodinia newara* : A, fore wing venation ; B, hind wing venation ; C, dorsal view of genitalia ; D, transtilla ; E, gnathos and a part of uncus ; F, lateral view of genitalia (without left valva) ; G, anellus ; H, aedeagus (A and B of same mag. ; C-H of same mag.).

Venation.—Fore wing (Text-fig. 6, A) : Veins R_1 to R_4 stalked, R_1 arising from near the origin of R_2 than R_4, R_2 from near the apex and ending just above it, R_3 ending at the apex, R_4 close to common stalk of R_5 and M_1 ; cell not completely closed by discocellulars, the latter

incomplete and incurved ; M_3 from lower angle of cell ; Cu_{1a-1b} and other veins as given in family characters. Hind wing (Text-fig. 6, B) : Mainly as in genus.

Male Genitalia (Text-fig. 6, C-H).—Uncus about thrice as long as its width at base, the basal one-third sharply sloped downwards, the distal two-thirds directed posteriorly, bifid, with the apex narrow, bent downwards and beset with setae. Gnathos well developed, meeting in the mid-ventral position. Tegumen very broad, the sides narrowing abruptly ; vinculum short and narrow ; saccus extremely reduced into a mere conical projection. Valva twice as long as its width at the middle ; sacculus well developed with a short process ; harpe well developed into a long process near the medial area ; inner area sparsely beset with setae distally. Transtilla well developed into a quadrate plate medially, with the distal margin notched ; anellus with the juxta broadly pentagonal and channelled dorsally. Aedeagus curved, broad basally, but narrowing gradually towards apex, the latter with two prominent cornutal spines.

Wing expanse.—Males, 110-144 mm ; females, 125-138 mm.

Material examined.—11 exs. (7 ♂♂,4 ♀♀). INDIA : Sikkim, 1524 m., 1 ♂, 16. xi. 1855, 1 ♂, 20. xi. 1855, 1 ♂,—.xi. 1858, 1 ♀ (no date) (all *G. C. Dudgeon* coll.) ; Meghalaya, Shillong, Motinagar, 1 ♂, 11. x. 1961 (*S. N. P* coll.), Risa Colony, 1 ♂, 2. viii. 1971 (*E. D. Albinus* coll.), 2 ♀♀, 30. xi. 1971 (*J. K. Prashad* coll.), Z. S. I. Office Compound, 1 ♂, 26. xi. 1971 (*G. M. Yazdani* coll.), 1 ♀, 21. x. 1972 (*S. C. Roy* coll.), Laban, 1 ♂, 14. xi. 1972 (*S. C. Roy* coll.).

Distribution.—INDIA (Sikkim, Meghalaya and West Bengal) ; and NEPAL (Kathmandu).

Host plants.—*Acer saccharum* Marshall (Sugar Maple), *Juglans regia* L. (Walnut), *Salix babylonica* L. (Weeping Willow) and *S. elegans* Wall (Willow).

Remarks.—Watson (1935) separated Assamese material into a new subspecies *Rhodinia newara nissori* on the basis of colour being "deeper and clearer yellow than Moore's types from NEPAL. The dusky fascia of both wings darker. The apical streak of the forewing more pronounced and invading the next interspace, although more reduced. The vitreous spot larger and more elongated, half moon shaped, or almost crescentric and not rounded elliptical or pyriform as in Nepal types. A distinct pinkish or purplish brown on the wings of freshly emerged specimens, not noticeable in Moore's types, but perhaps due to freshness of the bred specimens of this new race". The material before us is from both Sikkim as well as Assam and has, among Assamese specimens, both deeper as well as lighter tint, with the apical streak in fore wing not invading next interspace even in deeper coloured specimens. The vitreous spots are rounded, elliptical or pyriform, with slight variation but never half moon or crescentric as typical of *newara nissori*. The variations, however, indicate that these are met with frequently within this species and as such it is difficult to differentiate *newara newara* and *newara nissori* from each other.

Genus **Antheraea** Hübner

1820. *Antheraea* Hübner, *Verz. bek. Schmett.* : 152.
1820. *Telea* Hübner, *Verz. bek. Schmett.* 152.
1861. *Bombyx (Antheraea)*, Guérin-Méneville, *Rev. Mag. zool.*, (2) **13** : 223, 447.
1892. *Metosamia* Druce, *Ann. Mag. nat. Hist.*, (6)**9** : 276 (*Type-species.*—*Metosamia godmani* Druce from Central AMERICA).

Type-species.—*Phalaena mylitta* Drury (designated by Kirby, 1892).

Frons flat, with the laterofrontal sutures distinct. Antennae quadripectinate except for

a few apical segments ; ramii long and equal in male but short and unequal in female. Labial palpi three segmented. Epiphysis of fore tibia reaching about two-thirds its length apically, mid and hind tibiae each with a pair of short terminal spurs, distal half of each spur sclerotised, with margins serrated. Tarsi with spines on first to third segment in male whereas in female fourth tarsal segment of fore leg produced laterally into lobes, the latter with a spine each. Claws with arolium and pulvilli present.

Fore wing with the four radials present, vein R_1 variable, *i.e.* may be from the cell or from the common stalk of radials, veins R_2 and R_3 coincident.

Male genitalia with the uncus notched to strongly bifid. Gnathos absent or rudimentary. Transtilla absent. Labides present and well developed. Anellus without lobes. Valva with ventral as well as mid-ventral or disto-ventral margin produced posteriorly ; the distal process usually with well defined strong bristles. Aedeagus narrow, short or long, with the apical area beset with short spinules.

Distribution.—INDIA ; PAKISTAN ; NEPAL ; BHUTAN ; BANGLADESH ; BURMA ; SRI LANKA ; MALAYSIA ; S. VIETNAM ; PHILIPPINES ; INDONESIA ; CHINA ; JAPAN ; N. AMERICA ; and EUROPE (Introduced).

Remarks.—Schüssler (1933) recorded as many as 34 species under the genus *Antheraea* and excluded the American species under the genera *Metosamia* and *Telea*. Michener (1952) and Ferguson (1972), however, considered American genera as synonyms of *Antheraea* and referred to 35 Asian and Australesian, and three to four American species.

The genus *Antheraea* is most important economically as it includes three species amongst the Indian ones which produce silk of commercial value, i. e., *Antheraea paphia* (L.), *A. assamensis* (Helfer) and a hybrid of (*Indian*) *A. roylei* X *A. pernyi* (Chinese).

Taxonomically, the genus is of considerable interest because of having lost one radial vein and in the characteristic male genitalia, especially in having labides about which Ferguson (1972) was not clear and reported "The male genitalia with curiously developed valvae are very unlike those of any other group studied". These structures are unique and have not been hitherto reported to be present in other genera. Tegumen is invariably produced dorsally above the uncus into what has been termed as 'superuncus'

A total of seven species, including those commercially exploited in INDIA, have been studied so as to provide their clear identity.

Key to the species of the Genus **Antheraea** Hübner

1.	Fore wing with vein R_1 stalked with R_{2+3} and R_4		2
—	Fore wing with vein R_1 free and arising from the cell		4
2.	Antennae in female with distal ramii more than half the length of the basal ramii. Hind wing with submarginal line from much below the costa to inner margin ; ocellus filled with black on inner one-third, with hyaline spot reduced or absent. Male genitalia without long and strong bristles on the distal margin of the valva ...		*assamensis* (Helfer)
—	Antennae in female with distal ramii less than half the length of the basal ramii. Hind wing with submarginal line nearly from costa to inner margin ; ocellus not filled with black. Male genitalia with long and strong bristles on the distal margin of the valva ...		3

3.	Hind wing with submarginal line single, smoothly curved, pinkish red and outlined by white ; ocellus large ...	...	***paphia*** **(L.)**
—	Hind wing with submarginal line double, highly angulated ; ocellus small ...	...	***frithi*** **Moore**
4.	Hind wing with submarginal lines black and straight ; ocellus filled with black on inner half, hyaline spot obsolescent ...	...	*compta* **Rothschild**
—	Hind wing with submarginal line not black, straight or wavy ; ocellus without black on the inner side, hyaline spot reduced or well developed ...	...	5
5.	Fore wing with costal fascia extending up to basal half ; hind wing with antemedial line not touching ocellus ...	...	*roylei* **Moore**
—	Fore wing with costal fascia extending upto basal two-thirds ; hind wing with antemedial line farther from base and touching or nearly touching ocellus ...	...	6
6.	Hind wing with submarginal line double, wavy, the inner line curved inwards and touching the antemedial line ; ocellus with a well developed black blotch above. ...	...	*helferi* **Moore**
—	Hind wing with submarginal line single, not wavy, and not touching antemedial line ; ocellus without blotch above or very much reduced	...	*knyvetti* **Hampson**

5. **Antheraea assamensis** (Helfer)

(MUGA SILKMOTH)

(Pl. IV, nos. 15—18 ; Text-fig. 7, A—F)

1837. *Saturnia assamensis* Helfer, *J. Asiat. Soc. Beng.*, **6** : 43, no. 8, pl. 8 ♀ (*Type-locality.*—Assam).

1837. [*Saturnia*] mooga (also *moonga, monga, mounga, muga*) Hugon, *J. Asiat. Soc. Beng.*, **6** : 26-32.

1843. *Bombyx perrottetti* Guérin—Méneville, *Mag. Zool. Ins.* : pls. 123.

1848. *Saturnia assama* Westwood, *Cab. Or. Ent.* : 41-42, pl. 20, fig. 2. (*Type-locality.*—Assam).

1855. *Antheraea assama*, Walker, *Cat. Lep. Het. Brit. Mus.*, **5** : 1249 (*Localities* : Sylhet, CEYLON).

1855. *Bombyx assamentis*, Guérin-Méneville, *Rev. Mag. Zool.* (2) **7** : 300.

1862. *Antheraea mezankooria* Moore, *Trans, ent. Soc. Lond.*, (3) **1** (3) : 318 (*Type-locality.*—Assam) [Syn. *Vide*, Hampson, 1892].

1886. *Antheraeopsis assama*, Wood-Mason, *Ann. Rep. Indian Mus.*, : 21.

1892. *Caligula assamensis*, Kirby, *Syn. Cat. Lep. Het.*, **1** : 760, No. 3 (*Locality.*—N. INDIA).

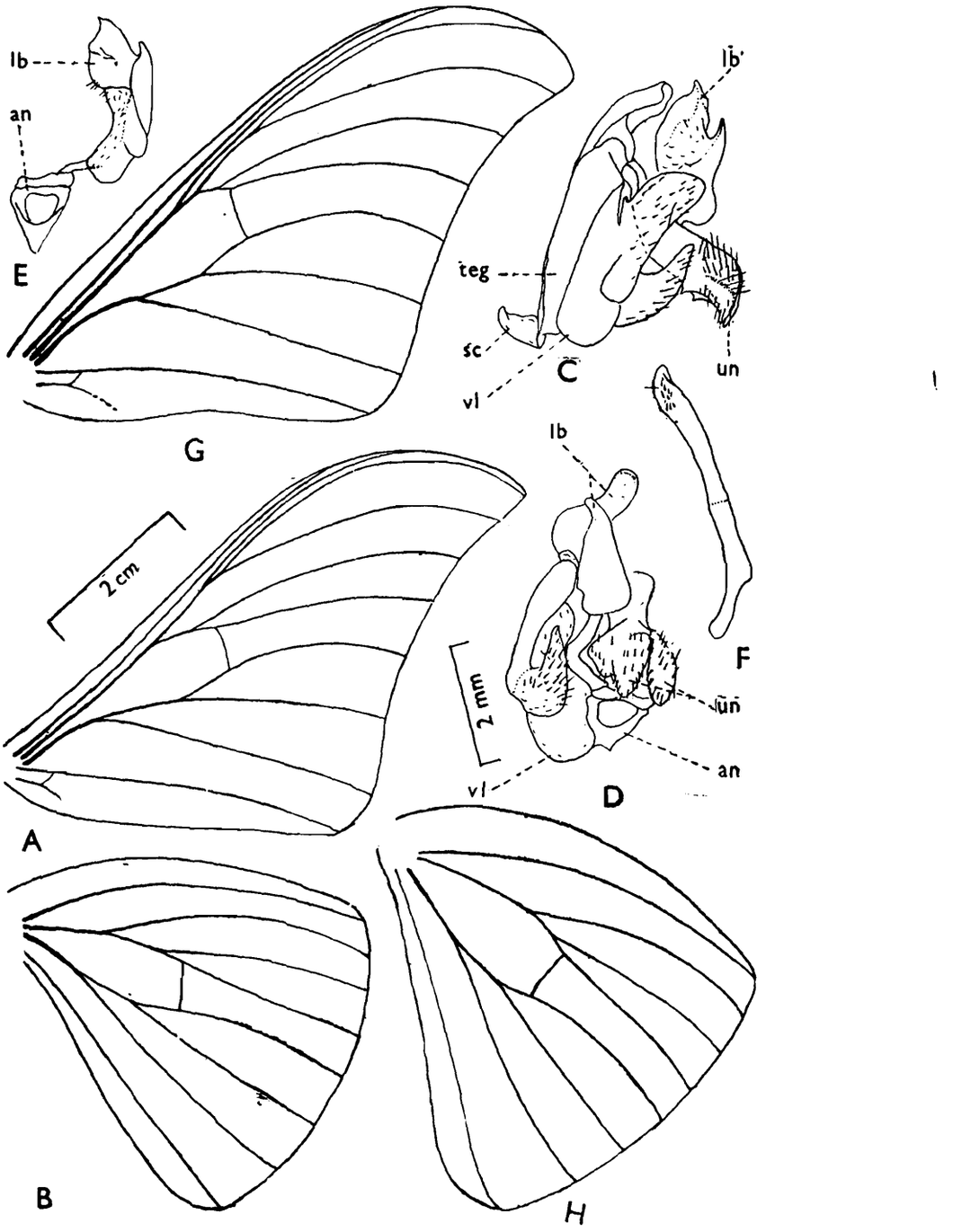
1892. *Antheraea assamensis*, Swinhoe, *Cat. East. & Aust. Lep. Oxford Mus.*, **1** : 252.

1969. *Antheraea assamensis*, Pruthi, *Textbook on Agricultural Entomology* : 416.

1975. *Antheraea assamensis*, Jolly *et al.*, *Non-Mulberry Sericulture in India* : 65.

Male.—Upperside : Frontal tufts reddish pink. Antennae dark brown, with their bases reddish pink. Collar greyish. Thorax, bases of wings and abdomen chestnut brown. Fore wing with costal fascia greyish brown up to basal two-thirds, apical part tinged with pinkish to red, suffused with black at apex ; antemedial line whitish from below the median nervure to the inner margin, incurved and outlined by dark brown, a similar line in the middle of the cell ; ocellus yellow, with deep red boundary enclosing black and white lunules on the inner side and reddish yellow on the outer ; hyaline spot absent ; postmedial line indistinct ; submarginal line black, double, filled with pale white in between and outlined by whitish ; submarginal area mostly yellow from apex to vein Cu_{1a}, the area beyond and below the vein Cu_{1a} same as the ground colour ; marginal line paler. Hind wing with the antemedial line faint, not reaching the inner margin ; hyaline spot reduced, linear and surrounded by ocellus, the latter with dark boundary enclosing blue and black lunules on the inner side, the black lunule thicker, the

outer area entirely yellowish or reddish yellow ; submarginal line double, black, with whitish in between, making a curve about the ocellus but not touching the antemedial line. *Underside* : Fore wing greyish brown except at their bases, the latter pale pinkish near the inner margin, ocellus as on upperside, with the inner half dark brown and the outer half pale brown. Hind wing reddish pink in the middle with their bases paler. Lines on both the wings more thicker



Text-fig. 7 *Antheraea assamensis* : A, fore wing venation ; B, hind wing venation ; C, lateral view of genitalia ; D, inner view of genitalia (without right valva and labide) ; E, anellus and right labide ; F, aedeagus. *Antheraea compta* : G, fore wing venation ; H, hind wing venation.

and diffused. Thorax and legs reddish pink. *Female* : Differs from male in being paler, particularly in antennae ; the body and wings being pinkish brown, tinged with yellow ; lines more prominently marked, especially the postmedial line which clearly expands into a patch at the

apex in the fore wings, and not reaching the costa in hind wings ; the submarginal area more paler than the ground colour. *Underside* : Darker, with the lines on wings thicker and diffused ; hind wings irrorated with grey and pink.

Frons with frontal tufts prominently developed in the lower half and protruded forwards and downwards. Antennae in male quadripectinate except for a few apical segments, ramii equal, longer, especially in the middle, being about eight segments of the shaft taken together, whereas in female the ramii unequal, shorter, being about five segments of the shaft taken together. Labial palpi short but exceeding beyond the frontal tufts.

Venation.—In fore wing vein R_1 stalked with veins R_{2+3} and R_4 (Text-fig. 7, A—B).

Male Genitalia (Text-fig. 7, C-H).—Uncus about four times as long as its width at base, narrowed before the middle, then broadens, with apex bifid, setose beyond the middle, a slight projection present on either side ventrally. Tegumen narrow and elongate, produced dorsally into a broader prolongation. Vinculum 'U' shaped. Saccus short. Valva about thrice as long as its width in the middle, dorsal margin reduced, ventral margin with membranous prolongation, the latter setose ; distally narrowed, sparsely beset with setae, the mesal surface membranous except the sacculus, the latter slightly chitinised. Labides well developed, beset with setae only on the inner side, the middle part being broader, with one of its margins folded, the apical part chitinised, incurved and turned upwards. Anellus ring well sclerotised, particularly dorsally, produced narrowly and meeting the labides on each side, ventrally being short and blunt. Aedeagus long and narrow, curved apically, with a few serrations.

Wing expanse.—Males, 110—145 mm. ; females, 112—150 mm.

Material examined.—Fifteen examples (5♂♂, 10♀♀). INDIA : Assam, Titabar, 1♂, 6♀♀, emerged from cocoons in Laboratory, 4. xii. 1974 (*K. Singh* Donor) ; 4♂♂, 4♀♀, emerged in Lab. (*G. S. Rao* Donor).

Distribution.—INDIA (Himachal Pradesh, Uttar Pradesh, Sikkim, Assam, Meghalaya, Gujarat, Pondicherry) ; BANGLADESH (Sylhet) ; SRI LANKA ; and INDONESIA (Sumatra, Borneo).

Host plants.—*Cinnamomum obtusifolium* Nees (Pati Chanda), *Laurus obtusifolia* (Patte shoonda), *Litsoea citrata* Bl. (Mejankori or Addakurry), *L. polyantha* Juss. (Soalu), *L. salicifolia* (Digloti), *Machilus bombycina* King (Som), *M. odoratissima* Nees (Laurel, Sum tree), *Magnolia sphenocarpa* (Chapa), *Michelia champaca* L. (Champa), *Michelia* sp. (Champa), *Quercus* sp. (Oak), *Sarcostemma brevistigma* W. & A. (Soom), *Symplocas grandiflora* (Bamrati), *Tetranthera diglottica* (Digluttee), *T glauca* (Dighlate), *T. macrophylla* (Sonhalloo), *T monopetala* (Sualu tree) and *T. polyantha* (Mezankuri).

Remarks.—*Antheraea assamensis* (Helfer), popularly called 'Muga silkmoth', is well known for the production of muga silk.

The species can easily be recognised by the distal ramii on the antennae in female being longer as compared to those of other species of *Antheraea*. It is allied to *A. paphia* (Text-fig. 8, A) and *A. frithi* (Text-fig. 9, A) in the origin of vein R_1 from the common stalk of veins R_{2+3} and R_4, but can be distinguished by the reduced hyaline spot in both the wings, ocellus in hind wing filled with black on the inner one-third and the male genitalia being without long and stout bristles on the distal margin of the valva.

Besides nominate subspecies, *assamensis perrotteti* Guérin-Méneville has been reported from Pondicherry in South India. While Schüssler recorded *assamensis assamensis* from "Lakhimpur, Darrong, Dhurumpore, Dehra Dun, Assam, Kangra, Silhet and Ceylon", Jolly *et al.* (1975) report it to be restricted to North Eastern States particularly Assam, in INDIA.

6. **Antheraea paphia** (Linnaeus)

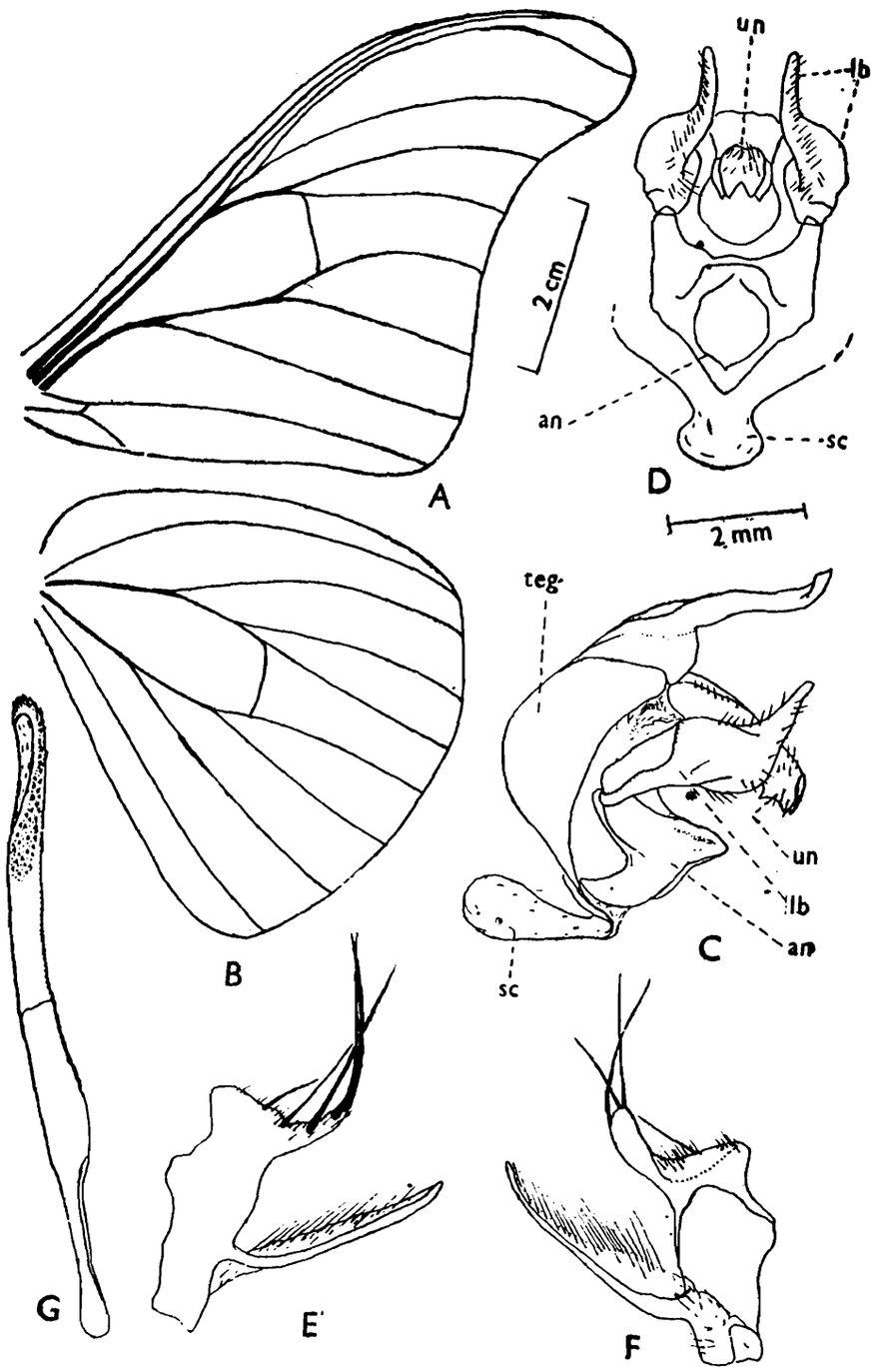
(TASAR SILKMOTH)

(Pl. V, nos. 19-22 ; Text-figs. 1, H—J ; 8, A-G)

1758. *Phalaena Bombyx paphia* Linnaeus, *Syst. Nat.*, Ed. X, **1** : 496 (*Type-locality.*—Guinea, in West AFRICA).
1767. *Phalaena Attacus paphia* (Linnaeus), *Syst. Nat.*, Ed. XII, (1) **2** : 809.
1773. *Phalaena Attacus mylitta* Drury, *Illustr. Nat. Hist. Ins.*, 2 : 8, pl. 5, fig. 1, ♂.
1775. *Bombyx paphia*, Fabricius, *Syst. Ent.* : 557, No. 4.
1775. *Bombyx mylitta*, Fabricius, *Syst. Ent.* : 558, No. 6.
1787. *Phalaena paphia*, Gevers, *Mus. Geversianum* : 186, No. 1531.
1820. *Antheraea paphia*, Hübner, *Verz. bek. Schmett.* : 152.
1837. *Saturnia mylitta*, Westwood, *Illustr. exot. Ent.*, 2 : 10, pl. 5, fig. 1, ♂.
1837. *Phalaena mylitta*, Helfer, *J. Asiat. Soc. Beng.*, **6** : 42.
1837. *Saturnia paphia*, Helfer, *J. Asiat. Soc. Beng.* **6** : 42.
1855. *Antheraea paphia*, Walker, *Cat. Lep. Het. Brit. Mus.*, **5** : 1247.
1855. *Bombyx mylitta*, Guérin-Méneville, *Rev. Zool.*, 2 (7) : 297-99.
1864. *Bombyx* (*Antheraea*) *mylitta*, Guérin-Méneville, *Rev. Mag. Zool.*, (2) **16** : 138-182.
1865. *Antheraea paphia*, Hutton, *Trans. ent. Soc. Lond.*, (3) **2** (4) : 318.
1869. *Antheraea nebulosa*, Hutton, *J. Asiat. Soc. Beng.* : 16.
1881. *Antheraea sivalica* Moore, In Wardle's, *Wild Silk in India* : 7.
1882-1883. *Antheraea cingalesa* Moore, *Lep. Ceylon*, **2** : 122, pl. 15, figs. 1, 1a, 1b.
1887. *Antheraea mylitta*, Cotes and Swinhoe, *Cat. Moths of India*, **2** : 228, No. 1564.
1892. *Antheraea paphia*, Hampson, *Fauna of British India*, Moths, **1** : 18-19.
1933. *Antheraea paphia*, Schüssler, *Lepid. Cat.*, **56** : 179-194.
1933. *Antheraea paphia mylitta*, Schüssler, *Lepid. Cat.*, **56** : 183-188.
1969. *Antheraea paphia*, Pruthi, *Textbook of Agricultural Entomology* : 416.
1976. *Antheraea paphia*, Nayar *et al.*, *General and Applied Entomology* : 254.
1977. *Antheraea paphia*, Richards & Davies, *Imm's Text Book of General Entomology* : 1138.

Male.—Upperside : General colour brown. Antennae yellowish brown. Fore wing with the costal fascia up to basal two-thirds brown and powdered with grey ; antemedial line indistinct ; median line indistinct in the cell ; hyaline spot large, lying on the discocellulars, bounded by ocellus which consists of yellow and greyish brown rings, followed by white and pink on inside and black on the outerside ; postmedial line diffused and passing through outer part of ocellus, postmedial area slightly darker than the basal area ; submarginal line pink, outlined by white, the area beyond pale yellowish. Hind wing with the antemedial line as in fore wing, median line not reaching the inner margin ; ocellus with the outermost ring black and complete, hyaline spot smaller than that of fore wing ; postmedial line as in fore wing but passing through middle of ocellus ; submarginal line and the area beyond that as in fore wing. *Underside* : Pale yellowish. Antemedial and medial lines indistinct in fore wing ; medial line in hind wing, postmedial lines and margins in both wings brown, tinged with fuscous ; postmedial line passing through ocellus. Fore wing with a pink subapical patch. *Female.—Upperside* : General colour yellowish brown to brown or fuscous brown. Antennae brown to dark brown. Fore wing with the costal fascia up to apex, brown and powdered with grey ; antemedial line brownish and lined by white ; median line in the cell lined by white ; ocellus with a large hyaline spot, bounded by yellow and greyish brown as in male except in certain specimens where black lunule on the inner side being additional and continuous with black of the outerside (in one of the specimens outer black of the ocellus off shooting to the costal fascia and directed backwards towards the base) ; postmedial line obsolete or diffused as in male ; submarginal line light

to deep reddish pink, outlined by white ; submarginal area pale yellowish. Hind wing with the antemedial line indistinct ; medial line as in male except in certain specimens where it touches the inner side of the ocellus, in the latter condition the hyaline spot very large ; colouration of ocellus as in male ; postmedial line from costa and bifurcated, one of the bifurcations passing through middle of the ocellus, the other one curved around the ocellus ;



Text-fig. 8. *Antheraea paphia* : A, fore wing venation ; B, hind wing venation ; C, lateral view of genitalia (without valvae and right labide) ; D, inner view of the part of genitalia ; E, outer and F, inner view of left valva ; G, aedeagus (A and B of same mag., C-G of same mag.).

submarginal line and area (submarginal area in one female specimen greyish brown) as in fore wing. *Underside* : Pale yellowish to brown, irrorated with pink, brown or black scales ; antemedial, medial and postmedial lines as on upperside, postmedial line usually not passing

through middle of ocellus ; the latter with outer black ring irregular and may form a short blotch, as in one of the specimens, below vein Cu_{1a} in fore wing.

Male Genitalia (Text-fig. 8, C-G).—Uncus highly chitinised, almost uniformly broad from base to apex, the latter slightly notched, turned downwards and ending into four short teeth, *i. e.*, two on each side. Tegumen broader in the middle but narrow at both ends, apically the ends extending into a flattened process, the latter broadened at its end. Vinculum very short and immediately entering into a short and bulbous saccus. Valva long and narrow, ventral margin oblique, with a long and slender process arising mid-ventrally ; the distal process very strong and backwardly curved, beset with bristles, some of these being stout and curved, continuous above with the dorsal margin, the latter very short and depressed medially. Labides broad medially, narrowed, curved, and considerably produced apically. Anellus very strongly chitinised into an almost quadrate plate, with the posterior ends continuing ventrally to form a narrow ring. Aedeagus about six times as long as its width at the middle, the apex about twice as broad as the basal part.

Wing expanse.—Males, 118-158. ; females 115-188 mm.

Material examined.—79 examples (35 ♂♂, 44 ♀♀). INDIA : Himachal Pradesh, Kasauli, 1 ♂, 1 ♀ (no further data), Simla, 1 ♀ (no further data) ; Uttar Pradesh, Lucknow, 1 ♂, 1 ♀ (no further data), Nainital, 1 ♀ (no further data) ; Sikkim, 2 ♂♂, 3 ♀♀ (no further data) ; Assam, Golpara, 1 ♂ (no further data) ; Meghalaya, Shillong, 1 ♀ (no further data) ; West Bengal, Akra, 2 ♂♂, 2 ♀♀, —i. 1886, Manbhum, 1 ♂, 3 ♀♀ (no further data), Kurseong, 1524 m., 1♂, 1♀ (no further data), Calcutta, 1 ♂, —.ii. 1870, 1 ♀, 2. viii. 1910, 2 ♂♂, 1 ♀ (*J. Cleghorn* coll.), 1 ♂, 3. viii. 1964 (*S. S. Saha* coll), Chandannagar, 1 ♂, (no further data) ; Orissa, Berhampur, 1 ♂, (no further data), Sambalpur, 1 ♀, 6. ix. 1875 (no coll.) ; Bihar, Palamau, 1 ♀ (no further data), Chaibassa, 1 ♂ (no further data), Sasaram, Dheerghat, 1 ♀ (no further data), Hazaribagh, 2 ♀♀ (no further data), Singhbhum, 1 ♂ (no further data), Bhagalpur, 1 ♂ (no further data) ; Madhya Pradesh, 1 ♀ (no further data) ; Maharashtra, Poona, 2 ♂♂, 7 ♀♀, 10. iv. 1948 (*Albert Mus. Bombay* colln.), Chanda, 5 ♂♂, 2 ♀♀ (no further data) ; Andhra Pradesh, Hyderabad, 2 ♀♀ (no further data) ; Tamil Nadu, Cuddalore, 2 ♀♀ (no further data) ; Pondicherry, 2 ♂♂, 4 ♀♀ (no further data).

SRI LANKA : Peradeniya, 1 ♀, —ix. 1900, 2 ♂♂, 1 ♀, —x. 1910, 2 ♂♂, —x. 1911, 1 ♂, —.1912.

BANGLADESH : Sylhet, 2 ♂♂, 1 ♀, 28. ii. 1880 (no coll.).

BURMA : Colgong, 1 ♂, 2 ♀♀ (no further data).

Distribution.—INDIA (Himachal Pradesh, Punjab, Rajasthan, Uttar Pradesh, Sikkim, Assam, Meghalaya, West Bengal, Orissa, Bihar, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Pondicherry) ; PAKISTAN ; BANGLADESH ; SOUTH CHINA ; NEPAL ; BHUTAN ; BURMA ; and SRI LANKA.

Host plants.—Anogeissus latifolia Wall. (Dhaura), *Bassia latifolia* Roxb. and *B. longifolia* L. (Mohwa trees), *Bauhinia variegata* L. (Kanchan), *Bombax heptaphyllum* (Semul), *B. malabaricum* DC. (Silk-Cotton tree), *Canthium diccocum* (Gaertn.) Merill, *Carpinus betulus* L. (Hornbeam), *Careya arborea* Roxb. (Kumbi), *C. sphuerica, Carissa carandas* L. (Karaunda or Karinda), *Cassia lanceolata, Celastrus paniculatus* Willd. (Malkangni), *Chloroxylon swietenia* DC. (East Indian Satin-wood, Billu), *Cipadessa fruticosa*

Bl., *Dodonaea viscosa* (L.) Jacq. (Sanatta), *Eugenia cuminii* (L.) Druce (Jaman), *Ficus benjamina* L. (Nandruck), *F religiosa* L. (Aswat, Peepul), *F retusa* L. (Kamrup), *Lagerstroemia indica* L. (Daiyeti, Telinga-China), *L. parviflora* Roxb. (Bakli), *Mangium caseolari rubrum*, *Pentaptera tomentosa*, *P. glabra*, *Prunus domestica* L. (Plum), *Quercus* sp. (Oak), *Rhizophora calceolaris*, *Ricinus communis* L. (Arund, Castor-Oil plant, Palma christi), *Shorea robusta* Gaertn. f. (Sal or Sakooa), *S. talura* Roxb., *Tectona grandis* L. (Sagun), *Terminalia alata*, *T. arjuna* Bedd. (Arjan, Sadara), *T. belerica* Roxb. (Bhaira), *T. catappa* L. (Jungli badam), *T. tomentosa* W. & A. (Ani, Asan, Saj), *Webera corymbosa*, *Zizyphus jujuba* (Ber tree).

Remarks.—*Antheraea paphia* (Linnaeus), popularly known as Tasar Silkmoth, produces tasar silk.

Schüssler (1933) catalogued three subspecies viz., *A. paphia paphia* (L.), *A. paphia mylitta* (Drury) and *A. paphia cingalesa* Moore. Since *A. paphia mylitta* is only a semidomesticated race, it is indistinguishable as a geographical race from *A. paphia paphia*, as also admitted by Seitz (1928) who remarked "*mylitta* is quite similar to *paphia*". Our studies on the specimens collected from South INDIA and SRI LANKA, further reveal their resemblance to the specimens collected from other parts of India as far as general colouration is concerned. These observations clearly indicate a great degree of variation in colour, which Lefroy (1909) assigned to hybridisation in the species and absence of mating in captivity by these moths. These variations are, however, insufficient to distinguish one population of an area from that of another area. Hence, it is appropriate that the species, referred as *A. paphia* (L.), should not be further differentiated into hitherto known subspecies.

Antheraea paphia (L.) is readily distinguished from its allied species *A. frithi* Moore, in having large hyaline spots on both wings (*vs.* smaller hyaline spots) and submarginal line oblique and not angulated (*vs.* submarginal line double and angulated).

7. **Antheraea frithi** (Moore)

(Pl. VI, nos. 23-24 ; Text-fig. 9, A-F)

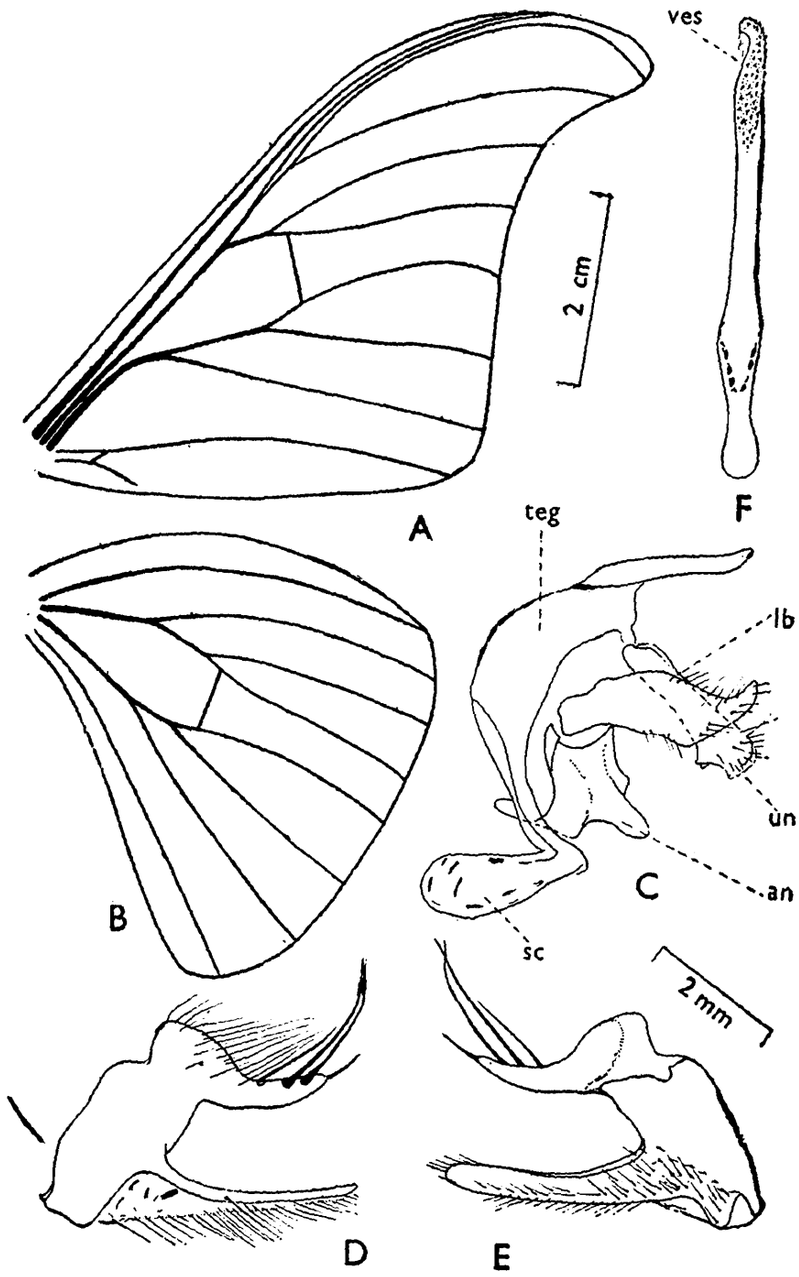
1858-59. *Antheraea frithi* Moore, *Cat. Lep. Ins. Mus. E. I. House*, **2** : 396-97 (*Type-locality.*—Darjeeling).
1933. *Antheraea frithi*, Schüssler, *Lepid. Cat.*, **56** : 176.

The specimens have lost their natural colours which have been described by Hampson (1892) as brown or pink suffused with yellow (pink tinge is not traceable at all in these specimens). Fore wing with the costal fascia extending up to basal two-thirds. However, the species is readily distinguished from other species of the *paphia* group by the following characters :—

Upperside : Fore wing with the ocelli comparatively smaller ; two highly lunulate postmedial lines present, the inner one diffused and touching the ocellus on the outer side ; submarginal line slightly wavy in the lower part. Hind wing with the antemedial, postmedial and submarginal lines highly angulated, postmedial line double as in fore wing. *Underside* : The lines mainly as on the upperside. Besides, the subapical patch (on the costa) in fore wing and submarginal spots on the hind wing present ; marginal lines present on upperside as well as on underside on both the wings.

Male Genitalia (Text-fig. 9, C—F).—Genitalia like that of *A. paphia* except the valva where the median arm is more membranous, broad and densely beset with setae, the distal part also

with a similar depression at the dorsal margin and continuous into a process, which is beset with setae as well as strong bristles, two of these being very strong. Labides broad up to basal two-thirds, bulged on inner side, the apical one-third narrow and slightly curved. Aedeagus long, narrow and blunt at the basal end so that the ejaculatory duct enters from one side at the basal one-third ; the apical part in its distal half serrated and curved.



Text-fig. 9. *Antheraea frithi* : A, fore wing venation ; B, hind wing venation ; C, lateral view of genitalia (without valva and right labide) ; D, outer and E, inner view of left valva ; F, aedeagus (A and B of same mag. ; C-F of same mag.).

Wing expanse.—Males, 105-144 mm. ; females, 130-155 mm.

Material examined.—18 examples (11♂♂, 7♀♀). INDIA : West Bengal, Darjeeling, 6♂♂, 7♀♀ (*F Möller* coll.) ; Sikkim, 4♂♂ (no further data) ; Meghalaya, Shillong, 1♂, 25. iv. 1927 (Reared in Laboratory).

Distribution.—INDIA (Himachal Pradesh, Bihar, West Bengal, Sikkim, Meghalaya and Andamans) ; BHUTAN ; SOUTH VIETNAM (Saigon) ; INDONESIA (Java).

Host plant.—*Shorea robusta* Gaertn. f. (Sal).

Remarks.—*Antheraea frithi* Moore is close to *A. paphia* in respect of wing venation, particularly the origin of vein R_1 which does not arise free from cell but stalked with other radials. However, it is easily and readily distinguishable from *A. paphia* in having smaller hyaline spots in both wings and highly angulated postmedial lines in hind wing.

8. **Antheraea compta** Rothschild

(Text fig. 7, G—H)

1899. *Antheraea compta* Rothschild, *Novit. zool.*, **6** (3) : 431-432 (*Type-locality.*—Khasia Hills, Assam).
1933. *Antheraea compta*, Schüssler, *Lepid. Cat.*, **56** : 175.

"Allied to *A. assamensis*. Body and wings *above* orange ochraceous, wings shaped with pink. Forewing : basal two-thirds of costal margin fuscous, with some whitish scaling, antemedian band rose pink, edged with white proximally, placed as in *assamensis*, ocellus ochre-yellow, encircled by an extremely thin pinkish brown line, the proximal part of which is feebly bordered white distally ; a very small linear hyaline centre ; a postdiscal black line contiguous with a white one of about half the width, almost parallel to outer margin ; anteriorly stopping at Sc^5, 9 mm. from edge of wing at M^2, 6_2 mm. at R^1 ; a conspicuous but small black costal spot about 6 mm. from apex ; a submarginal pink patch below apex, between Sc^4 and Sc^5, outwardly bordered by a broad brick-red line ; outer edge clayish buff, fringe more clay colour. Hindwing : Ocellus as in *assamensis*, larger, its proximal portion black, outer portion ochre-yellow, a white line in cell, about 3 mm. distant from black wing of ocellus, continued to abdominal margin, heavily bordered with rose-red distally, this red colour touching the ocellus ; a very faint orange band between ocellus and abdominal margin, being the continuation of a similar band on the forewing, which touches the ocellus of the forewing at the outer side ; a black and white submarginal line as on forewing, faintly bordered with pink proximally, terminating before R^1, not curved towards base, almost quite straight, situated about midway between ocellus and outer margin, crossing M_1 9 mm., SM^2 6 mm. from edge of wing, the latter coloured as on forewing ; the marginal area outside the black and white line orange on both wings, crossed by the yellow veins.

Underside similar to *assamensis*, brighter in tint. *Hab.* Khasia Hills, Assam, 8♂♂, no ♀", (Quoted from Rothschild, 1899)

Wing expanse.—Male, 166 mm.

Material examined.—One example (damaged). INDIA : Maghalaya, Cherra Punji, 1220-1524 m., 1 ♂, 24. vii. 1931 (no coll.).

Distribution.—INDIA ; Sikkim, Assam and Meghalaya.

Remarks.—*Antheraea compta* Rothschild resembles *Antheraea assamensis* (Helfer) as far as the ocellus in hind wing is concerned. In both the species ocellus is filled with black but differs in being black up to inner half in *A. compta* and one-third in *A. assamensis*. Besides, the postmedial line in hind wing of *A. compta* is single, black and broad unlike in the male of *A. assamensis* where the postmedial line is double and black ; vein R_1 is free, arising (Text-fig. 7, G) from cell unlike in *assamensis* where it is stalked with other radials and is rather close to origin of vein R_4.

9. **Antheraea roylei** Moore

(OAK TASAR MOTH)

(Pl. VII, nos. 27-30 ; Text-fig. 10, A—G)

1858-59. *Antheraea roylei* Moore, *Cat. Lep. Ins. Mus. E. I. House*, 2 : 397-398 (*Type-localities**.—N. INDIA and Darjeeling).

1864. *Bombyx* (*Antheraea*) *roylei*, Guérin-Méneville, *Rev. Mag. Zool.*, (2) **16** : 138-139.

1865. *Antheraea roylei*, Walker, *Cat. Lep. Het. Brit. Mus.*, **32** : 527 (Darjeeling).

1895. *Antheraea pernyi roylei*, Rothschild, *Novit. zool.*, **2** : 43-44.

1933. *Antheraea roylei*, Schüssler, *Lepid. Cat.*, **56** : 207-209.

Upperside : Frontal tuft brown, paler below. Antennae grey brown, with their bases brown. Labial palpi dark brown on sides, paler brown below. Collar dark brown irrorated with grey. Thorax and abdomem pale brown. Fore wing with the costal fascia brown, irrorated with grey up to basal half ; the ground colour greenish brown throughout except basal area, the latter pale brown ; an indistinct antemedial line reddish pink from below the costal fascia to the anal margin ; a similar line in the cell ; a hyaline spot on the discocellulars bounded by a greenish brown ocellus ; the ocellus with a white and pink lunule on the inner side, the yellow and dark brown lunule on the outer side ; postmedial line indistinct ; submarginal line double and pink, with inner one pale red and the outer reddish pink, edged with white, the latter expanding into a large grey patch at the apex ; marginal line yellow. Hind wing similar to fore wing except that the subbasal line obsolete ; antemedial line wavy and continued to inner margin ; submarginal line from Rs to inner margin. *Underside* paler, subbasal line in fore wing not distinct ; postmedial lines diffused, from costa to Cu_{1b} in fore wing and from costa to inner margin in hind wing, touching in both cases the outer edge of the ocellus ; submarginal line single, with subtriangular reddish pink spots, edged with white in the inter-nervural spaces. Legs pale brown.

Female generally with paler tinge tending to be ochreous brown.

Male Genitalia (Text-fig. 10, C—G).—Uncus bifid from a little beyond the middle, sparsely beset with setae on the dorsal side, the apex notched, downcurved and ending in two unequal teeth on each side. Tegumen like that of *A. paphia* except that the apical end is produced into a very short prolongation. Vinculum short. Saccus long and rounded at its end. Valva broader, ventral margin oblique, slightly incised before the median arm, the distal arm strongly curved backwards, deeply notched at its end and beset with strong bristles, particularly those on the tip on outer side. Transtilla well developed. Labides broader medially, curved and narrowly produced at the apex. Anellus strongly chitinised forming a very large plate over the dorsal part extending on to the ventral side in the form of a spade. Aedeagus long and narrow, with the basal part shorter than the apical part, the latter denticulated in its distal one-third part, ejaculatory duct enters at the side near the base, the distal end slightly bent and serrated.

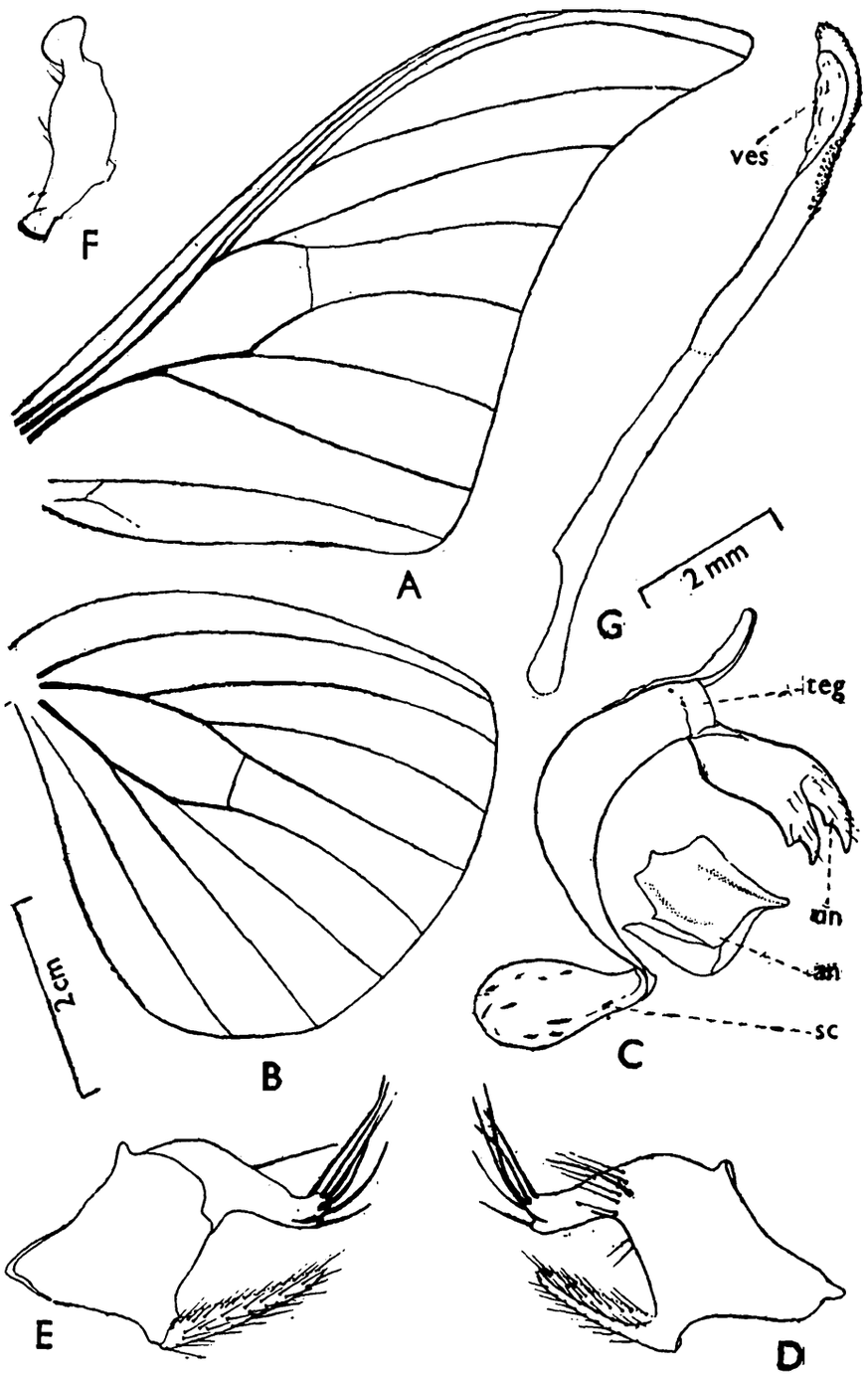
Wing expanse.—Males, 145-148 mm. ; females, 124-165 mm.

Material examined.—15 examples (5 ♂♂, 10 ♀♀). INDIA : Himachal Pradesh, Simla, 2 ♂♂, 3 ♀♀ (no further data) ; West Bengal, Darjeeling, Govt. Rest House, 1 ♀.—v. 1912 (*Lord Carmichael* coll.) ; Sikkim, 2 ♂♂, 5 ♀♀ (no further data) ; Meghalaya, Shillong, 1 ♀, 26. iv. 1927 (emerged in Laboratory), 1 ♂, 19. iv. 1976 (*R. Thapa* coll.).

* As given in the original publication.

Distribution.—INDIA : Himachal Pradesh, Uttar Pradesh, Sikkim, Meghalaya, Assam and West Bengal.

Host plants.—*Bassia latifolia* Roxb. and *B. longifolia* L. (Mohwa trees), *Betula alnoides* Buch.—Ham. (Indian Birch, Bhujpattra), *Cyperus esculentus* L. (Chestnut), *Daphniphyllum*



Text-fig. 10. *Antheraea roylei* : A, fore wing venation ; B, hind wing venation ; C, lateral view of genitalia (without valvae and labides) ; D, outer and E, inner view of right valva ; F, labide ; G, aedeagus (A and B of same mag. ; C-G of same mag.).

himalense, Evodia flaxinifolia Hook. f. (Poyam), *Prunus puddum* Roxb. (Wild Cherry), *Pyrus communis* L. (Pear), *P malus* L. (Apple), *Quercus dealbata* Hook. f. & Th., *Q. dilatata* Lindl. (The Green Oak of the Himalaya), *Q. glauca* Thunb., *Q. himalayana, Q. ilex* L. (Holm Oak), *Q. incana* Roxb. (The Grey Oak), *Q. semicarpifolia* Smith, *Q. semiserrata* and *Q. serrata*,

Remarks.—Antheraea roylei Moore, also popularly called as 'Oak Tasar silkmoth', had till recently not been of commercial value because of the larvae spinning a double layered cocoon. However, by crossing *A. roylei* with a Chinese *A. pernyi* Guèrin-Mèneville, this species has been exploited for commercial production of 'Oak-Tasar Silk'.

Externally, this species resembles *A. paphia* (L.) in general colouration, but can be distinguished in having smaller hyaline spots on both wings, in the origin of vein R_1 from the cell or very close to the common stalk of radial veins R_{2+3} and R_4, and in the costal fascia of the fore wing being half the length of the costa.

10. **Antheraea helferi** Moore

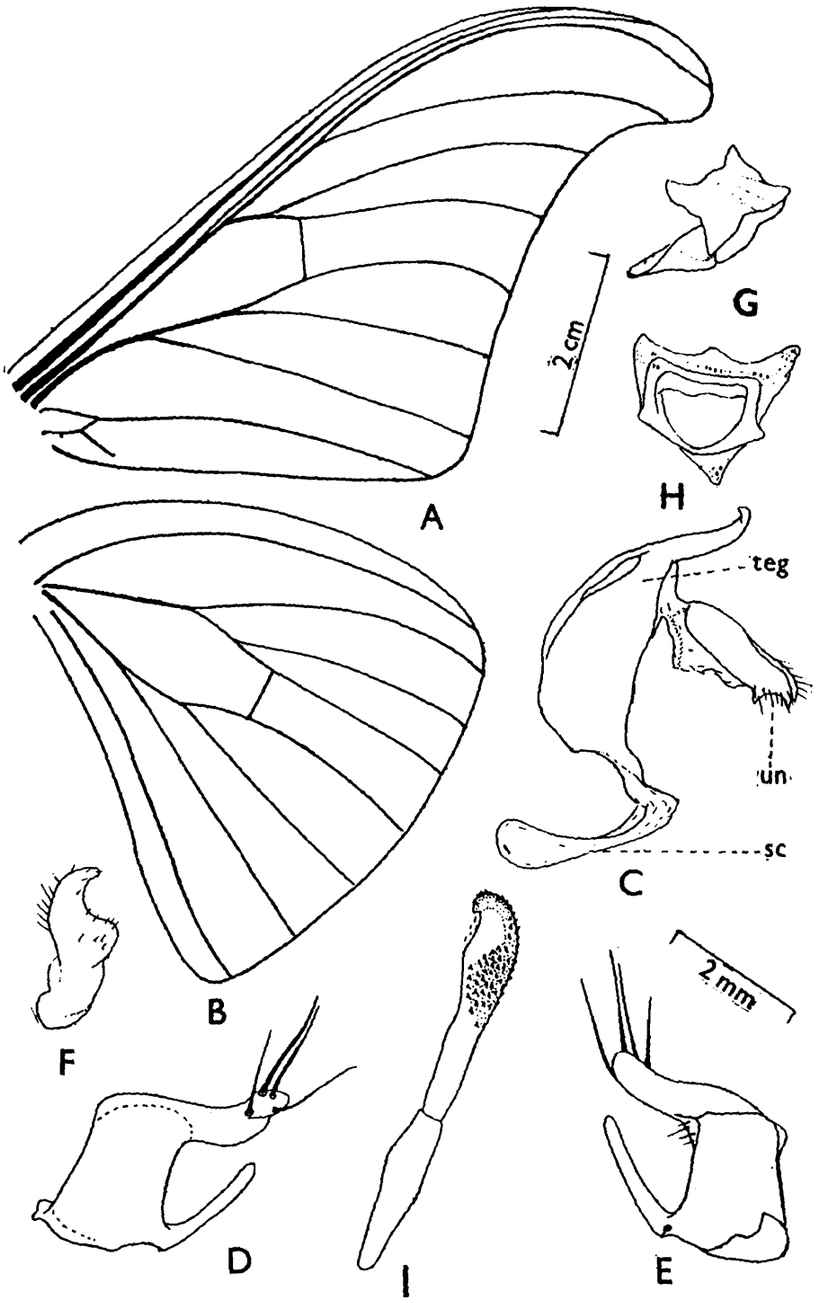
(Pl. VI, nos. 25-26 ; Text-fig. 11, A-I)

1858-59. *Antheraea helferi* Moore, *Cat. Lep. Ins. E. I. House*, **2** : 397 (*Type-locality.*—Darjeeling).
1892. *Caligula helferi*, Kirby, *Syn. Cat. Lep. Het.*, **1** : 760, No. 2, 937 (Darjeeling).
1933. *Antheraea helferi*, Schüssler, *Lepid. Cat.*, **56** : 178.

Male.—Upperside : Frontal tufts, antennae and labial palpi pale brownish. Prothorax with a brown band suffused with greyish white. Thorax and abdomen yellow brown. Wings yellow brown and suffused with ferruginous in their distal halves. Fore wing with the costal fascia like the band on prothorax and extending up to basal two-thirds ; antemedial line excurved from cubital vein to the inner margin, pink and suffused with whitish on both sides ; a short, pink median line, suffused with whitish on the innerside in the cell ; a small hyaline spot on the discocellular in the centre of ocellus, suffused with pink and white on the inner side but greyish brown lined by yellow on the outer side ; a short streak of pink colour running along the radio-median up to the upper angle of the cell and touching the ocellus ; postmedial band diffused, deeper than the ground colour, starting from beyond the end of costal fascia to inner margin and touching ocellus on its way ; submarginal line double and pinkish, from subapical blackish patch to inner margin, slightly wavy in the lower half ; marginal line dark brown followed by brownish margin. Hind wing like fore wing but without antemedial line ; median line pink and diffused from below the ocellus to the inner margin ; ocellus as in fore wing but with a black, well developed blotch above it ; submarginal line double, wavy, the inner one curved around above the ocellus and join the antemedial line, the outer one diffused at the costa. *Underside* : Wings ferruginous brown, irrorated with pink and whitish scales, except the bands, the latter diffused and ferruginous brown ; antemedial and submarginal lines lacking in both the wings, whereas marginal line and margin, as on the upperside ; small black dots bordered with white present in the internervural spaces of the submarginal area. *Female.—Upperside* : Differs from male in being yellowish brown, in the submarginal lines in both the wings dark brown, broad and outlined by whitish. *Underside* : Postmedial band usually not touching the ocellus in fore wing and submarginal dots in the internervural spaces well developed.

Male Genitalia (Text-fig. 11, C-I).—Uncus strongly chitinised, deeply bifid from a little beyond the middle, ending into two pointed teeth on each side, sparsely beset with short setae at apex. Tegumen short and broad, strongly curved on inner margin and produced apically into a short prolongation. Vinculum broadly V-shaped, continuing immediately from below the broader part of tegumen and extending into a large rounded saccus. Valva like that of *A. roylei* but being more broad, median arm less membranous, distal arm not notched

apically. Labides short and broad, notched apically with the outer end longer and curved than the inner end, the latter short and blunt. Anellus very strongly chitinised into a quadrate plate above which extends downwards and inwards into a conical prolongation. Aedeagus short and broad, with the basal part clearly differentiated from the apical part, the latter broad and serrated at its distal end.



Text-fig. 11. *Antheraea helferi* : A, fore wing venation ; B, hind wing venation ; C, lateral view of genitalia (without valvae and labides) ; D, outer and E, inner view of left valva ; F, labide ; G and H, anellus ; I, aedeagus. (A and B same mag. ; C-I of same mag.).

Wing expanse.—Males, 129-151 mm. ; females, 143-155 mm.

Material examined.—11 examples (9 ♂♂, 2 ♀♀). INDIA : West Bengal, Darjeeling, 1 ♂ (no further data) ; Sikkim, 7 ♂♂, 2 ♀♀ (no further data) ; Manipur, I. B. Mao, 1757 m., 1 ♂, 16. ix. 1975 (*M. S. Shishodia & party* coll.)

Distribution.—INDIA : West Bengal, Sikkim and Manipur.

Remarks.—*Antheraea helferi* Moore is allied to *A. knyvetti* Hampson in having costal fascia in fore wing up to basal two-thirds, antemedial line in hind wing approaching ocellus but may or may not touch the same, and in the origin of vein R_1 from the cell. *A. helferi*, however, differs from *A. knyvetti* in having a well developed black blotch above the ocellus in hind wing (*vs.* without black blotch above the ocellus in hind wing) ; and in the submarginal line in hind wing being double and wavy (*vs.* submarginal line not wavy).

11. **Antheraea knyvetti** Hampson

1892. *Antheraea knyvetti* Hampson, *Fauna Brit. India*, Moths, **1** : 19-20 (*Type-locality.*—Sikkim.)
1933. *Antheraea knyvetti*, Schüssler, *Lepid. Cat.*, **56** : 179.

"Reddish or olive yellow in colour, as in *paphia* ; the costal fascia of fore wing only extending along two-thirds of the costa ; the ocelli small, each hyaline spot usually with a dark lunule on its inner edge, the marginal line yellow ; the submarginal line of hind wing further from the margin, as in *roylei*.

Differs from *roylei* in its reddish-yellow colour, in the antemedial line of the hind wing being generally further from the base and touching the ocellus.

Larva differs from *roylei* in having sepia streaks on the head ; two silver spots only on the lateral band on 4th and 5th somites ; the apical tubercles on 2nd and 3rd somites blue instead of green. Food-plant "wild cherry" and "birch"

Cocoon small, hard, dark, and pedunculated. *Hab.* Sikhim (Knyvett). Exp. 156 millim. Types in colls. Knyvett and Elwes". (Quoted *vide* Hampson, 1892)

Material examined.—INDIA : Sikkim, 1 ♀ (damaged), reared in Museum (no other data).

Distribution.—INDIA : Sikkim.

Host plants.—*Betula alnoides* Buch-Ham. (Indian Birch, Bhujpattra), *Prunus puddum* Roxb. (Wild cherry) and *Quercus* sp. (Oak).

Remarks.—There is only one badly preserved female specimen so that the male genitalic studies could not be made. The description of the species has also been quoted in original. For comparison with other species, see *A. helferi*.

Genus **Loepa** Moore

1858-1859. *Loepa* Moore, *Cat. Lep. Ins. E. I. House*, **2** : 399, No. 923.
1936. *Loepa*, Schüssler, *Lepid. Cat.*, **56** : 90-91.
1976. *Leopa*, Nayar *et al.*, *General and Applied Entomology* : 254.

Type-species.—*Saturnia katinka* Westwood (1848) from Assam and Sylhet.*

Frons convex ; the latero-frontal sutures not visible. Antennae quadripectinate up to a few segments before apex, ramii short and equal ; distal ramii of one segment closely placed to basal ramii of the succeeding segment ; ramii beset with a few terminal and subterminal bristles ; cones multiple. Labial palpi short and three-segmented. Legs with the foretibial epiphyses reaching three-fourths apically ; mid and hind tibiae each with a pair of minute terminal spurs, the apical half of each sclerotised, with outer margins finely serrated ; tarsi with sparsely set spines ; claws with well developed arolium and pulvilli.

* As given in the original publication.

Venation.—Fore wings with all the radials present, R_5 from before the angle of cell ; discocellulars of both wings incurved.

Genitalia.—Uncus bifid apically. Gnathal arms free. Transtilla arms narrow, joined at the ends mid-ventrally through membranes. Anellus ring complete and highly chitinized. Valva with the outer margin rounded, the ventral margin produced into a process. Aedeagus narrowed apically and vesica with cornuti.

Distribution.—INDIA ; INDONESIA ; and CHINA.

Remarks.—The genus *Loepa* resembles *Cricula* in respect of the presence of five radials in fore wing, and gnathos, transtilla and cornuti, on the vesica of the aedeagus, in the male genitalia, but is readily distinguishable by the antennal ramii, not only from *Cricula* but all the other Indian genera presently studied. The frons is convex unlike that of *Cricula* in which it is flat.

The genus is represented by a single species *Loepa katinka* (Westwood).

12. **Loepa katinka** (Westwood)

(Pl. VIII, nos. 31—32 ; Text-figs. 1, K—M ; 12, A—F)

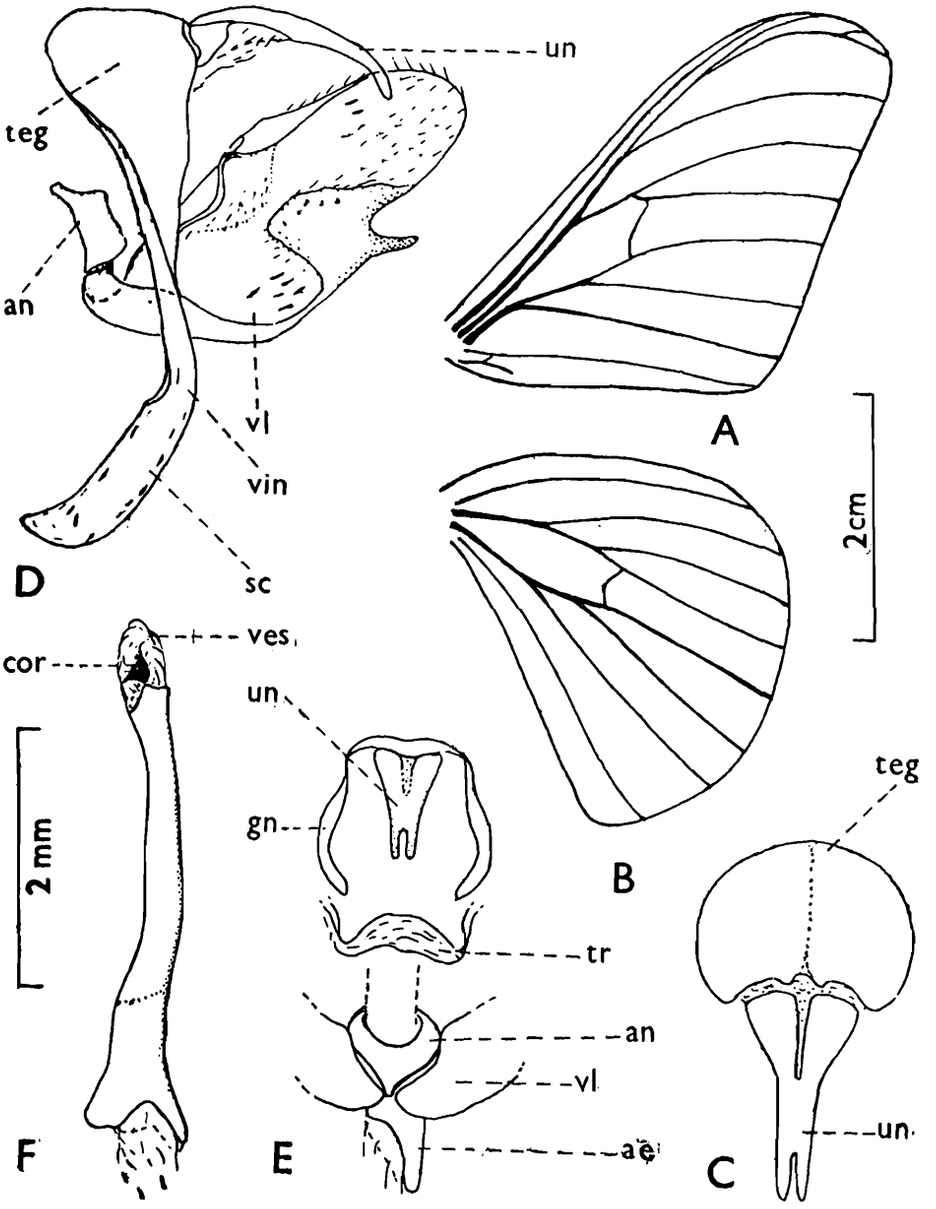
1848. *Saturnia katinka* Westwood, *Cab. Orient. Ent.* : 25, pl 12, fig. 2 (*Type-localities.**—'Assam and Sylhet').
1855. *Antheraea katinka,* Walker, *Cat. Lep. Het. Brit. Mus.,* **5** : 1251, No. 15.
1859. *Loepa katinka,* Moore, *Cat. Lep. Ins. Mus. E. I. House,* **2** : 399, pl. 20, figs. 1, 1a.
1865. *Loepa sikkima* Moore, *Proc. zool. Soc. Lond.* : 818 (*Type-locality.*—Darjeeling).
1865. *Loepa miranda* Moore, *Trans. ent. soc. Lond.,* (3) **2** (5) : 424-425 (*Type-locality.*—Darjeeling).
1936. *Loepa katinka,* Schüssler, *Lepid. Cat.,* **56** : 91-92.
1942. *Loepa katinka,* Cooper, *Amat. Ent.,* **6** (39) : 51.

Upperside : General colour yellow. Frontal tuft pale yellow. Labial palpi dark brown. Antennae pale brown. Collar greyish brown. Thorax yellow. Fore wing with the costal fascia greyish-brown up to basal two-thirds, apical one-third yellowish ; antemedial line pinkish, angulated, and suffused with white and pink on the inner side ; ocellus at the discocellulars oval, pinkish brown, the inner sides lined alternately with black and white lunules and the outerside blackish ; postmedial line black and highly angulated from costa to inner margin, touching the ocellus, the latter enlarged ; submarginal lines double, the inner line angulated from costa to inner margin, and the outer line angulated from a black spot between veins R_4 and R_5 to inner margin ; subapical area above the black spot pinkish, edged with reddish pink beyond it ; a series of white lunules present a little before the margin. Hind wings with markings generally as on fore wing ; antemedial line touching the lower margin of ocellus, the latter rounded ; colouration as in subapical part of fore wing lacking in hind wing. Abdomen pale yellow. *Underside* : Wings generally paler than the upperside, markings slightly faint. Hind wing with an additional pinkish spot which is suffused with white on the inner side. Legs with the tufts of scales greyish and suffused with pink.

Frons smooth. Labial palpi extremely short, not projecting beyond the frontal tufts ; the 3rd segment shortest. Antennae quadripectinate nearly up to tip ; ramii unequal ; longest ramii as long as three segments of the shaft at the middle ; the last segment simple, without ramii. Legs with spurs, spines and claws as given in genus.

* As given in the original publication.

Venation.—Fore wing (Text-fig. 12, A) : Veins R_1 to R_4 stalked, R_1 arising as far from R_4 as from R_2, R_5 arising from before the upper angle of cell ; M_1 from upper angle and M_3 from lower angle. Hind wing (Text-fig. 12, B) : Mainly as given in family characters.



Text-fig. 12. *Loepa katinka* : A, fore wing venation ; B, hind wing venation ; C, dorsal view of tegumen and uncus ; D, lateral view of genitalia (without left valva, and transtilla) ; E, inner view of the part of genitalia ; F, aedeagus. (A and B of same mag. ; C-F of same mag.).

Male Genitalia (Text-fig. 12, C—F).—Uncus about two and a half times longer than its width at base, the distal two-thirds long and narrow, nearly uniformly broad, the apex deeply bifid. Gnathal arms sclerotised and well developed but free at ends. Tegumen very broad dorsally but narrowing abruptly on sides ; vinculum narrow and 'U' shaped ; saccus large and conical. Valva simple ; costal process lightly sclerotised ; the mid ventral margin produced into a short process ; outer margin rounded. Transtilla arms narrow, sclerotised and meeting at their ends through membranes. Anellus ring highly sclerotised, channelled latero-ventrally, the ventral margin produced into a short conical projection. Aedeagus broad at base, gradually narrowing towards apex ; the vesica with a cornutal spine.

Wing expanse.—Males, 71-86 mm.

Material examined.—18 examples. INDIA : N. Sikkim, Toong, 1394 m., 1 ♂, 30. vii. 1959 (*A. G. K. Menon* coll.) ; Meghalaya, Shillong, Risa Colony, 1 ♂, 13. iv, 1973 (*M. Deb* coll.) ; Arunachal Pradesh, Lohit Dist., Roeing, 300 m. 2♂ ♂, 5. iii. 1969, 2♂ ♂, 6. iii. 1969, 9♂ ♂, 7. iii. 1969, 2♂ ♂, 8. iii. 1969 (all *S. K. Tandon* coll.) ; Tamil Nadu, Kala Mavu, 1♂, 11. x. 1975 (*R. S. Pillai* coll.).

Host plant.—*Dillenia pentagyna* Roxb.

Distribution.—INDIA (Himachal Pradesh, Uttar Pradesh, West Bengal, Sikkim, Assam, Meghalaya, Arunachal Pradesh and Tamil Nadu) ; BANGLADESH ; INDONESIA (Sumatra, Java) , and CHINA.

Genus **Cricula** Walker

1855. *Cricula* Walker, *Cat. Lep. Het. Brit. Mus.*, **5** : 1186-1187.
1858. *Euphranor*, Herr.-Schäffer, *Lep. exot. Spec. Nov.* : 61.
1936. *Cricula*, Schüssler, *Lepid. Cat.*, **56** : 152-153.
1976. *Cricula*, Nayar *et al.*, *General and Applied Entomology* : 254.

Type-species.—*Saturnia trifenestrata* Helfer (1837) from Assam.

Frons flat at sides next to eyes, slightly protruded at the middle ; latero-frontal sutures visible. Labial palpi extremely reduced, single jointed. Antennae in male quadripectinate nearly to apex, ramii short and equal ; in female the apical ramii extremely reduced so that the antennae appear nearly bipectinate ; cones multiple. Fore wings strongly falcate in males as compared to those in females. Legs with fore tibial epiphyses reaching two-thirds apically ; mid and hind tibiae each with a pair of short terminal spurs, the latter gradually narrowing from base to the tip ; the apical half of spur sclerotised, with outer margins minutely serrated ; tarsi without spines ; claws with well developed arolium and pulvilli.

Venation.—In both wings mainly as given in family characters except that cells being longer than the distance from discocellulars to outer margin ; discocellulars slightly excurved in fore wing but straight in hind wing.

Genitalia.—Uncus bifid apically. Gnathos weak, with the arms free at their ends. Transtilla present as a highly sclerotised plate. Anellus produced posteriorly into lobes. Aedeagus with cornuti on vesica.

Distribution.—INDIA ; BHUTAN ; BANGLADESH ; BURMA ; SRI LANKA ; MALAYSIA ; PHILIPPINES and INDONESIA.

Remarks.—The genus *Cricula* is represented by two species, *C. andrei* Jordan and *C. trifenestrata* (Helfer). For affinities and differences see genus *Loepa*.

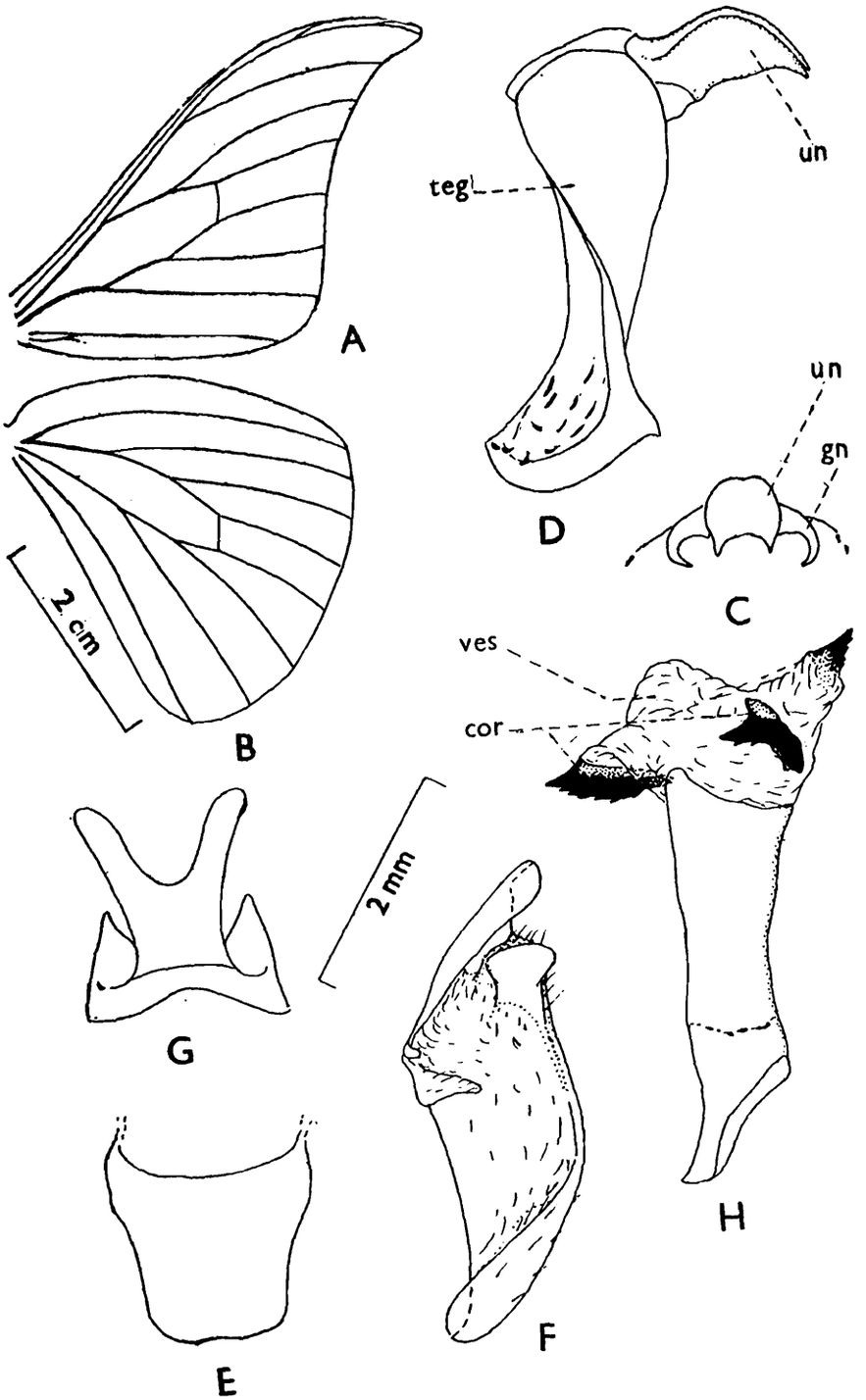
13. **Cricula andrei** Jordan

(Pl. VIII, nos. 33-34 ; Text-figs. 1, N ; 13, A—H)

1848. *Saturnia zuleika* Westwood, *Cab. Orient. Ent.*, **25** : 12. fig. ♂ (*Type-localities**.—Sylhet and Assam) [Nom. preocupp. *vide* Jordan, 1909].
1855. *Antheraea zuleika*, Walker, *Cat. Lep. Het. Brit. Mus.*, **5** : 1252, ♂.
1904. *Cricula zuleika*, Sonthonnax, *Essai. Classif. Lepid. prod. soie*, **4** : 11-12, sub. no. 1.
1909. *Cricula andrei* Jordan, *Novit. Zool.*, **16** (2) : 301, ♂, ♀, fig. G. (nom. nov. for *zuleika* Westwood, 1848).
1936. *Cricula andrei*, Schüssler, *Lepid. Cat.* **56** : 153.

* As given in the original publication.

Male.—Upperside : Frontal tuft, labial palpi, thorax and abdomen reddish brown. Antennae pale brown. Fore wing reddish brown except at the submarginal area, the latter greyish ; antemedial line angulated, dark brown tinged with purple ; postmedial line oblique



Text-fig. 13. *Cricula andrei* : A, fore wing venation ; B, hind wing venation ; C, distal part of uncus and free arms of gnathos ; D, lateral view of the part of genitalia ; E, transtilla ; F, inner view of the right valva ; G, anellus ; H, aedeagus. (A and B of same mag. ; C-H of same mag.).

from costa, before apex, to inner margin, dark brown tinged with purple ; hyaline spot single. Hind wings with the ground colour mainly as in fore wings except at the submarginal area, the latter yellowish brown ; medial and postmedial lines starting from a diffused dark brown

patch at the costal area, in interspace between vein R_5—M_1, running on either side of ocellus and ending at the inner margin ; postmedial line angulated. *Underside* : Both wings pale brown except at the inner area, the latter yellowish, irrorated with white and pink scales ; postmedial lines in both wings whitish, lined on inner side by pink ; submarginal area in both wings olive ; margin fringed with white in fore wing and pale yellow in hind wing. *Female.*—Differs from male in being darker in colour, with the submarginal area tinged with reddish brown ; underside as in male except in being slightly darker.

Frons smooth. Labial palpi very short. Antennae in male quadripectinate up to six or seven segments apically, the apical segments bipectinate with the branches shorter ; other ramii long and equal, the longest being as long as four segments of the shaft at the middle ; in female, antennae quadripectinate but with ramii short, unequal, the distal ramii reduced to mere long serrations, the longest basal ramii being as long as one middle segment. Legs with the tibial spurs, spines, claws, etc. as given in genus. Fore wing with the apex acute and produced in male than in female.

Venation.—Fore wing (Text-fig. 13, A) : Veins R_1 to R_5 stalked, R_1 and R_2 short, close to apex, R_3 ending at apex, R_4 arising as far from R_1 as from the origin of common stalk of R_5—M_1. Other features in fore and hind wings (Text-fig. 13, B) as given in the genus.

Male Genitalia (Text-fig. 13, C—H).—Uncus as long as its width at the base, raised mid-dorsally, with the apex bifid and slightly curved downwards. Gnathal arms short, weakly developed and free at the ends. Tegumen broad dorsally, narrowing gradually on sides, without clear demarcation into vinculum. Saccus very short. Valva twice as broad at its base as the distal part, the latter emarginate, the disto-ventral lobe being more sclerotised and well defined as compared to the disto-dorsal lobe. Transtilla plate quadrate, very large and well developed. Anellus broad and dorsally membranous ; ventrally produced into two diverging lobes, and channelled latero-ventrally. Aedeagus short and broad, about five times as long as its width at the middle, apex broad and rounded ; vesica bearing cornutal spines, the latter with their margins slightly dentate.

Wing expanse.—Males, 70-77 mm. ; female, 68 mm.

Material examined.—Eight examples (7 ♂♂, 1 ♀). INDIA : Meghalaya, Shillong, 1 ♂ (no further data), 2 ♂♂, 1 ♀, 24. viii. 1967 (no coll.), Risa colony, 1 ♂, 18. iii. 1971 (*Chandan Singh* coll.), 2 ♂♂, 20. vii. 1971 (*E. O. Albinus* coll.) ; Manipur, Mao Inspection Banglow, 1 ♂, 14. ix. 1975 (*M. S. Shishodia* coll.)

Distribution.—INDIA (Sikkim, Meghalaya and Manipur) ; BHUTAN ; and INDONESIA (Java).

Host-plants.—*Prunus avium* L. (Cherry) and *Pyrus malus* L. (Apple).

Remarks.—*Cricula andrei* can be distinguished from *C. trifenestrata* (Helfer) by the following characters : The general colour of the wings is reddish brown ; the fore wings in the male are strongly falcate ; the postmedial line in the fore wing is further away from the margin. In the male genitalia, the uncus is much broader medially than in *trifenestrata*, the apical lobe of the valva is much longer than the ventral lobe in contrast with that in *trifenestrata* in which these are nearly equal ; and the anellus has two backwardly directed ventral lobes, whereas in *trifenestrata* there is a single ventral lobe,

The material before us for study exhibits considerable variations on the hind wing in respect of medial and postmedial lines which join, in some of the specimens, in the interspace of veins Rs—M_1.

14. **Cricula trifenestrata** (Helfer)

(Pl. IX, nos. 35-38 ; Text-fig. 14, A-G)

1837. *Saturnia* (?) *trifenestrata* Helfer, *J. Asiat. Soc. Beng.*, **6** : 45, no. 10 ♂, ♀ (*Type-locality.*—Assam).
1837. [*Saturnia*] *haumpottonee* Hugon, *J. Asiat, Soc. Beng.*, **6** : 33 (*Type-locality.*—Assam).
1855. *Cricula trifenestrata*, Walker, *Cat. Lep. Het. Brit. Mus.*, **5** : 1187, 1196, ♂, ♀.
1858. *Euphranor trifenestrata*, Herrich-Schäffer, *Samml. Ausser, Schmett.*, **1** : 9, pl. 41, fig. 80, ♀.
1890. *Cricula burmana* Swinhoe, *Trans. ent. Soc. Lond.* : 198.
1929. *Copaxa nadari* Bouvier, *Annls. Sci. nat. Zool.*, (10) **12** : 339, pl. 3, fig. 2 ♂.
1936. *Cricula trifenestrata*, Schüssler, *Lepid. Cat.*, **56** : 154—158.
1976. *Cricula trifenestrata*, Nayar *et al.*, *General and Applied Entomology* : 254.

Male.—Upperside : Frontal tuft, thorax and abdomen yellowish brown to reddish brown. Labial palpi dark brown. Antennae pale brown. Fore wings yellowish brown to brown except at the area beyond postmedial line, which is grey brown ; antemedial line dark brown and wavy ; one or two hyaline spots outlined by dark brown, with a small dark brown spot above vein R_5 ; postmedial line oblique from costa, before apex, to inner margin. Hind wing yellowish brown to brown except the costal area which is paler ; medial line dark brown, outwardly curved from subcosta to cubital vein beyond which it is straight to inner margin ; a small dark spot with a minute hyaline spot on it present just outside the middle of discocellulars ; postmedial line dark brown, angulated between Rs and Cu_{1b} ; submarginal area greyish. *Underside* : Fore wings paler, irrorated with greyish except at the inner area which is yellowish ; submarginal area darker ; margin fringed with white scales. Legs pale yellowish to reddish brown. Hind wings as fore wings except the marginal fringe which is pale yellow. *Female.*—Mainly as in male except that they are darker, with the fuscous brown tinge at the area between antemedial and postmedial lines in fore wings, and medial and postmedial lines in hind wings ; the area beyond postmedial line greyish brown ; hyaline spots three to five and larger than in male.

Male Genitalia (Text-fig. 14, A—G).—Mainly as in *C. andrei* except that the uncus being broader medially, the valva with the disto-ventral and disto-dorsal lobes nearly equal, and the anellus produced into a single backwardly directed lobe. Aedeagus with the vesica provided with well developed cornutal spines.

Wing expanse.—Males, 60-112 mm. ; females, 57-88 mm.

Material examined.—30 examples (17 ♂♂, 13 ♀♀). INDIA : Sikkim, 1 ♂ (*Long* coll.) 1 ♀, (*O. Moller* coll.), 1♂, (no further data) ; Assam, Silchar (Cachar), 1 ♂, 2 ♀♀ (no further data) ; Meghalaya, Shillong, 1 ♂, 1 ♀ (no further data), Lachmiere, 1 ♀, 26. vi. 1961 (*A. R. Srinivasan* coll.) ; West Bengal, Calcutta, 1 ♂, 21. ii. 1892 (*Editor 'The Asian'* coll.), Kurseong, 1524 m., 1♂, 6. ix. 1909 (*Indian Mus.* colln.), Darjeeling, 1♂, 2 ♀♀ (no further data) ; Bihar, Ranchi, 1 ♀ (no further data) ; Tamil Nadu, Yercaud, 1 ♂,—.—.1922.

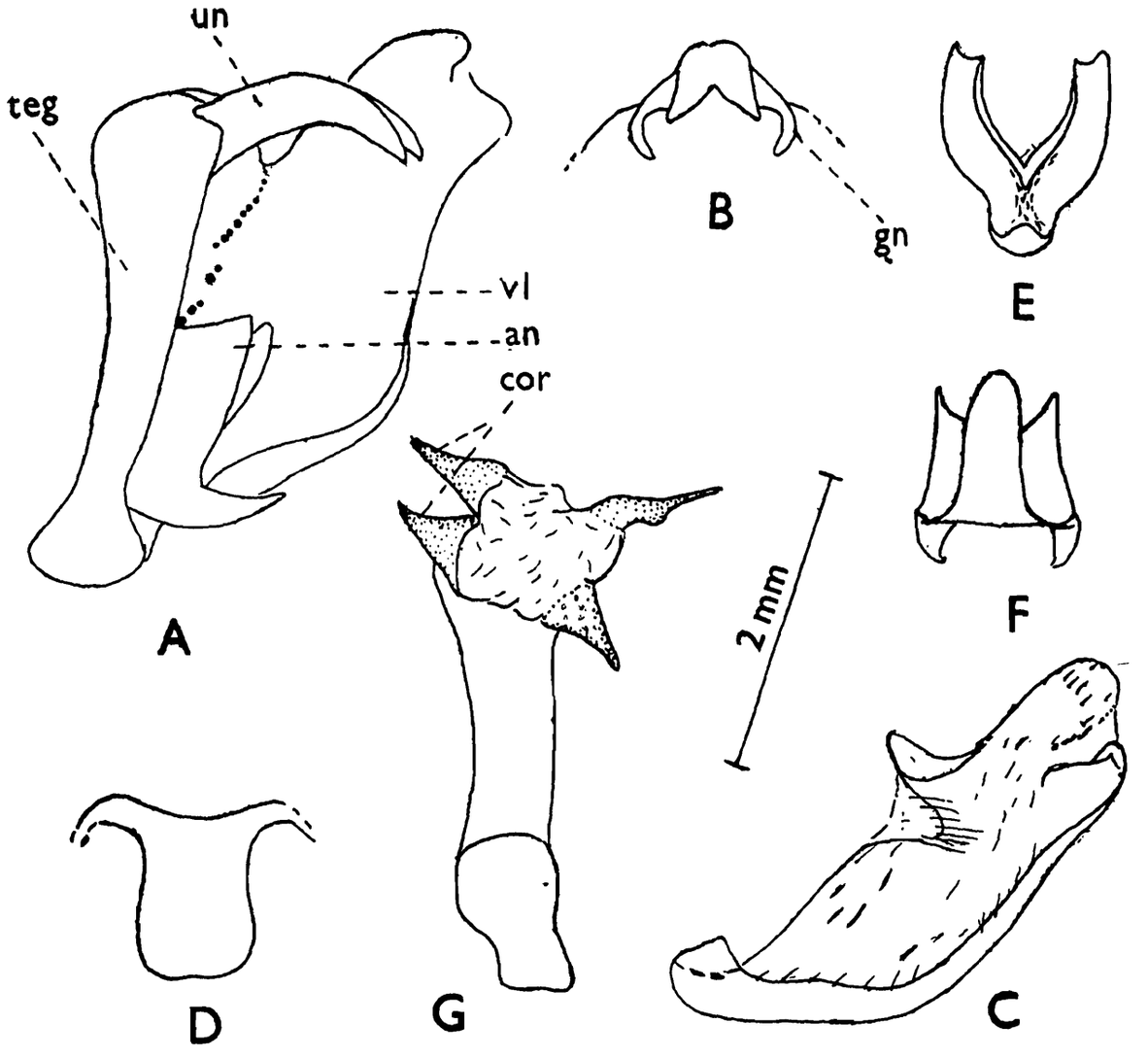
BANGLADESH : Dacca, 1 ♀ (no further data).

BURMA : Rangoon, 1 ♂,—.vii. 1887, 1♂,—.viii. 1887, 2 ♂♂, 3 ♀♀ (no further data), Pegu, 4 ♂♂ (*Allan* coll.).

INDONESIA : Java, 1♂, 1 ♀ (no further data).

Distribution.—INDIA (Sikkim, Assam, Meghalaya, West Bengal, Bihar, Tamil Nadu, Kerala, Andamans) ; BANGLADESH, BURMA ; SRI LANKA ; and INDONESIA.

Host plants.—*Anacardium occidentale* L. (Cashewnut) *Careya arborea* Roxb. (Kumbi), *Magnifera indica* L. (Mango), *Pyrus communis* L. (Pear), *Machilus odoratissima* Nees (Som tree), *Pyrus malus* L. (Apple), *Quercus* sp. (Oak), *Salix babylonica* L. (Weeping Willow), *S. elegans* (Willow) and *Schleichera oleosa* (Lour.) Oken.



Text-fig. 14. *Cricula trifenestrata* : A, lateral view of genitalia (without gnathal arms and left valva) ; B, distal part of uncus and free arms of gnathos ; C, inner view of right valva ; D, transtilla ; E, inner view of anellus ; F, ventral view of anellus ; G, aedeagus. (A-G of same mag.).

Remarks.—Schüssler (1936) recorded as many as seven subspecies, including nominate subspecies, under *Cricula trifenestrata* of which only two occur in India, i. e., *C. trifenestrata trifenestrata* and *C. trifenestrata andamanica* Jordan. *C. trifenestrata agria* Jordan (1909), described from Travancore, has been treated only as a form of *trifenestrata trifenestrata* (*vide* Schüssler, 1936).

It is closely allied to *C. andrei* in general appearance and wing venation, but differs in respect of outline of fore wings and the male genitalia, the details of which have been given in *C. andrei*.

Jordan (1909) differentiated *trifenestrata andamanica* from the nominate subspecies, by its larger size, the fuscous colour of the wings and in the absence of a black spot on the fore wings.

Ab. : A single female from Shillong is interesting in that its general colouration is smoky brown except for a small area around tornus, in both wings, which is ash-grey, the postmedial line on the fore wing does not reach the inner margin and is ash-grey in colour like that of the hind wing, and the medial line on hind wing is black. Underside : Thorax and legs brown ; wings greyish except at the upper part of submarginal area, the latter as on upper side.

Tribe ATTACINI

Key to the Genera of the Tribe ATTACINI

1. Frons flat ; labial palpi one-segmented. Fore wing with a slender reddish streak between veins R_4 and R_5 ; antemedial line not sending spurs along veins Cu_{1a} and Cu_{1b}. Mid and hind tibiae without terminal spurs. Anellus simple. Transtilla absent. ... ... *Attacus* Linn.
— Frons convex ; labial palpi three-segmented. Fore wing without reddish streak between veins R_4 and R_5 ; antemedial line sending whitish spurs at bases of veins Cu_{1a} and Cu_{1b}. Mid and hind tibiae with terminal spurs. Anellus well developed, produced posteriorly and channelled. Transtilla present 2
2. Fore wing with a short blackish patch between veins R_4 and R_5 ; discocellular spot large and triangular ... ... *Archaeoattacus* Watson
— Fore wing with a short ocellate spot between R_4 and R_5 ; discocellular spot narrow and lunate ... ... *Samia* Hübner

Genus **Attacus** Linnaeus

1767. *Phalaena Attacus* Linnaeus, *Syst. Nat.*, XII ed., **1** (2) : 808.
1820. *Attacus*, Hübner, *Verz. bek. Schmett* : 155.
1841. *Hyalophora* Duncan, In Jardine, *Natur. Libr.*, **7** : 124 (part).

Type-species.—*Phalaena Bombyx atlas* Linnaeus.

Frons flat, next to eyes ; laterofrontal sutures distinct. Antennae quadripectinate, except a few apical segments, in both sexes, ramii long and equal in male, slightly shorter and subequal in female, the apical segments bipectinate. Labial palpi single segmented. Fore wing highly falcate. Epiphysis of fore leg nearly as long as fore tibia ; mid and hind tibiae without spurs ; second to fourth tarsal segments broad, fourth tarsal segment bilobed and produced into a spine each, fifth tarsal segment highly enlarged and as long as second to fourth segments taken together in female ; tarsi with minute and highly sclerotised spines.

All the radials present ; vein R_1 free, arising from the cell before the radio-median ; cell open in both wings (Text-fig. 15, A-B).

In the male genitalia the uncus bifid, the gnathos and the transtilla absent. Anellus without lobes. Aedeagus short and broad, vesica without cornuti.

Distribution.—INDIA ; BANGLADESH ; BURMA ; S. ASIA ; SRI LANKA ; MALAYSIA ; PHILIPPINES ; INDONESIA ; AUSTRALIA ; and CHINA.

Remarks.—The genus *Attacus* like *Archaeoattacus*, includes one of the largest species of moths popularly known as the 'Indian Atlas Moth'. It is characterised by the flat frons, the

one-segmented labial palpi, a reddish streak in interspace of veins R_4 and R_5, and by the absence of mid and hind tibial spurs. It differs in the above characters from both the other genera viz., *Archaeoattacus* and *Samia*.

Only one species *Attacus atlas* (L.) known to occur in INDIA, producing wild silk 'Fagara', is described here.

15. **Attacus atlas** (Linnaeus)

(INDIAN ATLAS MOTH)

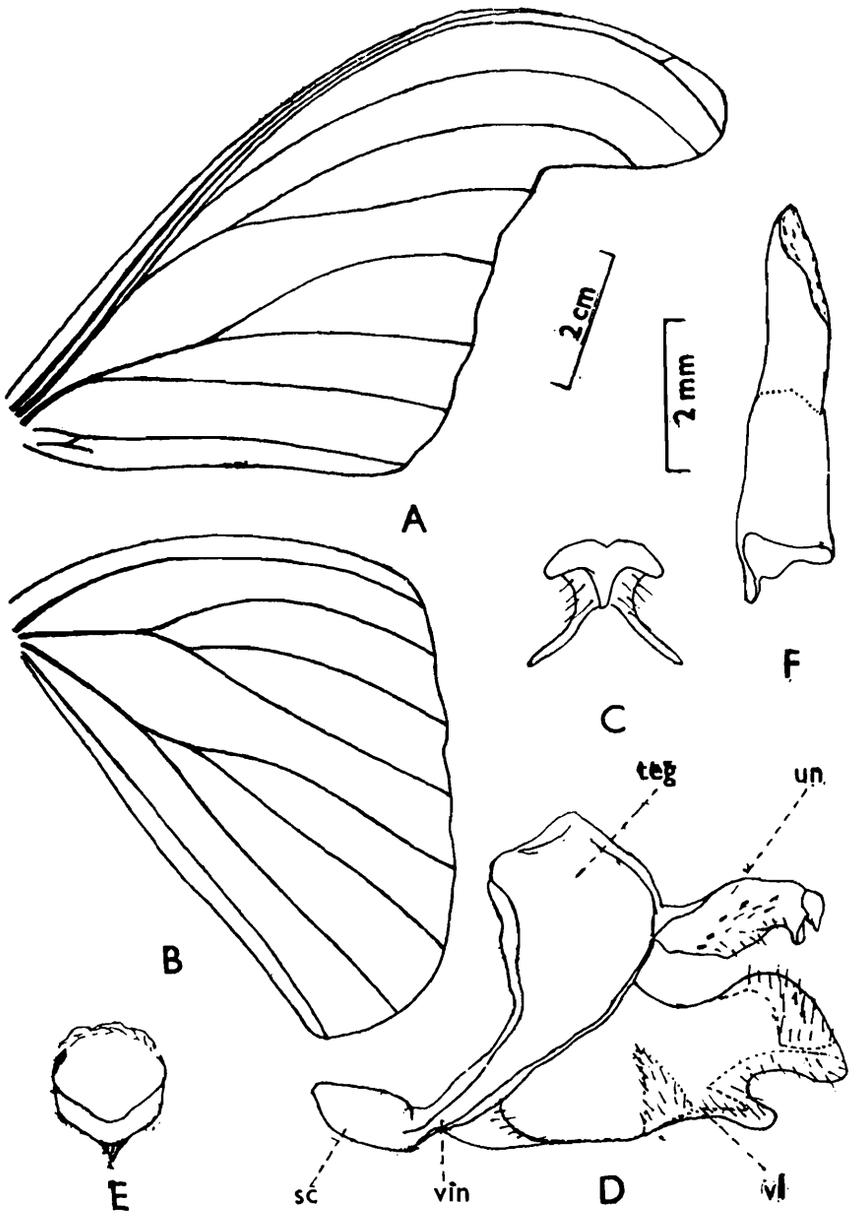
(Pl. X, nos. 39-40 ; Text-figs. 2, A-B ; 15, A-F)

1758. *Phalaena Bombyx atlas* Linnaeus, *Syst. Nat.*, Ed. X., **1** : 495 (*Type-locality.*—"Citro Afiae, Americae").
1767. *Phalaena Attacus atlas* Linnaeus, *Syst. Nat.*, Ed. XII, **1** (2) : 808 [Syn. *vide*, Westwood, 1842].
1775. *Bombyx atlas*, Fabricius, *Syst. Ent.*, **1** : 556, No. 1.
1820. *Attacus atlas*, Hübner, *Verz. bek. Schmett* : 156.
1837. *Saturnia silhetica*, Helfer, *J. Asiat. Soc. Beng.*, **6** : 41 (*Type-locality.*—Sylhet, Dacca).
1841. *Hyalophora atlas*, Duncan, In Jardine, *Natur. Libr.*, **7** : 124.
1842. *Saturnia atlas*, Westwood, (ed. Donovan) : *Nat. Hist. Ins. China* : 75, tab. 42 ♂ [*Phalaena Attacus atlas* as a synonym].
1855. *Aglia atlas*, Pokorny, *Naturgesch* : 127, No. 240.
1883. *Attacus taprobanis*, Moore, *Lepid. Cey.*, **2** : 124-125, pl. 127, fig 1 ♂, 1 a (*Type-locality.*—Colombo).
1887. *Attacus silhetica*, Cotes and Swinhoe, *Cat. Moths of India*, Calcutta : 225.
1933. *Attacus atlas*, Schüssler, *Lepid. Cat.*, **55** : 12-14.
1976. *Attacus atlas*, Nayar *et al. General and Applied Entomology* : 254.

Male.—Upperside : Frontal tuft red brown, paler below. Antennae pale brown. Thorax and abdomen red brown. Fore wing costa brown, basal area brown to red brown, edged by red, white and black lines, curved from below the costa to vein Cu_{1b}, then oblique to near the base of the inner margin ; medial area red brown from below the costa to inner margin edged by black, white and red postmedial line, the latter curved inwards from subcosta to vein Cu_{1b} and then obliquely outwards to inner margin ; a large triangular hyaline spot touching the postmedial line in both sexes, edged with black in the medial area at the end of the cell ; a hyaline streak between veins R_5 and M_1 may or may not be present ; area beyond postmedial line with fuscous shading, powdered with pale bluish and tawny scales, followed by tawny brown area up to submarginal band ; the submarginal band brown, marked with black, submarginal line wavy below vein R_4 to the first anal vein ; margin darker than the submarginal band ; apical area yellowish to pink ; the membrane below the costa wrinkled and suffused with blue-grey scales ending in a black spot which is edged outwardly with white ; a slender reddish streak between veins R_4 and R_5. Hind wing colouration same as the fore wing, antemedial line curved outwards above the triangular hyaline spot to meet the postmedial line ; black line on the submarginal band less wavy and shaded with yellow on inner as well as outerside in the internervural space. Legs brown. Abdomen with the first segment whitish, other segments with pale fringe. *Underside* : Fore wing with the antemedial line inconspicuous ; costal and inner area up to the postmedial line pale brown, the remaining area from near the base to the postmedial line fuscous brown or tinged with black ; postmedial area as on the upper side except that the fuscous shading inconspicuous, blue greyish scaling replaced by pinkish one and the costa up to the subapical area, paler. Hind wing also paler along costa up to basal three-fourths and at subbasal area ; inner area up to the postmedial band pale brown ; the area beyond it suffused with pink followed by yellowish brown and brown. Abdomen darker.

The female differs from male in the hyaline spots being larger and more rounded on the inner side.

Male Genitalia (Text-fig. 15, C-F).—Uncus 'X'-shaped, with the base as wide as apex, narrow in the middle, the latter about half its length, laterally beset with short setae. Tegumen short and broad. Vinculum almost like tegumen but narrow. Saccus conical. Valva about



Text-fig. 15. *Attacus atlas* : A, fore wing venation ; B, hind wing venation ; C, uncus ; D, lateral view of genitalia (without left valva and anellus) ; E, anellus ; F, aedeagus. (A and B of same mag. ; C-F of same mag.).

thrice as long as its width in the middle, lightly chitinised throughout except at the apex, the latter more membranous and beset with setae, the distal margin folded towards the inner side, dorsal and ventral margins at their bases narrowly produced and turned inwards, a short ventral lobe arises two-thirds from the base and beset with short setae. Anellus ring membranous on the dorsal side and chitinized into a V-shaped structure on the ventral side. Aedeagus short and broad, about five times longer than its width in the middle ; vesica without cornuti.

Wing expanse.—Males, 167-271 mm. ; females, 142-262 mm.

Material examined.—27 examples (20 ♂♂, 7 ♀♀). INDIA : Uttar Pradesh, Almora, 3 ♂♂, 1 ♀ (no further data) ; Sikkim, 1 ♀,—.—.1887 (*O. Moller* coll.), 1 ♂,—.—. 1888 (*Jordan* coll.), 1 ♂, 1 ♀,—.—. 1889 (*G. C. Dudgeon* coll.), 1 ♂ (no further data) ; Assam, Margherita, 1 ♂, 22. v. 1920 (no coll.), 1 ♂, 23. ix. 1971 (*G. S. Arora* coll.), 1 ♀ (no further data), Sibsagar, 3 ♂♂ (no further data) ; Bihar, Gobindpur, 3 ♂♂, 1 ♀ (no further data), Pusa, 1 ♂, 1 ♀ (no further data).

BANGLADESH : Sylhet, 2 ♂♂, 28. ii. 1880 (no coll.).

BURMA : 1 ♂ (no further data) ; Rangoon, 1 ♂, 1 ♀,—.vi. 1887 (no coll.) ; Moulmein, 1 ♂, 12. ii.—(emerged) (no coll.).

Distribution.—INDIA (Uttar Pradesh, Sikkim, Assam, West Bengal, Bihar, Gujarat, Maharashtra, Karnataka, Tamil Nadu and Andamans) ; BANGLADESH (Sylhet) ; BURMA ; SOUTH ASIA ; SINGAPORE ; SRI LANKA ; and INDONESIA (Sumatra, Borneo, Java).

Host plants.—*Ardisia* sp., *Berberis* sp. (Barberry), *Bradleia ovata*, *Carpinus betulus* L. (Hornbeam), *Clerodendrum infortunatum* L. (Ghantuphul, Bhant), *Dillenia pentagyna* Roxb., *Falconesia insignis*, *Lagerstroemia indica* L. (Daiyeti, Telinga-China), *Nalbeli* sp., *Nauclea rotundifolia*, *Ocimum* sp. (Tulsi), *Phyllanthus embelica* L. (Amla, Amlaki), *Pyrus malus* L. (Apple), *Salix babylonica* L. (Weeping Willow), *S. elegans* Wall. (Willow), *Sarcostemma brevistigma* (Soom tree), *Schleichera oleosa* (Lour.) Oken, *Teucrium macrostachyum* W. & A. (Soom) and *Vangueria spinosa*.

Remarks.—*Attacus atlas* (L.) has the largest wing-area among the hitherto known Lepidoptera. For other remarks see under the genus *Attacus*.

Genus **Archaeoattacus** Watson

1914. *Archaeoattacus* Watson, In Packard, *Mem. nat. Acad. Sci.*, **12** (1) : 265.

Type-species.—*Attacus edwardsii* White.

Frons highly convex, next to eyes ; laterofrontal sutures not visible. Antennae quadripectinate up to a few apical segments. Labial palpi three-segmented, terminal joint shortest and slightly inverted. Apex of fore wing falcate. Epiphysis of fore leg reaching two-thirds apically along fore tibia ; mid and hind tibiae each with a pair of short terminal spurs, the latter sclerotised at the tips ; mid tibial spurs shorter and about half as long as hind tibial spurs. Tarsi with minute spines.

Fore wing with all the radials present ; vein R_1 free from cell and before the origin of radio-median (Text-fig. 16, A-B).

Male genitalia with the uncus strongly bifid. Gnathos present, gnathal arms free. Transtilla present. Anellus well developed, produced posteriorly and channelled. Aedeagus with the vesica without cornuti.

Distribution.—INDIA ; NEPAL ; BHUTAN ; and INDONESIA.

Remarks.—Watson (1910) erected the subgenus *Archaeoattacus* to include *edwardsi* and *staudingeri* and differentiated it from *Attacus* in the antennae in female being less deeply pectinated and on the basis of the distance being twice between veins Sc and R_1 than between veins R_2 and R_3, unlike in *Attacus* where these are equidistant. The present studies, however, show that the above mentioned veins are equidistant, in both the genera, so that it is not possible to separate the two genera on these characters. Since the genus

Archaeoattacus resembles *Attacus* in appearance, the species *edwardsii* had been mostly treated under the genus *Attacus* instead of *Archaeoattacus*. The genus *Archaeoattacus*, however, can easily be differentiated in colouration as well as on the basis of morphological characters such as highly convex frons (*vs.* flat frons) ; three-segmented labial palpi (*vs.* single segmented) ; in the presence of mid and hind tibial spurs (*vs.* mid and hind tibial spurs absent) ; and by the male genitalia, particularly the anellus being channelled (*vs.* anellus simple) and in the presence of transtilla (*vs.* transtilla absent).

Watson (*loc. cit.*) considered the genus *Archaeoattacus* as closely allied to '*Philosamia*' without referring to similarities except those of larvae. However, the present studies show that the two genera are close to each other in the frons being convex ; three segmented labial palpi ; antemedial lines in wings sending whitish spurs along veins Cu_{1a} and Cu_{1b} ; and in the presence of tibial spurs but are separable on the basis of presence, in fore wing, of a large, triangular hyaline spot in *Archaeoattacus* (*vs.* lunate hyaline spot in *Samia*).

Schüssler (1933) recorded only two species under the genus *Archaeoattacus*, one of which *A. edwardsii* (White), occurs in INDIA.

16. **Archaeoattacus edwardsii** (White)

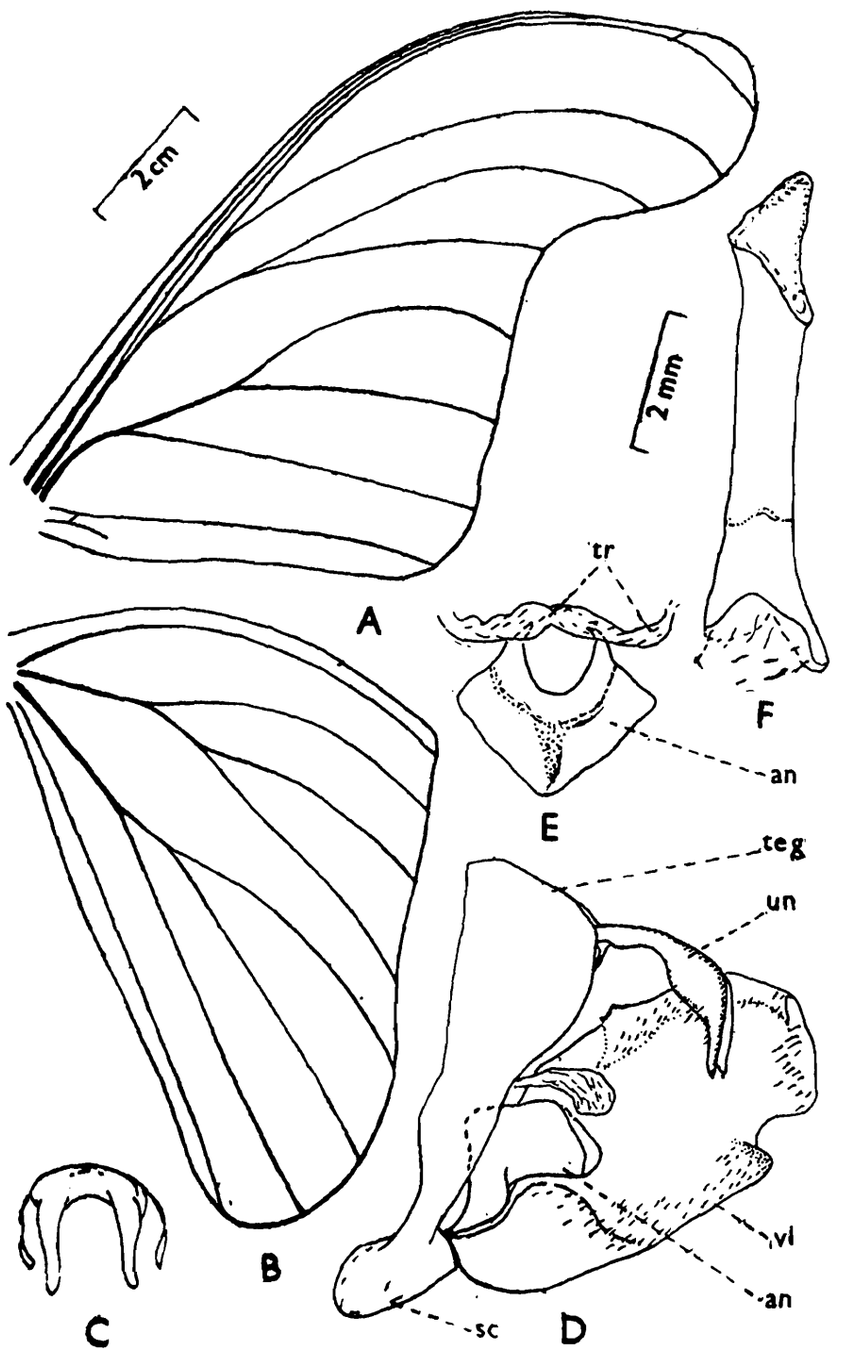
(EDWARD'S SILKMOTH)

(Pl. X, nos. 41-42 ; Text-figs. 2, C-D ; 16, A—F)

1859. *Attacus edwardsii* White, *Proc. zool. Soc. Lond.*, **27** : 115 pl. 57 (*Type-locality.*—Darjeeling).
1914. *Archaeoattacus edwardsi*, Watson, In Packard, *Mem. nat. Acad. Sci.*, **12** (1) : 265.
1933. *Archaeoattacus edwardsii*, Schüssler, *Lepid. Cat.*, **75** : 21-22.
1976. *Attacus edwardsi*, Nayar *et al.*, *General and Applied. Entomology* : 254.
1977. *Attacus edwardsi*, Richards & Davies, *Imm's General Text book of Entomology* : 1138.

Male.—Upperside : Vertex brown, mixed with white scales which run into a line along curvature of the eyes. Frontal tuft pale brown. Antennae pale brown, with their bases white. Labial palpi dark brown. Thorax dark brown, mixed with white on the sides. Fore wing with the antemedial area dark brown, edged with white antemedial band, the latter runs from the subcosta to a little before the base of vein Cu_{1a} then obliquely to the inner margin ; two short whitish streaks from beyond the antemedial band, one reaching the base of vein Cu_{1a} and another running half the way along Cu_{1b} between the antemedial and postmedial bands ; the medial area fuscous brown except at the inner area, the latter reddish brown, the medial area with a large triangular hyaline spot edged with yellow brown, not touching the postmedial line ; the postmedial band white, incurved from costa to inner margin except between veins R_5 and M_1 where it may be excurved ; the area beyond postmedial band from below R_5 to inner margin dark brown, irrorated with grey scales particularly in the middle part ; the area above the vein R_5 from beyond the postmedial band to the apex yellowish brown, with a black rounded apical spot and another elongated blackish patch between vein R_{2+3} and R_4 present and connected to each other by a whitish wavy submarginal line, the latter black, starting from a small black patch between veins R_5 and M_1 and running up to vein 1A, edged with yellowish brown on inner side ; submarginal area beyond the spots more yellowish, followed by grey brown margin. Hind wing colouration usually as in fore wing, subbasal band white and continuous with the antemedial band of fore wing on one hand, and base of abdomen on the other ; antemedial line whitish and oblique from costa to inner margin, curved outwards and

meeting the postmedial band, the latter whitish and wavy from below the triangular patch to the inner margin ; area beyond the postmedial band as in fore wing ; submarginal line dark brown, nearly straight from costa to inner margin, edged with large notched spots, the latter outlined with yellowish brown. Abdomen white at base and extremity, with white segmental streaks on each side of the mid-dorsal line. *Underside* as upper except the antemedial line being absent in both the fore and hind wings ; inner margin of fore wing greyish brown ; in hind wing the costa pale yellow up to submarginal area, inner margin pale yellowish up to basal one-third.



Text-fig. 16. *Archaeoattacus edwardsii* : A, fore wing venation ; B, hind wing venation ; C, distal part of uncus and rudimentary gnathal arms ; D, lateral view of genitalia (without left valva) ; F, anellus and transtilla ; F, aedeagus. (A and B of same mag. ; C-F of same mag.).

Male Genitalia (Text-fig. 16, C-F).—Uncus strongly chitinised throughout except in the subbasal area, bifid beyond middle, with both the ends curved downwards almost at right

angle ; ventral margin beset with setae. Tegumen long and narrow. Vinculum short. Saccus broad and conical. Gnathal arms, narrow and curved inwards. Valva very short and broad, almost twice as long as its width in the middle, ventral margin deeply incised near its dorsal one-fourth and folded in the basal one-fourth. Transtilla well developed though narrow. Anellus chitinised except dorsally, where it is membranous, channelled and produced posteriorly ; antero-ventrally produced into a nearly pentagonal plate. Aedeagus short and broad, about seven times as long as its width in the middle, strongly chitinised, apex produced narrowly on one side, vesica without cornuti.

Wing expanse.—Males, 204-244 mm. ; female, 224 mm.

Material examined.—7 examples (6♂ ♂, 1♀). INDIA : Sikkim, 1♂ (*O. Möller* coll.), 2♂ ♂, 1♀ (no date of colln.) (*G. C. Dudgeon* coll.) ; Meghalaya, N. Khasia Hills, 1♂, (no coll.).

BHUTAN : 1♂, 5. i. 1874, 1♂,—vi. 1893 (*G. C. Dudgeon* coll.).

Distribution.—INDIA (West Bengal, Sikkim, Assam, Meghalaya) ; NEPAL ; and BHUTAN.

Host plants.—*Ailanthus glandulosa*, *Machilus odoratissma* Nees (Laurel, Sum tree) and *Prunus domestica* L. (Pear).

Remarks.—See under the genus.

Genus **Samia** Hübner

1820. *Samia* Hübner, *Verz. bek. Schmett.* : 156.
1874. *Philosamia* Grote, *Proc. Amer. Phil. Soc.*, **14** : 258.
1914. *Desgodinisia* Oberthür, *Étud. Lepid. Comp.*, **9** (2) : 56, pl. 256, fig. 2159.
1972. *Samia*, Ferguson, *The Moths of America North of Mexico*, Fasc. **20** (2B) : 212—214.

Type-species.—*Phalaena cynthia* Drury (Designated by Grote, 1865).

Frons convex throughout, next to eyes ; laterofrontal suture not distinct. Antennae quadripectinate except a few apical segments, the latter bipectinate in both the sexes ; ramii long, equal and curved in male but slightly shorter in female ; basal ramii with a few terminal bristles. Labial palpi three-segmented, the terminal joint shortest. Proboscis more or less 3 mm. long, the galeae fringed with slender, long and sclerotised setae in male, whereas annulated with margins serrated, unequal and fringed with very short hairs in female. Fore wing with the apex slightly falcate. Epiphysis of fore leg shorter than the length of the fore tibia ; mid and hind tibiae each with a pair of short terminal spurs ; only fourth tarsal segment of fore leg in female much broadened, bilobed and with a spine each.

Fore wing with all the radials present, vein R_1 arising free from the cell and before the origin of radio-median (Text-fig. 17, A—B).

Male genitalia with the uncus bifid. Gnathos rudimentary. Transtilla present. Anellus well developed, produced posteriorly and channelled. Aedeagus with the vesica bearing cornuti.

Distribution.—INDIA ; BANGLADESH ; BURMA ; SRI LANKA ; MALAYSIA ; PHILIPPINES ; EAST INDIES ; INDONESIA ; CHINA ; JAPAN ; and introduced to EUROPE ; AFRICA ; and U. S. A.

Remarks.—There had been a lot of confusion regarding taxonomic status of the genus *Samia* (*Sens. lat.*) especially regarding its nomenclature. Packard (1914) treated *Samia* Hübner and *Philosamia* Grote separately, whereas Seitz (1926) considered *Samia* as valid and treated

Philosamia and *Drepanoptera* Rothschild as its counterparts representing Indian and African fauna of the same, respectively. Subsequently, Draudt (1927) referred to *Drepanoptera* as a subgenus of *Epiphora* but Schüssler (1933) treated it as an independent genus, who as well revalidated both *Samia* and *Philosamia* as separate genera, representing African, American and Oriental fauna, respectively. Michener (1952) set at rest the controversy and regarded the genus *Philosamia* as a synonym and stated "this is an Oriental genus represented in the Eastern United States by a single introduced species". Ferguson (1972) followed Michener (*loc. cit.*) and was also of the view that "*Samia* is indigenous to the Oriental Region, but the type species was introduced into United States where it has not been naturalized for over 100 years". The genus includes but a single species *cynthia* Drury with several subspecies, including '*ricini*' which, however, is a domesticated race.

The genus *Samia* belongs to Old World group which includes Asiatic genera *Attacus*, *Archaeoattacus* and an African genus *Drepanoptera*. The genus *Samia* is rather closely allied to *Archaeoattacus* than *Attacus* in respect of characters of frons, labial palpi and tibial spurs but can be distinguished by olive-green colouration, long lunate discal spots and by the abdominal markings.

17. **Samia cynthia** (Drury)

(Eri Silkmoth or Ailanthus Silkmoth)

(Plate XI, nos. 43-46 ; Text-figs. 2, E-G ; 17, A-F)

1773. *Phalaena Attacus cynthia* Drury, *Illust. Nat. Hist. Exot. Ins.*, **2** : 10, pl. 6, fig. 2♂, App. II (*Type-locality.*—China).

1790. *Bombyx cynthia*, Olivier, *Encyclop. Meth. Hist. Nat. Ins.*, **5** : 30, No. 26.

1820. *Samia cynthia*, Hübner, *Verz. bek. Schmett.* : 156.

1837. *Saturnia cynthia*, Westwood, ed. Drury, *Illust. exot. Ent.*, **2** : 12, pl. 6, fig. 2.

1837. *Phalaena cynthia*, Helfer, *J. Asiat. Soc. Beng.*, **6** : 45, pl. 5.

1854. *Saturnia ricini* Boisduval, *Annls. Soc. Ent. Fr.*, (3) **2** : 755.

1855 *Attacus cynthia*, Walker, *Cat. Lep. Het. Brit. Mus.*, **5** : 1220-1221 (*Locality.*—N. China).

1858. *Bombyx guerini*, Moore, *Cat. Lep. E. I. House*, **2** : 409.

1859. *Attacus ricini*, Moore, *Proc. zool. Soc. Lond.* : 267.

1860. *Attacus canningi* Hutton, *J. Agric. Soc. India*, **10**.

1874. *Philosamia cynthia*, Grote, *Proc. Amer. Phil. Soc.*, **14** : 258.

1879. *Attacus obscurus* Butler, *Trans. ent. Soc. Lond.* : 5 (*Type-locality.*—Cachar).

1887. *Attacus vesta*, Cotes and Swinhoe, *Cat. Moths of India* : 225, No. 1544.

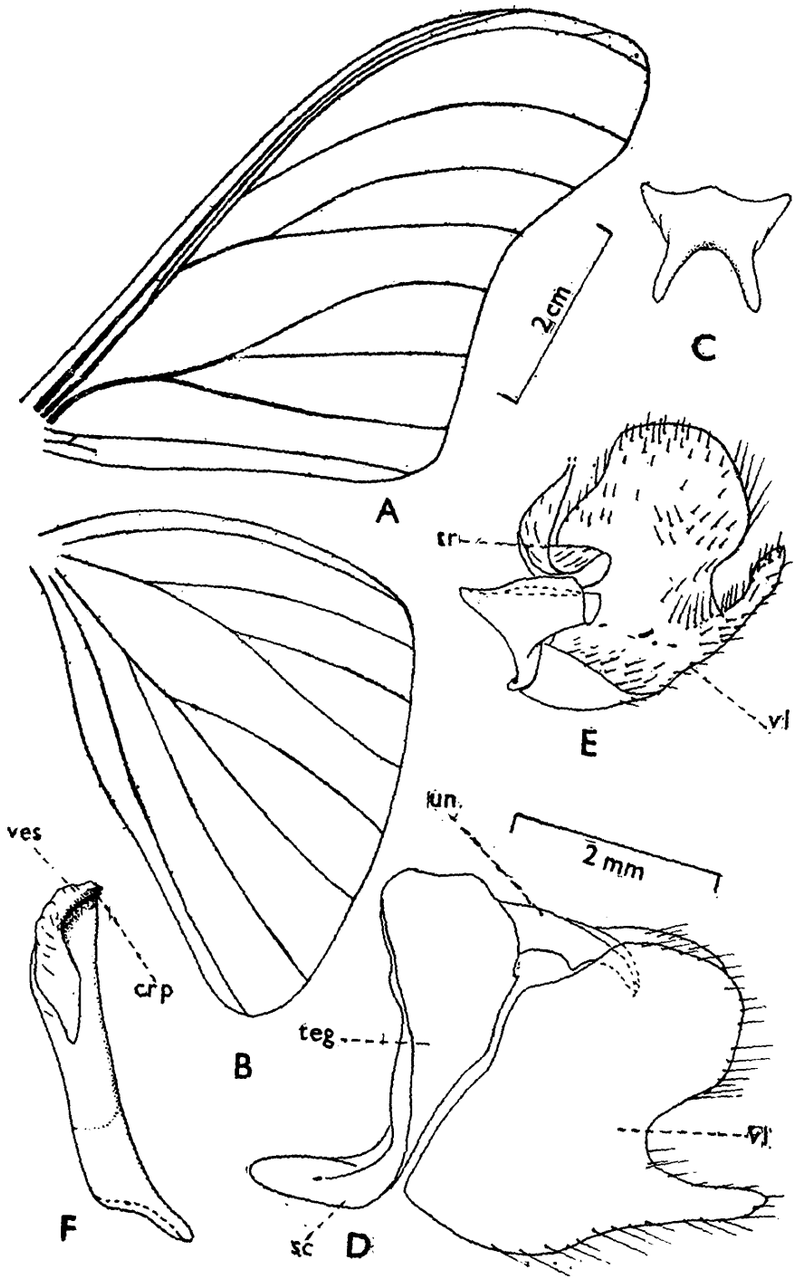
1887. *Philosamia ricini*, Wardle, *Royal Jubilee Exhibition* : 23.

1933. *Philosamia cynthia*, Schüssler, *Lepid. Cat.*, **55** : 24-41.

1972. *Samia cynthia*, Ferguson, *The Moths of America North of Mexico*, Fasc **20** (2B) : 215-218, pl. 16. fig. 8, ♀

Male.—Upperside : Frontal tuft pale brown. Antennal pale brown, with their bases paler. Labial palpi pale brown, with the tip and underside mixed with whitish scales. Collar with a white fringe of whitish scales. Thorax pale brown. Fore wing yellowish brown ; antemedial line directed outwards from costa to vein Cu_{1a} then inwards and terminating at inner margin, outlined by black prominently on the outer side, sending short and white spurs along veins Cu_{1a} and Cu_{1b}, sometimes touching the postmedial line ; hyaline lunule obliquely placed, suffused with yellow below and lined by dark brown above, the latter joining the antemedial and postmedial lines ; postmedial line dark brown, angulated outwardly at the lunule, edged with white, pink,

and the white suffused with pink , area beyond the postmedial line, except subapical and tornus, irrorated with fuscous ; submarginal area pale brown, outlined by a brown line from below the apex to vein 2A and angled inwards between veins R_5 and M_1 ; margin grey brown ;



Text-fig. 17. *Samia cynthia* : A, fore wing venation ; B, hind wing venation ; C, uncus ; D, lateral view of genitalia ; E, lateral view of anellus, transtilla, and inner view of right valva ; F, aedeagus. (A and B of same mag. ; C-F of same mag.).

subapical area suffused with pink, outlined by a short and wavy white line terminating at the blackish spot near the outer margin, the white line forming a lunule on the inner side ; the black spot with some yellow scales below the lunule. Hind wing differs from fore wing in having antemedial line inwardly curved from below subcosta to inner margin, and joined to the

postmedial line at subcosta ; the lunule shorter than in fore wing ; submarginal line double and brown. Abdomen pale brown, with first and the last segment whitish ; a dorsal white line from base to the tip, with sublateral and lateral tufts of white scales. *Underside* same as the upperside except that the antemedial line absent, costa of hind wing pale yellow and the ground colour of both the wings generally paler. Legs yellowish brown, fringed with white on the sides. Abdomen paler, with two lateral, two sublateral and two ventral white lines.

Male Genitalia (Text-fig. 17, C-F).—Uncus as long as its width at base, distal half with diverging lobes. Tegumen broad dorsally and dorsolaterally but narrowing on sides. Vinculum 'U' shaped, short and narrow. Saccus as long as its width at base and the tip rounded. Gnathos rudimentary. Valva simple, about twice as long as its width at the middle, mid-ventral margin produced into a well developed process. Transtilla uniformly broad throughout except in the middle, which is broad and slanting upwards. Anellus channelled, membranous dorsally, otherwise chitinised ; antero-ventrally produced into a broadly pentagonal plate. Aedeagus about four to five times as long as its width in the middle ; vesica carrying a single prominent carinal process with its margins serrated.

Wing expanse.—Males, 88-141 mm ; females, 88-168 mm.

Material examined.—66 examples (42 ♂♂, 24 ♀♀). INDIA : Himachal Pradesh, Kangra valley, 1372 m., 3♂♂, 3♀♀,—. viii. 1899 (*G. C. Dudgeon* coll.) ; Uttar Pradesh, 1♀ (no further data) ; Sikkim, 2♂♂, 5♀♀ (no further data), 1♂, 1♀ (no date of colln.) (*O. Moller* coll.), 1♂, —.—. 1887 (*G. C. Dudgeon* coll.) ; Arunachal Pradesh, Lohit, Roing, 300 m., 1♂, 8. iii. 1969, Tezu, 150m., 1♂, 10. iii. 1969 (*S. K. Tandon* coll.) ; Assam, Silchar (Cachar), 3♂♂, 4♀♀ (no date of colln.) (*Long* coll.), 3♂♂ (no further data), Sibsagar, 1♂, 2♀♀ (no further data), Jorhat, 1♂, 1♀ (no date of colln.) (*E. Fraushton* coll.) ; Meghalaya, 1♀ (no further data), Shillong, 1♂ (no further data), Risa Colony, 1♀, 19. vii. 1963 (*S. N. Prasad* coll.) ; West Bengal, 1♂ (no further data), Darjeeling, 11 ♂♂,—.ii. 1904, reared from cocoons, 1♂, 21. i. 1894 (all *F. Moller* coll.), 1♂, 1♀ (no date of colln.) (*Long* coll.), 2♂♂, 17. i. 1894 (no coll.), Kurseong, 1♀ (no further data), Dinajpur, 2♂♂, 1♀ (no further data) ; Bihar, Hazaribagh, 2♂♂, 1♀ (no further data), Buxur, 1♂, 27. ix. 1883 (*Mus.* colln.) ; South Andamans, 1 ♀ (no further data).

BURMA : 3♂♂, (no further data).

Distribution.—INDIA (Himachal Pradesh, Uttar Pradesh, Sikkim, Arunachal Pradesh, Assam, Meghalaya, West Bengal, Bihar and South Andamans) ; BANGLADESH ; BURMA ; SRI LANKA ; INDONESIA (Java) ; and CHINA.

Host plants.—*Ailanthus excelsa, A. glandulosa, Ailanthus* sp., (Barkeseru), *Althaea rosea* Cav. (Hollyhock), *Apium graveolans* L. (Celery), *Azadiracht indica A.* Juss. (Persian lilac), *Berberis* sp. (Barberry), *Carica papaya* L. (Papaya, Papeeta), *Carpinus betulus* L. (Hornbeam), *Cassia fistula* L. (Laburnum, Amaltas girimalah), *Coriaria nepalensis* Wall. (Masuri, Makola), *Evodia flaxinifolia* Hock. f. (Poyam), *Gmelina arborea* L. (Gomari), *Heteropanax fragrans* Seem. (Keseru), *Jatropha curcas* L. (Gulancha), *Juglans regia* L. (Walnut), *Lawsonia alba* Lamk. (Indian Privet), *Ligustrum robustum* Blume (Privet), *Manihot utilissima* Pohl. (Cassava), *Plumeria acuminata* Ait. (Champa), *Prunus avium* L. (Cherry), *P domestica* L. (Plum), *Pyrus malus* L. (Apple), *Ricinus communis* L. (Arund, Castor, Palma christi), *Xanthophyllum hostile, Zanthoxylem acanthopodium, Z. alatium* and *Zyziphus jujuba* (Bogri, Ber).

Remarks.—*Samia cynthia* (Drury), one of the most economically important non-mulberry silkmoths, popularly called "Ailanthus or Eri Silkmoth", is widely distributed and represented by several subspecies, of which *ricini* (Boisduval) is a domesticated race. These two, i. e., *cynthia* and *ricini*, were treated as separate species by Hampson (1892) who differentiated *ricini* from *cynthia* on the basis of "abdomen having segmental bands of white hairs above instead of tufts ; the colour usually darker. Forewing with the antemedial line more angled and generally joining the postmedial band ; the lunule much shorter ; the postmedial band of both wings with fuscous replacing the pink." Seitz (1928), however, treated *ricini* as a form of *cynthia* on the same basis as considered by Hampson (*loc. cit.*).

While Draudt (1929) merely referred to the presence of non-functional proboscis in *Samia*, Taylor (1957) reported an interesting observation that the proboscis in *Samia* both in male as well as female, is functional as in "Papilionids, Pierids and Lycaenids" and referred to sexual dimorphism, *i. e.*, in male the galae are fringed with 'long stout spines' unlike in female where these are annulated and filiform and the edges are slightly serrated.

V. SUMMARY

'Wild Silkmoths' belonging to the family Saturniidae are among the most economically important species of Lepidoptera, and are represented in INDIA by two subfamilies, *viz.*, Saturniinae and Salassinae. *Antheraea paphia* (L.), *A. assamensis* (Helfer) and *Samia cynthia* (Drury) of Saturniinae produce tasar, muga and eri silk, respectively. INDIA ranks second in the world as far as the total yield of tasar is concerned, but holds first place as a producer of muga and eri silk.

The present study deals with 17 species distributed over 10 genera of Saturniinae : *Sonthonnaxia* (1 sp.), *Actias* (1 sp.), *Proactias* gen. nov. (1 sp.), *Rhodinia* (1 sp.), *Antheraea* (7 spp.), *Loepa* (1 sp.), *Cricula* (2 spp.), *Attacus* (1 sp.), *Archaeoattacus* (1 sp.) and *Samia* (1 sp.).

The study was undertaken to clarify identity of various silkmoth species, including other allied species, on the basis of morphological characters such as structure of antennae in both sexes, the shape of the frons, the shape and markings of the wings and their venation, the structure of tibial spurs, tarsal spines, and male genitalia. The geographical distribution and host-plants of the species have been given. Keys to genera and species have also been included. Relationships among various genera as well as species have been discussed.

As a result of the present studies, a few changes have been brought about, i.e., *Proactias* gen. nov. is proposed for *Actias sinensis* (Walker) (or *Sonthonnaxia sinensis* (Walker), *vide* Schüssler, 1936) ; *Rhodinia newara nissori* described by Watson (1913) from Assamese material, is within the variational limits of the nominate subspecies viz. *Rhodinia newara newara* Moore, and hence considered synonymous to the latter ; *Samia ricini* (Boisduval), *Antheraea mylitta* (Drury) and *A. cingalesa* Moore, treated hitherto in the literature as either species or subspecies, are considered here as synonyms of *Samia cynthia* (Drury) and *Antheraea paphia* (L.), respectively.

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VIII. INDEX

The following is an index to the names of subspecies, species, genera, tribes and subfamilies of the family Saturniidae. The valid names of the subspecies, species and genera have been indicated in bold letters and the synonyms in italics.

Abbreviations used

A., Anal vein
Ab., Aberration
ae., aedeagus
an., anellus
anl., anellus lobes
coll., collector
colln., collection
cor., cornuti cornutus
crp., carinal process
Cu., Cubital vein
ex., example
fig., figure
gn., gnathos
lb., labide
M_1-M_3, Median veins
mag., magnification
N. Z. C., National Zoological Collection
R_1 to R_5, Radial veins
R_s, Radial sector
sc., saccus
teg., tegumen
tr., transtilla
un., uncus
ves., vesica
vin., vinculum
vl., valva
Z. S. I., Zoological Survey of India

ERRATA

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3	B 6	Text-fig. 1, H	Text-fig. 1, N
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20	B 2	*Phalaena mylitta* Drury (designation by Kirby, 1892)	*Phalaena Bombyx paphia* Linn.
25	B 22	Imm's	Imms'
47	B 21		
42	T 4	*Magnifera*	*Mangifera*
47	T 8	Watson (*Loc. cit.*)	Watson (1914)

T=from Top
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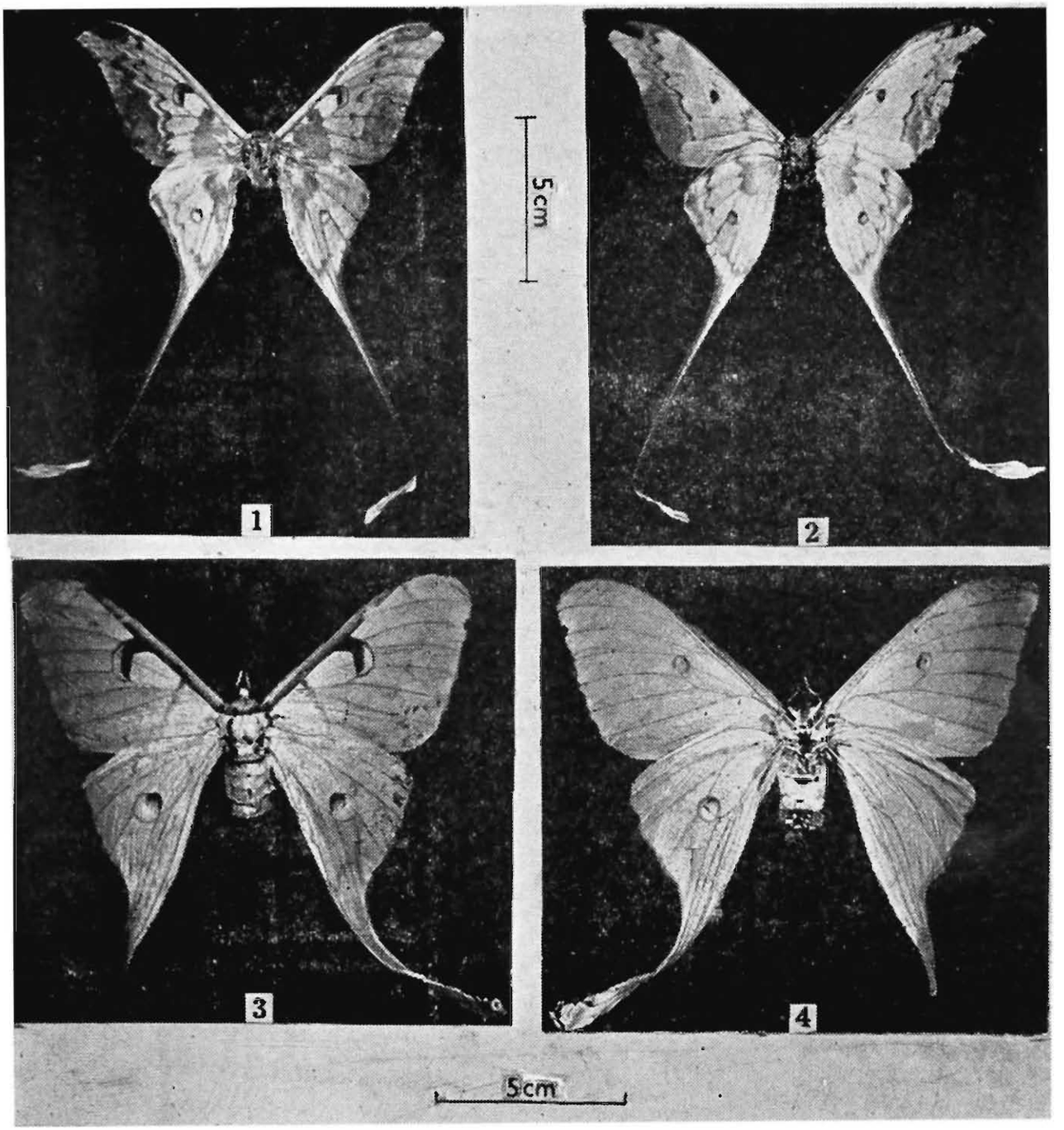
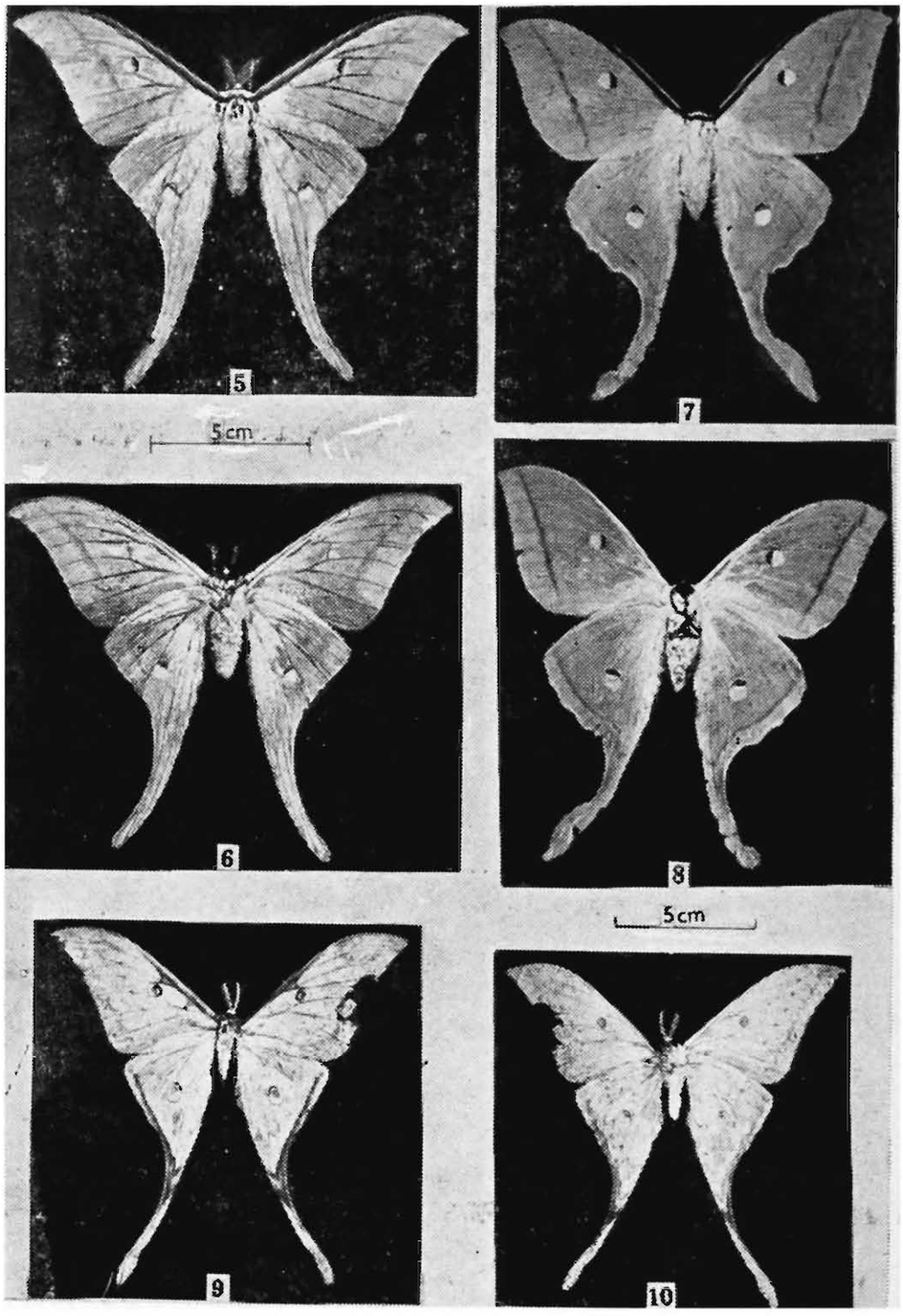
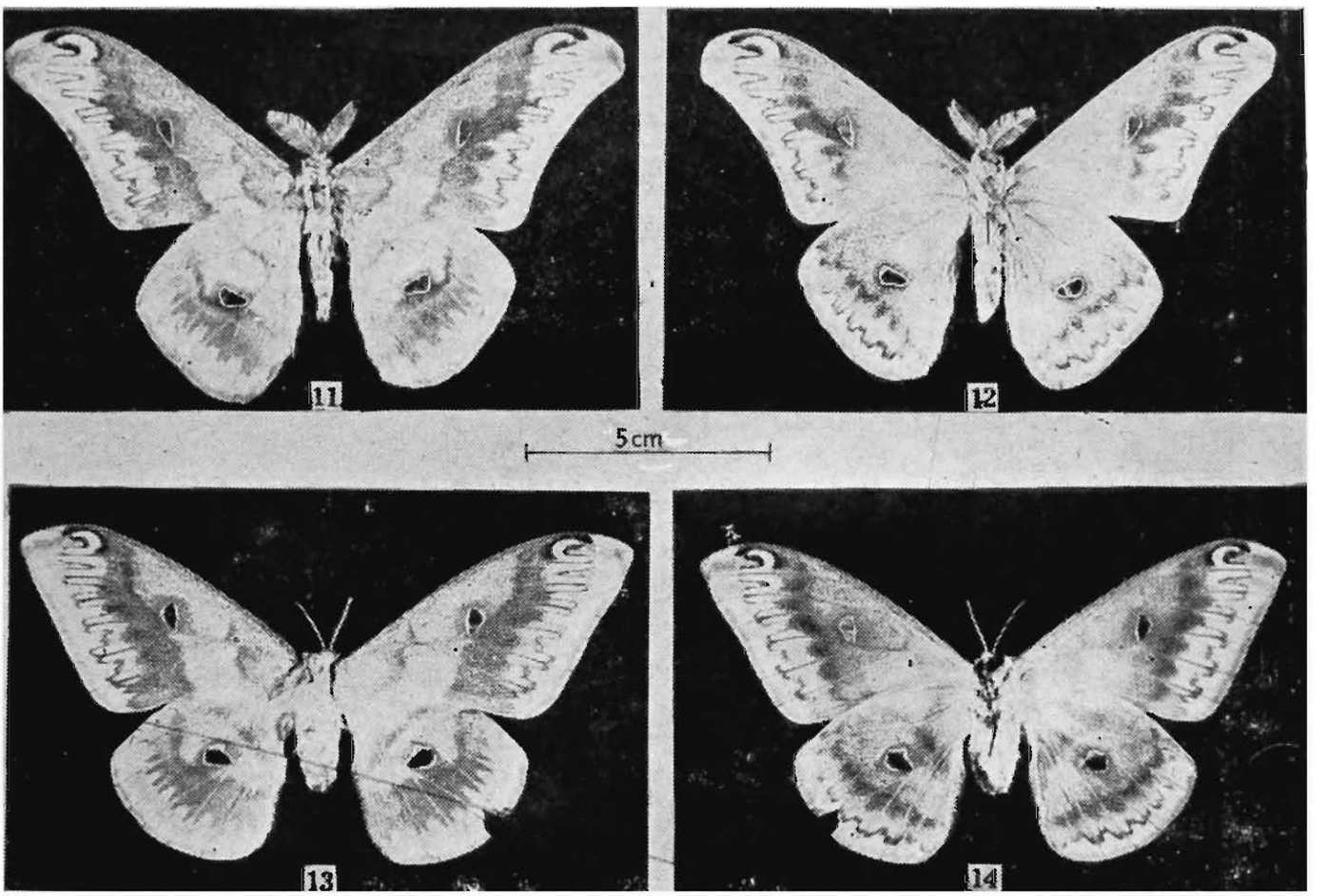


1. Upperside. 2. Underside of *Sonthonnaxia maenas* (Doubleday), ♂, Sikkim.
3. Upperside. 4. Underside of *Sonthonnaxia maenas* (Doubleday) ♀, Sikkim, 3. iii. 1888 *(O. Miller* coll.).

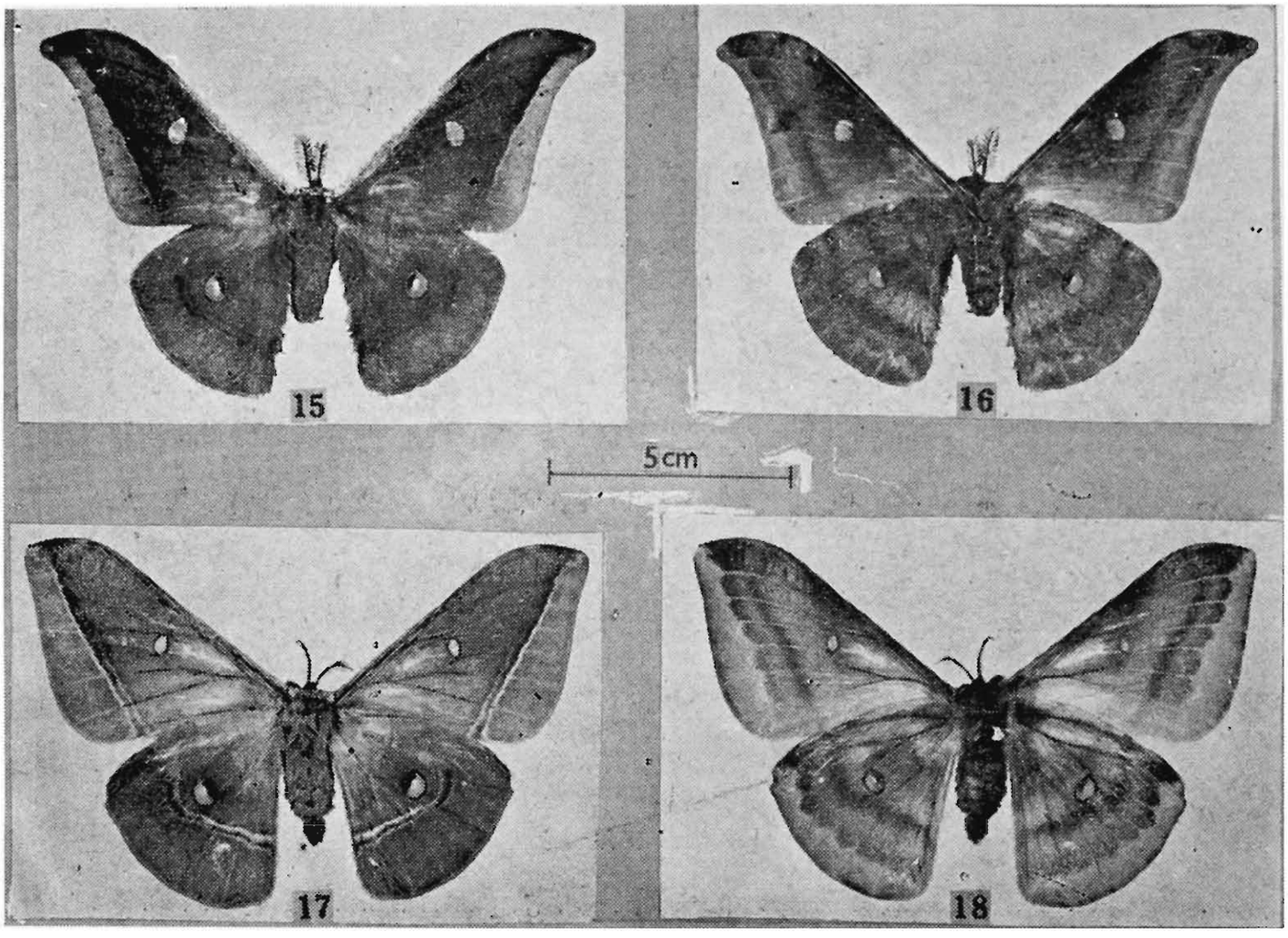


5. Upperside. 6. Underside of *Actias selene* (Hübner), ♂ Shillong, Risa colony, 29. vii. 1963 (*S.N.P.* coll.).
7. Upperside. 8. Underside of *Actias selene* (Hübner), ♀, Shillong, 23. viii. 1976 (*M.S. Jyrwa* coll.).
9. Upperside. 10. Underside of *Proactias sinensis* (Walker), ♂, Lohit district, Roing, 300 m, 7. iii. 1969 (*S. K. Tandon* coll.).



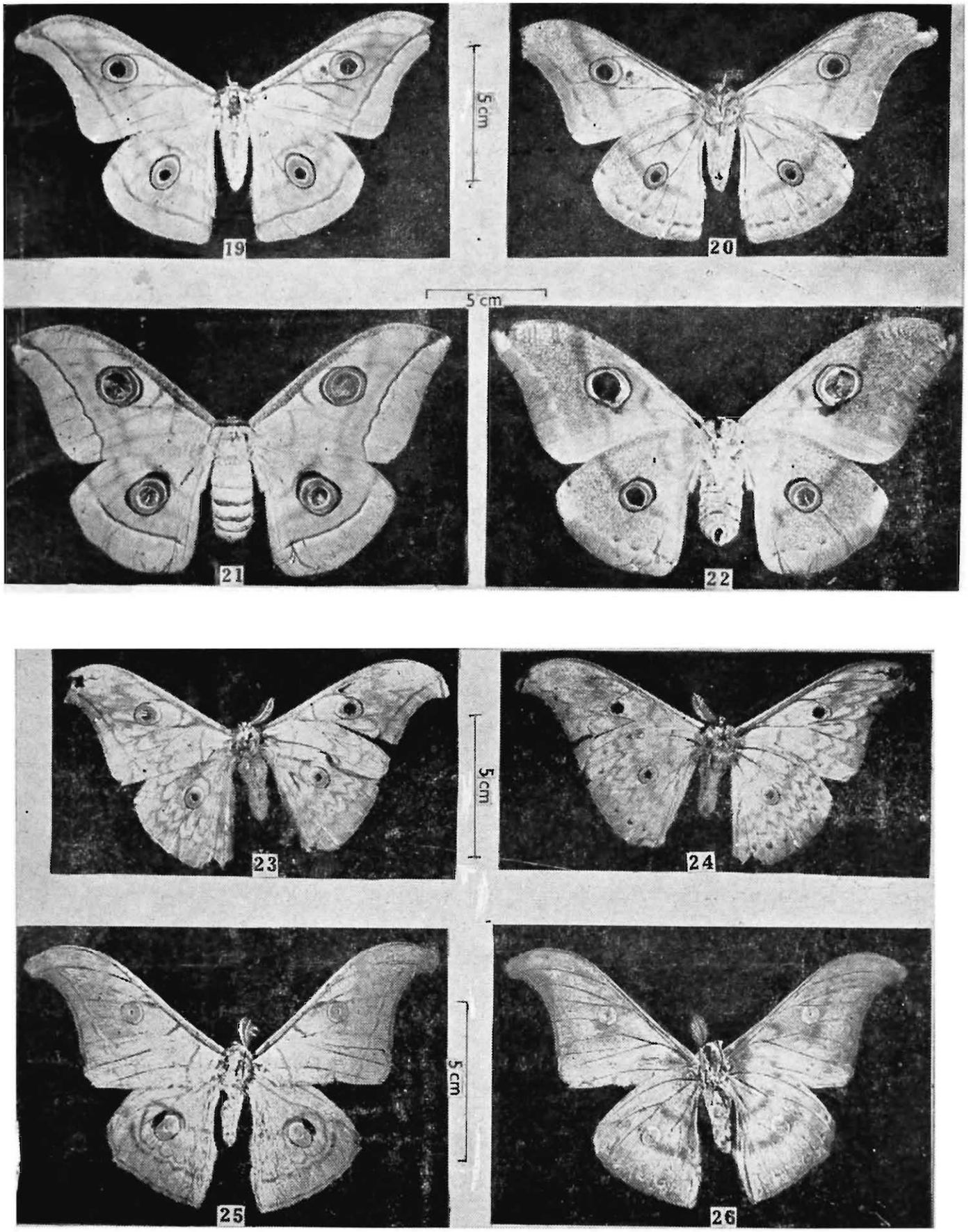
11. Upperside. 12. Underside of *Rhodinia newara* (Moore), ♂, Shillong, Z. S. I. compound, 26. xi. 1971 (*G. M. Yazdani* coll.).

13. Upperside. 14. Underside of *Rhodinia newara* (Moore), ♀, Shillong, Risa colony, 30. xi. 1972 (*J. K. Prasad* coll.).

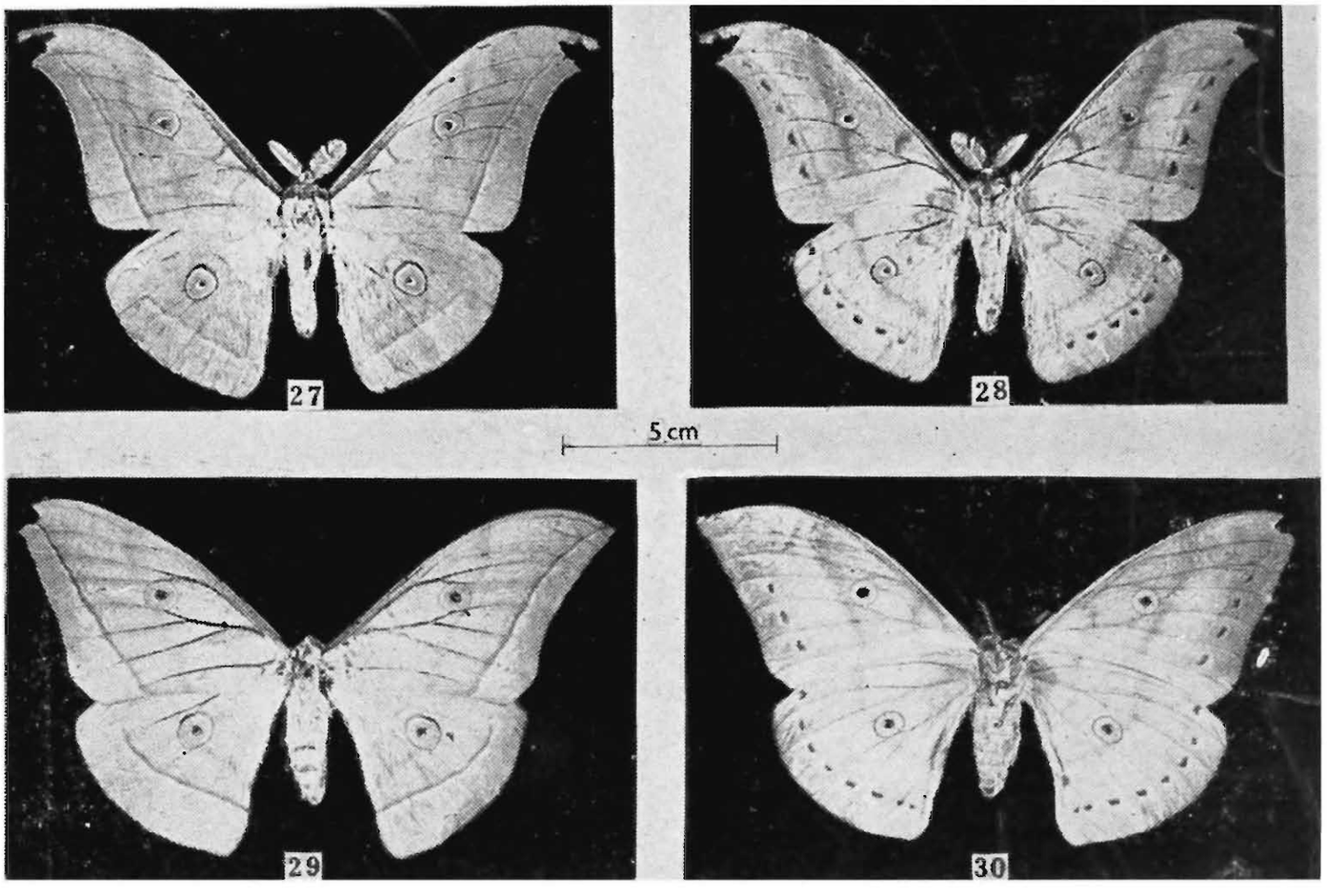


15. Upperside. 16. Underside of *Antheraea assamensis* (Helfer) ♂ Titabar (*G. Subba Rao* colln.).

17. Upperside. 18. Underside of *Antheraea assamensis* (Helfer) ♀, Titabar (*G. Subba Rao* colln.).

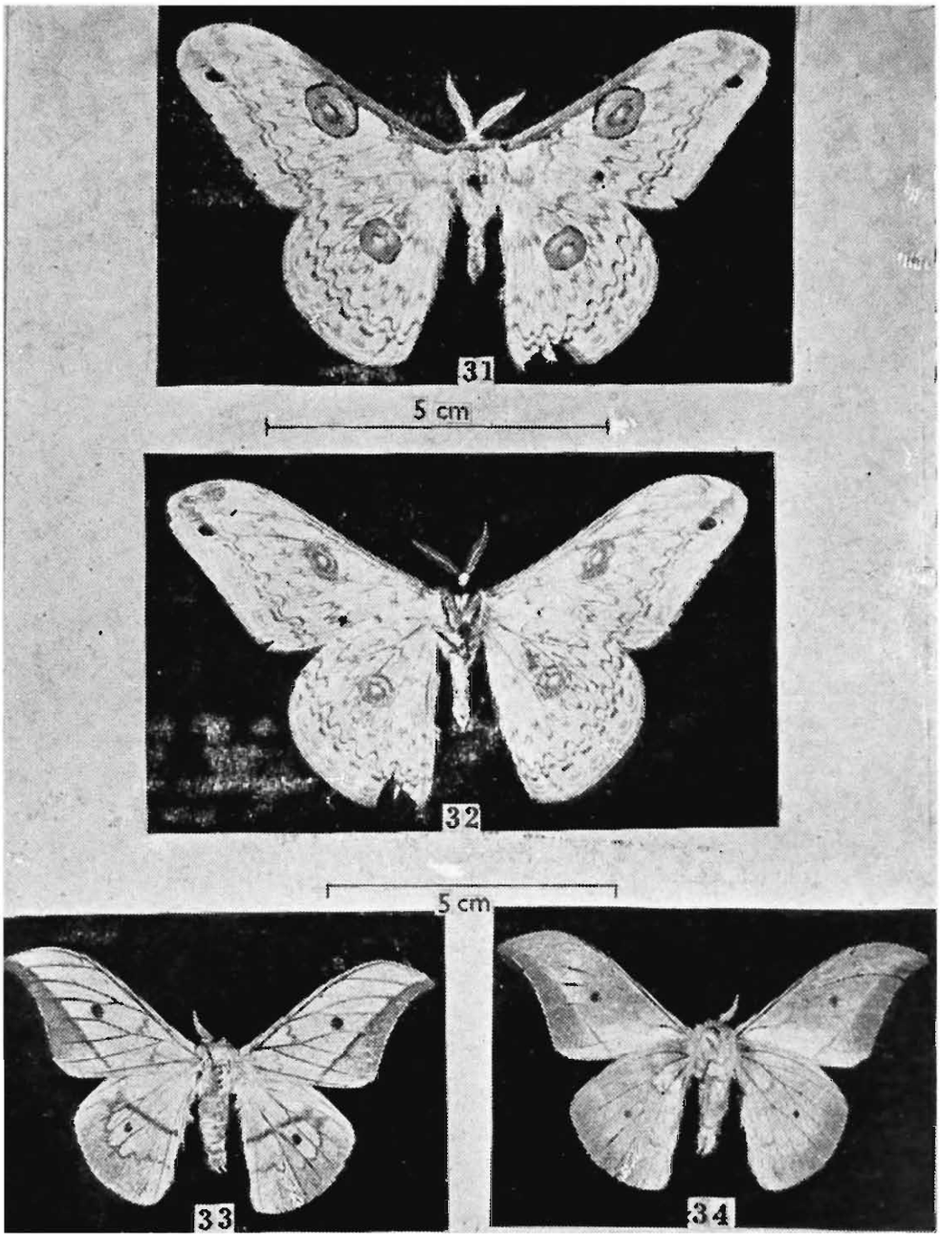


19. Upperside. 20 Underside of *Antheraea paphia* (Linn.) ♂, Calcutta, 3. viii. 1964 (*S. S. Saha* coll.).
21. Upperside. 22. Underside of *Antheraea paphia* (Linn.) ♀.
23. Upperside. 24. Underside of *Antheraea frithi* Moore, ♂, Shillong (reared in laboratory on 25. iv. 1927).
25. Upperside. 26. Underside of *Antheraea helferi* Moore ♂, Manipur, I. B., Mao, 1757 m., 16. ix. 1975 (*M. S. Shishodia* coll.).



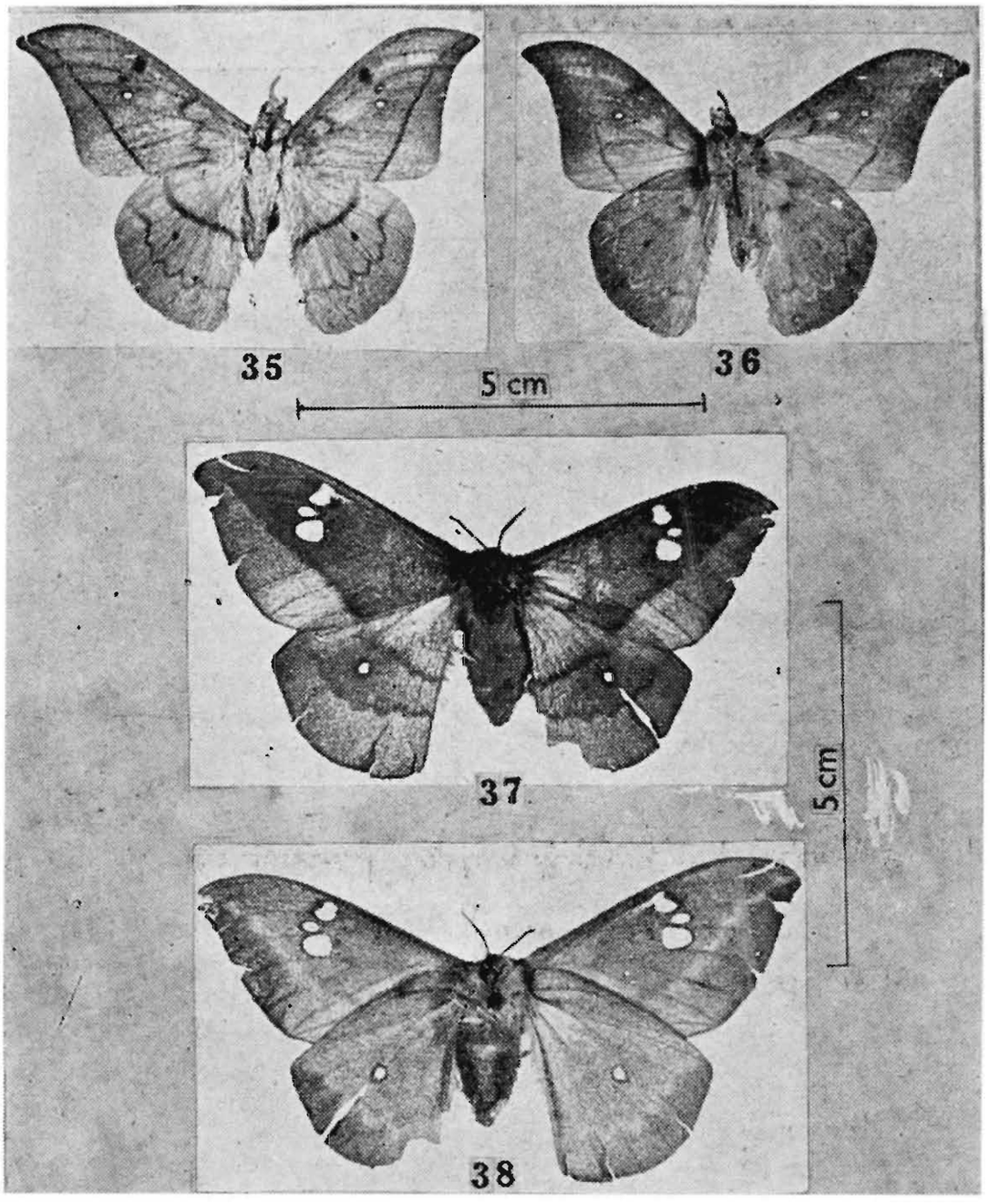
27. Upperside. 28. Underside of *Antheraea roylei* Moore, ♂ Shillong, Risa colony, 19. iv. 1976 (*R. Thapa* coll.).

29. Upperside. 30. Underside of *Antheraea roylei* Moore, ♀, Darjeeling, Govt. Rest House,—. v. 1912 (*Lord Carmichael* coll.).

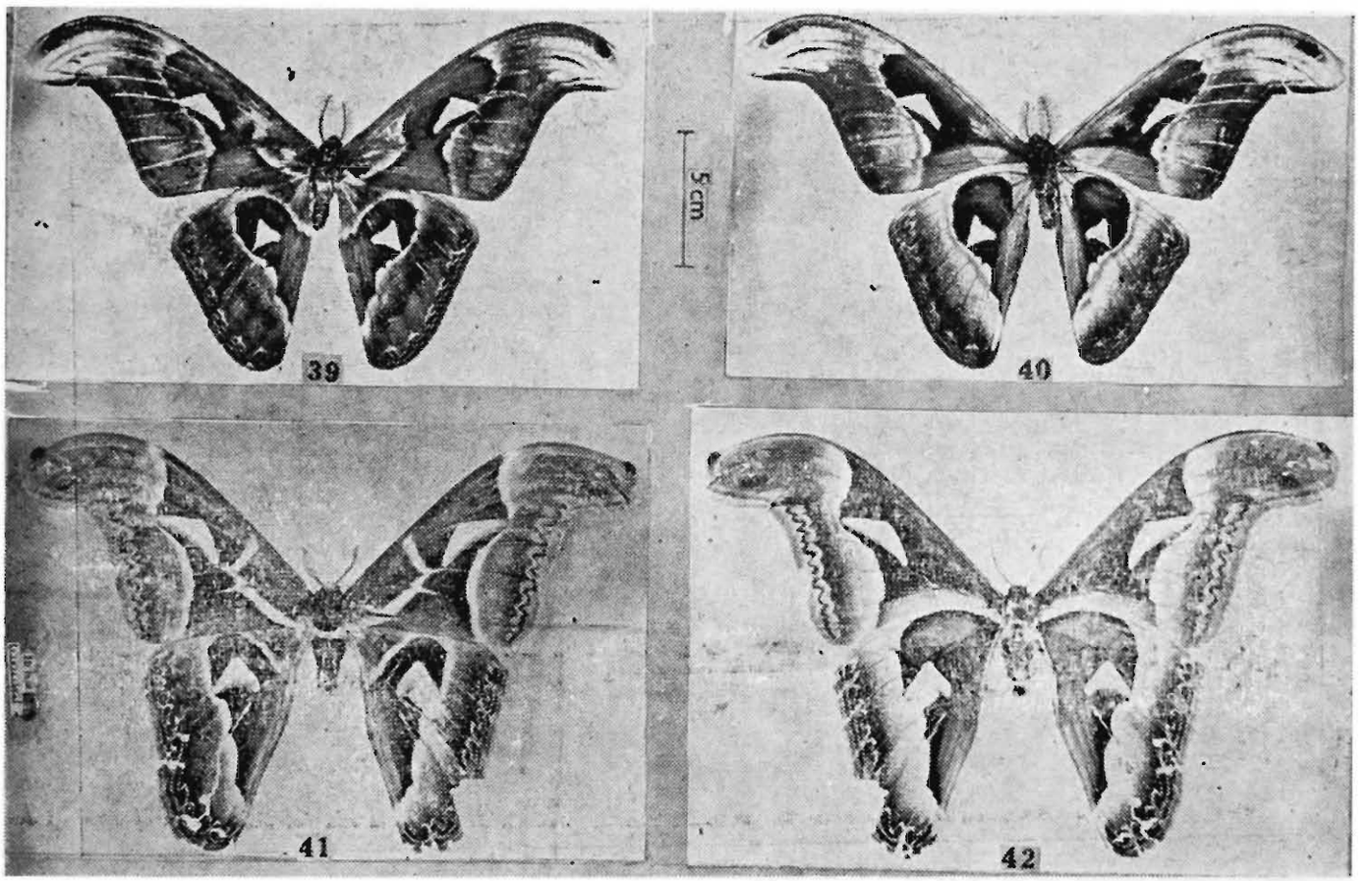


31. Upperside. 32. Underside of *Loepa katinka* (Westwood), ♂, Shillong, Risa colony, 13. iv. 1973 (*M. Deb* coll.).

33. Upperside. 34. Underside of *Cricula andrei* Jordan, ♂, Shillong, Risa colony, 18. iii. 1971 (*Chandan Singh* coll.).

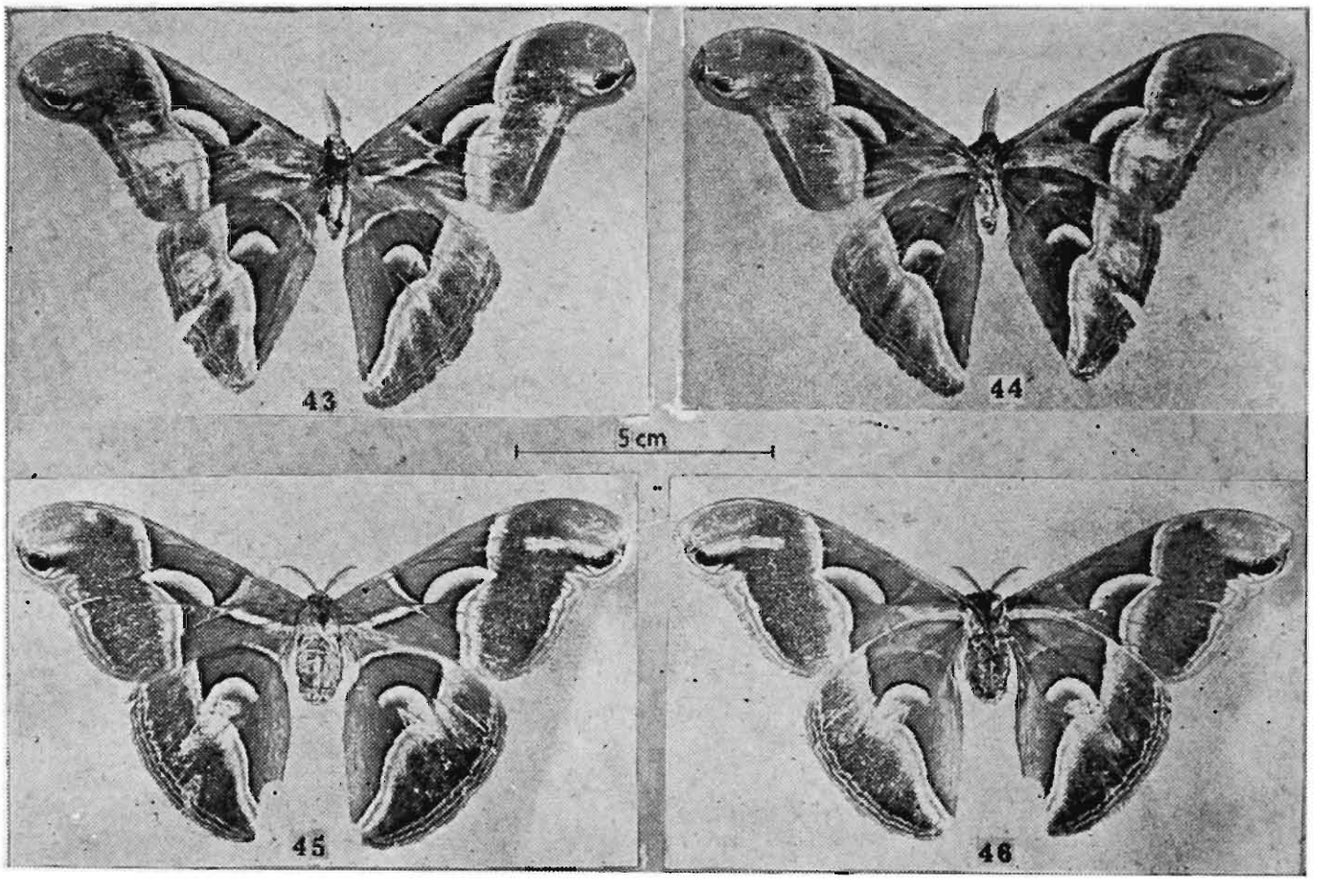


35. Upperside. 36. Underside of *Cricula trifenestrata* (Helfer), ♂, Yercaud, 1922 (*Hearsay* coll.).
37. Upperside. 38. Underside of *Cricula trifenestrata* (Helfer), ♀, Shillong, Lachamiere, 26. vi. 1961 (*A. R. Srinivasan* coll.).



39. Upperside. 40. Underside of *Attacus atlas* (Linn.), ♂, Assam, Margharieta, 23. ix. 1971 (*G. S. Arora* coll.).

41. Upperside.. 42. Underside of *Archaeoattacus edwardsii* (White), ♂, Bhutan, —. vi. 1893 (*G. C. Dudgeon* coll.).



43. Upperside. 44. Underside of *Samia cynthia* (Drury), ♂, Lohit district, Roing, 300 m., 8. iii. 1969 (*S. K. Tandon* coll.).

45. Upperside. 46. Underside of *Samia cynthia* (Drury), ♀, Shillong, Risa colony, 29. vii. 1963 (*S. N. Prasad* coll.).